To the Graduate Council:

I am submitting herewith a thesis written by Treasure H. Rogers, Jr. entitled "A Review of Approaches to Incorporating Environmental Considerations in Planning in Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning.

George E. Bowen

George E. Bowen, Major Professor

We have read this thesis
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Accepted for the Council:

L Evans Peck

Vice Chancellor
Graduate Studies and Research

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A REVIEW OF APPROACHES TO INCORPORATING ENVIRONMENTAL CONSIDERATIONS IN PLANNING IN TENNESSEE

A Thesis

Presented for the

Master of Science in Planning

Degree

The University of Tennessee, Knoxville

Treasure H. Rogers, Jr.

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DEDICATION

This thesis is dedicated first to God the Almighty for the love and blessings He has given me through the years. Secondly, to the ladies of my life: my mother, Ms. Constance Vernetta Hopkins-Rogers, for her tender loving care and unspoiling kindness; my grandmother (Mother), Ms. Lillie Belle Hopkins for the love and support she has given me just as she has given her own sons; and last but not least, my fiance, Diane Marie Settles, for the tender love and understanding she has given me during these trying times.

ABSTRACT

The comprehensive planning process has traditionally neglected environmental considerations. Environmental features were usually given consideration only insofar as they affected the suitability of the land to accommodate development. Some of the problems of this limited consideration has been pollution and depletion of ground water supplies from development located on acquifers and their recharge areas and loss of property from building in active geologic zones. Where the full range on environmental features are considered in the planning process, suitable measures can be taken to prevent these problems.

This research had two main objectives. The first objective was to review the works of planning agencies and consultants outside the state of Tennessee and survey selected Tennessee planning agencies to ascertain how they incorporate environmental considerations into the comprehensive planning process. The second objective was to build a model, based on the findings of the literature search and the survey, which could be employed to incorporate environmental considerations into each phase of the comprehensive planning process.

The Environmental Planning Model developed as a result of this research represents a combination of the additive approach (which adds a new element or planning section to focus on environmental concerns) and the realignment of objectives approach (which calls for a fundamental realignment of all community goals and objectives in light of environmental implications). The critical component of this model is an inventory and analysis of environmental features. This model should be given serious

consideration by the various Tennessee planning agencies for incorporation into their planning process.

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CHAPTER I

INTRODUCTION

I. BACKGROUND AND PROBLEM SETTING

The traditional approach to land use planning begins with projections of future economic growth in the urban area based on trends in both the national and regional economies. These projections, in amount and type of economic activity, are used to estimate future population. The projections are then translated into estimates of future land demand for industrial, commercial, residential and public activities. The basic assumption of this approach is that economic growth can best be fostered by designing land use patterns to minimize development cost and maximize economic activity.[1]

Although environmental concerns were part of such early efforts as the Conservation Movement in the early 1900's, the New Deal Programs of the 1930's and air pollution control laws passed by both California and the U.S. Congress in the 1940's and 1950's, it was not until the 1960's that environmental protection became a major nationwide issue.[2] Environmental features such as soils, slopes, floodplains, and other natural features were considered only insofar as they affected the suitability of the land for urban development.

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[1] Edward J. Kaiser, et al., Promoting Environmental Quality Through Urban Planning and Controls (Washington, D.C.: U.S. Environmental Protection Agency, 1973), p. 107.

[2] Ibid., p. 44.

Only within the last decade has land use planning progressed to the point where environmental features have been given broader consideration. This progressive step was taken as local residents and planning commission members brought planners to task for such mistakes as locating residential development in flood prone areas, scheduling industrial development in areas where soils exhibit a low bearing strength, and projecting increased residential densities in areas where it would be impractical or very costly to extend underground utilities due to the level of bedrock.[3]

As a result of these mistakes, many communities began conducting environmental studies. One such study was conducted by the Metropolitan Washington Council of Governments. The Council noted that various expensive and hazardous mistakes resulted when such natural features as soils, rocks, and water bodies were overlooked when decisions regarding development were made. Therefore, to prevent these mistakes from recurring, the study sought a better understanding of the natural environment and a recognition of the environment's implications for urban development.[4]

In view of the failure of the traditional approach to properly recognize the importance of environmental features, it is evident that a broader approach must emerge, i.e., an approach which promotes

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[3]Ohio Department of Natural Resources, A New Approach to Land Use Planning (Columbus, Ohio: Ohio Department of Natural Resources, 1974), p. 4.

[4]Metropolitan Washington Council of Governments, Natural Features of the Washington Metropolitan Area (Washington, D.C.: Metropolitan Washington Council of Governments, 1968), p. 1.

the quality of the environment by incorporating environmental considerations in planning.

At the Federal level, the enactment of the National Environmental Policy Act (NEPA) of 1969 is considered as one form of this approach. The stated purposes of NEPA are:

> to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.[5]

The strength of NEPA is a requirement placed on all Federal agencies involved in various projects to submit an Environmental Impact Statement (EIS). The EIS is essentially a detailed statement documenting the impacts of a particular project of a Federal agency. An agency's involvement may be the approval of a private license application, the granting of funds to a private party, or the funding of work carried out by a state or local governmental agency. Once the agency's involvement has been established, the EIS is necessary only if the proposed action is both "major" and "significantly affecting the quality of the human environment."

This research is most concerned with who prepares the impact statement. The Act provides for preparation of the EIS to be the responsibility of the "lead agency" or that arm of government that has direct supervisory control or funding responsibility for the action.[6]

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[5] National Environmental Policy Act, 42 U.S.C., Sec. 4321 (1969).

[6] Robert Burchell, and David Listokin, The Environmental Impact Handbook (New Brunswick, New Jersey: Rutgers University Center for Urban Policy Research, 1975), p. 89.

The two issues that have surfaced from this provision are whether the Act permits any delegation of responsibility for preparing the impact statement and if so, what degree of federal participation is necessary to insure compliance with the goals of the Act.[7]

In 1972, in Green County Planning Board v. Federal Power Commission (FPC), the Second Circuit Court prohibited any delegation of responsibility. The court agreed that while delegation may not interfere with the procedural aspects of EIS preparation, it created a high potential for substantive failure in the content and quality of the statement.[8] The court held that:

> The FPC has abdicated a significant part of its responsibility by substituting the statement of PASNY (Power Authority of Southern New York) for its own. . . the degree of [this] procedure, and one obvious shortcoming is the potential, if not the likelihood, that the applicant's statement will be based upon self-serving assumptions. . . .[9]

Furthermore, the ruling of the case does not appear to require the agency to bear all the additional expenses and conduct all the necessary studies. The agency is free to require state governments and private parties to supply information, hire consultants, conduct field studies, and such other assistance in carrying out its responsibility. The synthesis and evaluation of such information must be done by the agency.[10]

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[7] Ibid., p. 205.

[8] Ibid.

[9] Ibid., p. 206, "citing" Green County Planning Board v. Federal Power Commission, 455 F.2d 412 (2d Cir.), cert. denied, 409 U.S. 849 (1972).

[10] Frederick K. Anderson, NEPA in the Courts (Baltimore: John Hopkins Press, 1973), p. 195.

Other circuit courts, while superficially recognizing the potential hazards of delegation, have still permitted it. These circuit courts have relied on distinguishing the case at hand from Green County by finding "significant agency participation" in the EIS process.[11]

This legislation, as one approach to incorporating environmental considerations in planning, is limited because it is applicable only when an agency of the federal government is involved. Therefore, in the absence of such an agency, the environment will continue to be susceptible to degradation by various development proponents.

At the state level, one approach to incorporating environmental considerations in land use planning is to establish NEPA type legislation. Numerous states have followed the Federal lead by legislating little NEPA's of general application, limited application, or administratively promulgated NEPA equivalents.[12]

Little NEPA's of general application apply to all areas and all development within definitional bounds. Some of the states which impose little NEPA's of this type contain almost the identical five EIS requirements of NEPA and add further requirements that the impact statement contain a section discussing mitigation measures and/or the secondary growth-inducing aspects of the proposed development.[13]

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[11] Burchell, op. cit., p. 206.

[12] Ibid., p. 8, "citing" Nicholas C. Yost, "NEPA's Progeny: State Environmental Policy Acts," Environmental Law Reports, Vol. 3, 1973, p. 50090.

[13] Ibid., p. 9.

Of those states which have little NEPA's of limited application, the EIS requirements are imposed within defined geographic areas for both public and private activities or on the types and/or location of development activity.[14]

Finally, of those states which administratively impose EISs, some extend the requirement to publicly permitted private activities. Others may extend the EIS requirement to public and private water-oriented development activities.[15]

The concern of this research with little NEPA's is the same as that for NEPA--who prepares the EIS? The responsibility varies. In California this responsibility lies with the state or local agency approving the project. Two alternatives are available to the government to meet this responsibility. The first alternative calls for hiring a consultant to do the report and then billing the developer for the cost of its preparation. The second alternative calls for the government agency to prepare the report. In preparing the report, the agency can require the developer to provide basic information about the project. This latter alternative is the most popular.[16]

George Sternlieb, et al., suggests a few words of caution about local government involvement in preparing impact statements. They noted that:

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[14] Ibid.

[15] Ibid.

[16] Burchell, op. cit., p. 90.

> a local governmental fiefdom may have just as selfish reasons for fixing the outcome of an impact evaluation as the developer himself. If a community has taken a position of "no growth" based upon "desired community size" or "optimum servicing level" environmental concerns can indeed be misused.[17]

Other states have taken a different approach to incorporating environmental considerations in land use planning. In Vermont, the Environmental Control Law of 1970 requires the state to adopt a series of statewide plans--one of which is an interim land capability plan. This plan provides a preliminary classification of the state by physical limitations on development, capability for agriculture, forestry or mining, and the existence of unique or fragile environmental conditions.[18]

The efforts of the above federal and state government approaches, along with their EIS requirement, does not go unnoticed. However, if states (such as Tennessee) have not adopted legislation equivalent to NEPA, the environment will surely continue to be susceptible to misuse by various development proponents. Therefore, this research advocates an approach, by way of a model, that can be directly applied at the local governmental level which incorporates environmental considerations in land use planning.

II. PURPOSE OF THE RESEARCH

This research has two objectives. The first is to review the works of planning agencies and consultants outside the state of Tennessee and

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[17] Ibid., p. 91, "citing" George Sternlieb, et al., "The Future of Housing and Urban Development" in Robert Burchell and David Listokin, Eds., Future Land Use (New Brunswick: Center for Urban Research, 1975).

[18] Fred Bosselman, and David Callies, The Quiet Revolution in Land Use Controls: Summary Report (Washington, D.C.: Council on Environmental Quality, 1971), p. 8.

selected Tennessee planning agencies, via a survey, to ascertain how they incorporate environmental considerations into the comprehensive planning process. The second and primary objective is to build a model based on the literature search and the survey, which could be employed to incorporate environmental considerations into the comprehensive planning process.

III. DEFINITIONS

1. Ecosystem Analysis--An examination of the living organisms and their non-living environment found in the study area.

2. Environmental Impact Statement--A detailed statement documenting the impacts of a proposed project.

3. Land Capability Analysis--An analysis of the natural features of the environment to determine their natural ability to accommodate particular land uses without creating significant problems for either the inhabitants of an area or the environment itself.

4. Land Suitability Analysis--An analysis which links the needs and desires placed upon the land to accommodate various types of uses without extensive artificial measures and the results of the capability analysis.

IV. METHODOLOGY

The methodology employed in this research consists of the following elements:

1. Literature Search--A comprehensive review of the literature was conducted to gain an understanding of how Ian McHarg, et al., utilize

natural environmental data in their planning efforts. This review includes articles from professional journals, analytical reports commissioned by various governmental agencies, and relevant books.

2. Survey of Major Tennessee Planning Agencies and Non-Planning Bodies--A survey was conducted to ascertain how these agencies and bodies utilize environmental data, the degree of their involvement with inventorying and analyzing environmental data, and other relevant information pertaining to incorporating environmental considerations in the planning process. Questionnaires were used to obtain the information from these agencies and bodies. The questionnaires utilized are displayed in Appendix B.

The planning agencies participating in the survey were:

- Regional: Tennessee Valley Authority
- State: Tennessee State Planning Offices
- Regional Councils: Development Districts
- Metropolitan: Memphis, Nashville, Knoxville, and Chattanooga

The non-planning bodies participating in the survey were:

- Tennessee Heritage Program
- Tennessee Department of Conservation
- Tennessee Citizens for Wilderness Planning
- Tennessee Chapter of Sierra Club
- Tennessee Environmental Council

A complete listing of the agencies and bodies participating in the survey are shown in Appendix A.

3. Analysis of Survey Findings--As the final element of the methodology, the survey findings were compared with the findings in the

literature search to assess the similarities and differences in the manner that the Tennessee planning agencies and McHarg, et al., applied natural environmental data in their planning efforts.

V. ORGANIZATION OF THE RESEARCH

Chapter II contains that part of the literature search which deals with the works of Ian McHarg, et al. Specifically, this chapter focuses on the objectives, fundamental features, and the various approaches employed to incorporate natural environmental data into the comprehensive planning process.

Presented in Chapter III are the findings of the survey of the major Tennessee planning agencies and non-planning bodies. The findings are analyzed to reveal the degree to which these agencies and bodies utilize natural environmental data in their planning efforts, the similarities and differences in the application of the data between Ian McHarg et al., and the prospects for continuous use of this data by the Tennessee planning agencies.

Chapter IV deals with the building of a model which the planning agencies of Tennessee could employ to incorporate environmental data in their planning efforts. Specifically, this chapter reveals the methodology utilized in building the model, the critical components of the model, and the modeling implications of the works of Ian McHarg, Edward Kaiser, and the Tennessee planning agencies.

The conclusions and recommendations of the author are presented in Chapter V.

CHAPTER II

STATE OF THE ART: THE WORKS OF IAN MCHARG, ET AL.

I. BASIC OBJECTIVES

According to Edward J. Kaiser, there are two fundamentally contrasting objectives to environmental resource inventories.[19] The first determines constraints to development and places highest priority on urban system demands. The second objective focuses on protecting the environment from development and places higher priority on nature and its demands.

Attempts to determine which objective a particular environmental study is seeking to accomplish can be a cumbersome task. William M. Marsh, however, has provided some insight as to how this determination can be made.[20] According to Marsh, the starting point of an analysis of environmental constraints is the action itself. The analysis seeks only to identify any environmental conditions that would conflict with that action. In contrast, an analysis that seeks to protect the environment, the starting point is the area or environment itself and the many different ways in which it could be used. This analysis must therefore be comprehensive in order to protect the natural values and functions of the environment and seeks the wisest and most appropriate use of land.

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[19] Kaiser, op. cit., p. 120.

[20] William M. Marsh, Environmental Analysis for Land Use and Site Planning (New York, New York: McGraw-Hill, 1978), p. 201.

Figure 1 shows a list of environmental studies and the objectives that are most commonly associated with them. It should be noted that some of the studies can be employed to achieve both objectives simultaneously. For instance, Land Capability Analysis can be used to achieve both objectives, whereas Visual Landscape Analysis is most often used to achieve a single objective, i.e., protecting the environment.

Determine Environmental Constraints to Development

As mentioned earlier, the starting point of an analysis which seeks to determine environmental constraints to development begins with an action. The environmental study of the Washington Metropolitan area can serve as an example of this objective.[21] The study surfaced positive and negative aspects of environmental features which could be used to influence development policies. For instance, shallow bedrock was interpreted as most restrictive to urban development because it requires water and sewer lines to be placed prior to development which directly affects construction requirements and the cost of public facilities. Based on other interpretations similar to this one, the study recommended that environmental features should be considered in formulating future metropolitan development policies and plans.

Studies employed to realize this objective are feasibility and site planning studies. Feasibility studies investigate certain engineering and economic requirements that must be met as well as certain environmental conditions that must be recognized: houses must not subside or be flooded; highways will not be funded if they destroy endangered species or their habitat; and landfills must be properly drained.

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[21] Metropolitan Washington Council of Governments, op. cit., p. 1.

Type of Studies	Objectives	Constraints	Protection
Land Capability Analysis		x	x
Land Suitability Analysis		x	x
Ecosystem Analysis		x	x
Visual Landscape Analysis			x
Natural Resource Analysis			x
Critical Areas Analysis			x

Figure 1

Environmental Studies and
Their Objectives

Site planning studies such as Land Capability Analysis, Land Suitability Analysis and Ecosystem Analysis could be employed but they would be limited in their scope since they would focus only on a few natural environmental features. For instance, they might focus on soils, geology, and hydrology and not fully consider the consequences of the action on vegetation and/or wildlife.

Protecting the Environment from Development

The starting point for an analysis which seeks to achieve this objective is the area or environment itself. Ian McHarg has become associated with this objective which focuses on protecting the environment.[22] His environmental analysis of the Twin Cities Metropolitan Area serves to illustrate an analysis of environmental features for the primary purpose of their protection.[23] He considers this to be the first study where a comprehensive analysis of biophysical phenomena and processes was made prior to the formulation of a regional plan. He contends that the planning process should ask nature to advise man as to the form and pattern of metropolitan growth. When this is known, then demands should be identified--future needs for housing, industry, commerce, and recreation--and their location and spatial requirements.

Studies conducted to achieve this objective can follow two forms: site planning studies and resource identification studies. Although such site planning studies as Land Capability Analysis, Land Suitability

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[22]Kaiser, op. cit., p. 121.

[23]David A. Wallace, et al., Excerpt from Ecological Report (St Paul-Minneapolis, Minnesota: Twin Cities Metropolitan Council, 1969), p. 1.

Analysis, and Ecosystem Analysis can be employed to achieve an objective which seeks to determine constraints to development, they can also be employed to achieve this objective; protecting the environment from development. These studies, like McHarg's study of the Twin Cities, must be comprehensive in order to identify and protect the natural values and functions of the area and seek the wisest and most appropriate use of them. As McHarg puts it:

> planning for natural process must begin with the identification of discrete sub-processes, then determine the value of these sub-processes to man, and finally establish principles of development based upon preserving and enhancing the tolerance and intolerance of the natural process to various aspects of urbanization.[24]

Since his study of the Twin Cities, his methodology for interpretation of data as well as the data collection process has been revised and improved.[25]

Resource identification studies can take the form of Visual Landscape Analysis, Natural Resource Analysis, or Critical Area Analysis. Visual Landscape Analysis inventories key natural environmental features with primary emphasis on interpreting their significance in terms of man's visual perception. Natural Resource Analysis identifies environmental features to determine whether their inherent qualities are

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[24] Ibid., p. 9.

[25] For further studies by McHarg see: Development Research Associates, Inc. and Wallace, McHarg, Roberts, and Todd, Inc., An Ecological Planning Study for the Regional Transportation District, Denver, Colorado (Denver: Regional Transportation District, January 1972); Wallace, McHarg, Roberts, and Todd, Inc., An Ecological Planning Study for Wilmington and Dover, Vermont (Wilmington: Windham Regional Planning and Development Commission and Vermont State Planning Office, April 1972); Wallace, McHarg, Roberts, and Todd, Inc., A Report on the Master Planning Process for a New Recreational Community, Amelia Island, Florida (Hilton Head Island, South Carolina: The Sea Pines Company, 1971).

significant enough to be classed as a natural, historical, cultural, or recreational resource. Critical Areas Analysis identifies such areas as flood plains, aquifer recharge areas, marshlands, etc., and advocates their protection from development.

The environmental study conducted for Sarasota County, Florida serves as an example of a resource identification study.[26] In this study three environmental zones were established: preservation zones, areas which exhibit sensitive soils but provide essential habitat for wildlife; conservation zones, areas that are developable but better left alone or used as open space and recreation; and potentially developable zones, areas whose normal development pattern may not be incompatible with existing natural systems.

An important relationship between an analysis which seeks to determine constraints to development and an analysis which seeks to protect the environment from development is the possibility of converting constraints into opportunities to protect the environment. Frequently, environmental conditions that constrain some type of action may provide unusual opportunities for poretcting the environment. For instance, development in a floodplain may be too hazardous for housing but it may provide an excellent site for a recreation activity.

II. FUNDAMENTAL FEATURES

This section reviews two fundamental features of the various approaches employed to incorporate environmental features in planning.

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[26] Sarasota County Planning Department, Environmental Limitations (Sarasota, Florida: Long Range Planning Division, Sarasota County Planning Department, 1973), p. 2.

Specifically, the features to be reviewed are: most common environmental features inventoried; and the methods employed to analyze these environmental features.

Key Environmental Features Inventoried

The most common environmental features inventoried are soils, geology, hydrology (surface and subsurface), and slopes. Most of the studies reviewed for this research do not suggest any order in which these features should be inventoried. However, James Smith, in his study of ecological data, noted that Ian McHarg emphasizes such an ordering.[27] McHarg emphasizes that data on environmental features be collected in a sequence because it suggests causality. That is, an understanding of the climate and geology of an area facilitates the interpretation of its physiography which in turns allows an understanding of hydrology, including river and stream patterns, aquifer and aquifer recharge areas. And an understanding of the natural process helps to explain the pattern of land use. Therefore, the features should be inventoried in the following sequence: climate, geology, physiography, hydrology, pedology (soils), vegetation, wildlife, and land use. Since land use is considered to be a product of man's needed and desired activities and not a natural environmental feature in itself, it will not be included in the following discussion.

Climate. Local climate conditions can have important effects on development. It can also affect the level and dispersion of air pollution

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[27] James B. Smith, Ecological Data for Land Development Planning (Champaign, Illinois: University of Illinois at Urbana-Champaign, 1974), p. 7.

from different sources. Climate studies can provide valuable information on the effects of particular pollutants on people with specified health problems, on other materials, on vegetation (including agricultural crops), and on wildlife. Michael J. Meshenberg contends that such studies should be made a part of the planning process in undeveloped areas because it could play a major role in identifying areas with high pollution potential as a result of topographic or meteorological conditions. Furthermore, these studies can provide the basis for public policies with respect to industrial location, highway corridor selection, and other pollution sources.[28]

Most air resource management studies have been or are being done by or with the support of the National Air Pollution Control Administration, or its predecessor agencies. These studies focused on sources and concentration of pollutants, microclimatic differences (including temperature and wind speed and direction), and moisture content (including fog pockets and snow belts).[29]

Geology. Although rock strata in the deeper subsurface layers of the land are used less frequently than the soil, these layers are of critical importance. For instance, they are a source of raw materials, including water; they serve as disposal sites; and they give the land

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[28]Michael J. Meshenberg, Environmental Planning: 1 Environmental Information for Policy Formulation, Planning Advisory Service Report No. 263 (Chicago, Illinois: American Society of Planning Officials, 1970), p. 21.

[29]Ibid., p. 21.

backbone so it can support heavy structures on the surface. Improper use of this resource results in jeopardized water supplies, ineffective disposal systems, and damaged buildings and highways.[30]

In order to avoid the results of improper use of this resource, geologic survey maps published by the U.S. Geological Survey should be consulted. These surveys generally include interpretation of basic geologic data for engineering purposes. The interpretative data may include, in addition to soil, water, and mineral resource characteristics, such engineering properties as: (1) foundation-bearing quality and supportive strength; (2) tunneling and boring capabilities affecting transportation and utilities; (3) potential construction hazards, such as landslides and rockfall zones; (4) physical limitations and costs; (5) depth to bedrock; (6) fault movement potential, earthquakes, and other dynamic characteristics; (7) workability; (8) groundwater (permeability, well yield, quality); (9) suitability for septic systems and refuse disposal.[31]

These maps do not take the place of site investigations of engineering properties nor do they eliminate the need for detailed studies of mineral deposits, but they do provide valuable information about a planning area. Site investigation might reveal an area where multiple-use benefits may be realized. For instance, the investigation may reveal large deposits of sand and gravel suitable for use as

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[30]Hugh B. Montgomery, "Environmental Analysis in Local Development Planning," in Challenges for Appalachia Energy, Environment and Natural Resources (Washington, D.C.: Appalachia Regional Commission, 1976), p. 223.

[31]Meshenberg, op. cit., p. 13.

construction materials. The excavation of the gravel might be followed by development of public recreational lakes or of private lakes for residential estates or industrial parks. The excavations also could be used as storage basins for flood flows or as ground water recharge pits.[32]

Physiography. Physiography is an important consideration in land planning because of its influences on: the type and cost of development; the direction and rate of water runoff; and the types of vegetation and wildlife.

Problems encountered with slope generally fall into three categories: grade; erosion; and failure.[33] The grade of a slope becomes a problem when it is too steep or too gentle for a particular land use and, therefore, must be changed by mechanical cut-and-fill processes. The analysis of slope used in planning studies are generally confined to four categories. Slopes greater than 25% are considered very steep and if disturbed by construction processes or forest removal, widespread slope failure is highly probable. Slopes between 15% and 25% are considered steep. If plant cover is removed, the slope is highly susceptible to erosion and gully formation. Moderate slopes are those between 5% and 15%. These slopes will support residential and agricultural land uses; however, if misused, are definitely susceptible to serious erosion. Gentle slopes, less than 8% will sustain the most intensive use with least management.[34]

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[32]Peter Flauin, Environmental Geology: Conservation, Land Planning and Resource Management (New York: Harper and Row, 1970), p. 14.

[33]Marsh, op. cit., pp. 50-68.

[34]Ibid., pp. 66-67.

A second problem with slopes is erosion. The steeper the slope and the lighter the vegetation cover, the greater the rate of erosion. The rate of erosion is controlled by the velocity and the volume of runoff as well as by the resistance of the soil to the erosive power of moving water. The influence of vegetation is fourfold: (1) raindrop input, a highly erosive process on barren soil, is mitigated by plant foliage; (2) percolation of water into the soil is increased by the presence of roots and organic litter, thereby decreasing the volume of water available for surface runoff; (3) the friction posed to runoff by plant stems, foliage, and debris reduces the velocity of flow; and (4) the additional cohesiveness impartial to soil by plant roots increase greatly soil resistance to the erosion forces of runoff.

The last problem associated with slopes is failure. This occurs when slopes are composed of weak, steeply inclined materials which have low bearing (weight-supporting) capacity and are prone to mass movements such as mudflows, slides, and creep. Slope failure usually occurs at its base and is caused by one or more of the following: (1) undercutting by waves, streams, or construction processes; (2) increased groundwater content as along the banks of a reservoir; and/or (3) devegetation, particular of forest cover.

The U.S. Geological Survey is the most noted source for slope information. The Survey also publishes urban area maps, useful for planning, which show land elevation, transportation networks and facilities, woodlands, wetlands, and densely built-up areas.

Hydrology. The hydrosphere is defined as: (1) the underground water-subsurface; (2) the shallow layer of water which covers two-thirds

of the earth's surface and forms oceans, seas, lakes, rivers, and streams; and (3) the water vapor in the atmosphere.[35]

An important function performed by underground water is to influence the soils, rock strata, and mineral resources, e.g., the height of the water table affects the ability of the soil to accept construction and absorb waste material. Another important function is to serve as a supply of fresh water which is crucial to public health, safety, and welfare. In performing these functions, the underground water flows through water-bearing rock called aquifers.

Underground water recharge areas, aquifers, represent places where surface water can easily enter into the rock strata. From a planning standpoint, these areas need protection since the possibility of contamination or disruption of the groundwater supply is great at these places. In addition, if existing homes and industries depend on the underground water-bearing strata for well water, then various planning and conservation measures are needed to insure that the supply of surface water is not diminished or contaminated. Extensive development such as paved parking lots could diminish the re-supply of the aquifer. Sewage discharge from septic tanks could pollute the aquifer.[36]

Surface water quality is effected by two major factors: (1) the biological systems which inhabit the surface water (whose tenants range in size from bacteria to mammals as large as beavers); and (2) the chemical processes which take place in the surface waters. Any human

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[35]Meshenberg, op. cit., p. 16.

[36]Ohio Department of Natural Resources, op. cit., p. 10.

activity which affects either of these factors will determine whether the water will be usable and at what expense. Surface water quantity is also a matter of public concern. Planning can assure that future water supplies will be sufficient to meet total needs, and streams and other surface water bodies with unique qualities, e.g., the white water rapids which attract adventurous tourists, can be preserved for special-priority uses. Flows of streams can also be controlled and development planned to respect existing flows to prevent damaging floods.[37]

Soils. The soil properties that are most often used in land planning are permeability, bearing capacity, groundwater level, and depth to bedrock.

Permeability is a measure of the capacity of a soil to transmit water and is based on the time taken for one inch of water to pass through a given quantity of soil expressed in inches per hour. It is mainly a function of soil texture but is also related to soil water content, vegetation, and interparticle chemical deposits. It regulates the amount of precipitation which is converted to surface runoff.[38]

A percolation rate test, a function of permeability, is usually conducted at the site of a proposed development seeking to utilize an on-site sewage disposal system, i.e., septic tanks. The percolation rate is based on the length of time required for one inch of water to move or percolate into saturated soil from a hole dug to the depth of the

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[37] Montgomery, op. cit., pp. 222-223.

[38] Marsh, op. cit., p. 83.

proposed septic tank trench. Soils with percolation rates slower than one inch per sixty minutes are not suitable for any type of septic tank system. Soils with sand and silt content have available connected pore space through which water can percolate freely. In contrast, soils with high clay content retard free percolation of water because they lack interconnected pore space.[39]

The bearing capacity of soils is measured by its ability to support weight such as buildings, road, and vehicles. It can be a serious consideration in problems which involve loading the soil surface. Nearly all soils settle under the weight of surface structures, but in most cases the amount of subsidence is negligible with little influence on the structures themselves. In certain locales, however, soils of low-bearing capacity have presented some of the most critical land use problems.[40]

Ground-water level is the level below the earth's soil that is naturally saturated with water. In those areas where the level is at or near the surface, the soil is saturated with water and will not permit additional water from other sources, such as septic tank water, to be absorbed.[41] Limitations on development occurs when the level is less than four feet from the surface. In cases such as this an area is usually considered unsuitable for development. Where the level is greater than four feet the area is usually considered suitable for development purposes.

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[39]Leonard D. Harris, and Robert A. Lawrence, Mineral Resources of Knox County, Tennessee (Washington: U.S. Geological Survey, 1974).

[40]Marsh, op. cit., p. 71.

[41]Harris, op. cit.

According to the U.S. Geological Survey:

> depth to bedrock is inadequate in about 42% of the country, where soil materials are developed over shale and limestone bedrock and averages less than five feet thick. Because shale soils as well as shale bedrock transmit water slowly, effluent discharge from such sources as septic tanks may build up to a point where it may flow out of the ground or it may flow laterally along the contact between soil and shale bedrock; discharging directly into streams.[42]

Vegetation. As a functional element of the environment, vegetative cover serves to stabilize slopes, retard erosion, conserve water quality and quantity, maintain local micro-climate, filter the atmosphere, decrease noise, and provide habitat for wildlife. Viewed in this expanded context, vegetation can be utilized, not only as a primary determinant in gauging ecological sensitivity, but also as an indicator of environmental constraints that have influenced previous land use.[43]

An inventory of vegetation should reveal its diversity and present state of health as a result partly from a variation of natural soil-water relationships and primarily from man's management practices. Such practices as lumbering and the alteration of ground water conditions produces an effect on vegetation.

Plant classification schemes have been employed by planners, foresters, ecologists, and others to determine the present and future state of vegetation. William M. Marsh has identified four major classification schemes with one having application to planners.[44] This scheme

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[42] Ibid.

[43] Marsh, op. cit., p. 110.

[44] Ibid., pp. 110-114.

employs a system of four levels. The first level is based on vegetation structure and includes height, percentage of area cover by canopy, and life forms. Level two identifies the dominant plants, which may involve one or more tree types depending on the area under study. Level three calls for an indication of the density and trunk sizes of trees and shrubs. Level four provides information of the physical setting. This information is described by familiar terms such as floodplain, upland, vacant farmland, or residential area. This classification schemes can be adjusted to suit the particular planning problem. For instance, level one may be more than adequate for township and county level planning, whereas all four levels may be barely adequate for site analysis in environmental impact statement preparation.

Some of the purposes for inventorying vegetation are to identify areas that are unique and scarce and may require preservation type measures; areas that have recreational potentials; and/or areas that are conducive to various types of lumbering activities. In McHarg's environmental study of Medford Township, vegetation was inventoried not only to ascertain its present state but also to recommend specific management practices that should be followed by the township.[45]

Information on vegetation can be generated from aerial photographs augmented by field observations, and special sources such as infrared aerial photographs, forestry maps, and botanical reports.

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[45]Narendra Juneja, Medford: Performance Requirements for the Maintenance of Social Values Represented by the Natural Environment of Medford Township, New Jersey (Philadelphia, Pennsylvania: Center for Ecological Research in Planning and Design, Department of Landscape Architecture and Regional Planning, University of Pennsylvania, 1974), p. 31.

Wildlife. Information on wildlife necessary for planning purposes will show the nature, type, and extent of wildlife species and their habitats. These data may be interpreted to show: (1) food, water, and land requirements, (2) capacity to reproduce, (3) natural and man-made decimating factors, (4) predator control, and (5) artificial propagation and other methods of regulating the use of wildlife.[46]

The level of detail of the inventory and interpretation will depend on such factors as: the type of area studied, i.e., urban, rural, island, etc.; the range of staff expertise preparing the study; and/or the values placed on wildlife by the community. For instance, in McHarg's study of Medford Township, his inventory of wildlife is limited to defining their habitat and rating the various wildlife species with respect to their uniqueness or rarity, and their beneficial, hazardous, nuisance, commercial or aesthetic values.[47] On the other hand, John Clark's study of Sanibel Island included all of the five factors enumerated above plus factors to determine whether certain species are threatened, endangered or require special consideration because they are restricted to specific habitats.[48]

Basic information sources for wildlife are the Fish and Wildlife Services of the U.S. Department of Interior and university, state, and other federal departments of conservation.

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[46]Meshenberg, op. cit., p. 23.

[47]Juneja, op. cit., p. 22.

[48]John Clark, The Sanibel Report: Formulation of a Comprehensive Plan Based on Natural Systems (Washington, D.C.: The Conservation Foundation, 1976), pp. 259-270.

After the inventories are concluded on the natural environmental features (climate, geology, physiography, hydrology, pedology, vegetation, and/or wildlife), interpretation can be made regarding their suitability for various types of development. Such interpretations would include, but are not limited to, the following:

1. Suitability ratings for potential intensive residential, extensive residential, commercial, industrial, transportation, natural, and developed recreational, and agricultural land uses;
2. suitability ratings for septic tank disposal field, building foundation for low buildings, trafficability, surface stabilization, road and railroad subgrade and earthwork uses;
3. suitability ratings for soil and bedrock as a source of material for road base, backfill, sand or gravel, topsoil, and water reservoir embankments and linings;
4. ratings with respect to flooding potential, water level characteristics, susceptibility to erosion, and susceptibility to frost action; and
5. suitability for wildlife habitat and habitat improvement, lawns, golf courses, playgrounds and parks, and related open areas requiring other maintenance of vegetation.[49]

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[49]Kurt W. Bauer, "Application of Soils Studies in Comprehensive Regional Planning," in Soil Surveys and Land Use Planning, edited by L. J. Bartelli (Madison, Wisconsin: Soil Science Society of America, 1966), pp. 49, 50, 52.

Methods of Inventory and Analysis

Before reviewing the various methodological procedures for conducting an inventory and analysis, some generalizations can be made. Environmental inventories are considered time consuming and expensive and require the skills of specialists not usually found on the staff of planning agencies. However, it is contended that those local planning agencies with minimal resources should be able to conduct an adequate inventory and analysis by employing the manual procedures reviewed below. Computer programs are no doubt a time-saving procedure, but most local agencies are not equipped with, nor have access to, such programs. Furthermore, the expenses anticipated and the lack of specialized skills can often be supplemented by using existing maps and reports and technical engineering and planning assistance from agencies at the state and regional levels.

The specialists, and their methodologies, to be reviewed in this section are Ian McHarg, Phillip H. Lewis,[50] Ohio Department of Natural Resources, and Kirk Wickersham.[51]

Ian McHarg. To uncover the meaning of the field of natural science, especially to the laymen and the urban planner, McHarg has tried to dramatize the alternative consequences of proper and improper use of natural

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[50]Phillip H. Lewis is a landscape architect working mainly in the midwestern states. His work focuses on the identification of patterns of unique perceptual quality within the landscape for recreation and conservation purposes.

[51]Kirk Wickersham was project director for the Rocky Mountain Center in Environment, a private non-profit regional environmental service center headquartered in Denver, Colorado, which prepared the report A Land Use Decision Methodology for Environmental Control.[73]

processes. This dramatization is embedded in his methodology which interprets and applies the knowledge of the natural sciences to planning the location and form of development. In order to understand and appreciate his method of inventory and analysis, various fundamentals of his philosophy must first be described.

The basic proposition he employs states that:

> any place is the sum of historical, physical and biological processes; that these processes are dynamic; they constitute social values; each area has an intrinsic suitability for certain land uses; and that certain areas lend themselves to multiple co-existing land uses.[52]

Any place is the sum of historical, physical and biological processes. In order to understand a place sufficiently to diagnose and prescribe, it is necessary to appreciate the major physical and biological processes which have occurred in the past and are operative today. This involves considerations of climate, historical and surficial geology, physiography, hydrology, soils, plant ecology, wildlife habitat, and human land use. For instance, the climatic processes that have occurred in a particular area over time have modified the geological formations, which account for current physiography, drainage, and distribution of soils.[53]

Physical and biological processes are dynamic. The place has come to be as a result of the dynamism which is inherent in all natural

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[52]Wallace, McHarg, Roberts, and Todd, "Excerpt from Ecological Report--The Metropolitan Council," Minnesota, 1969. (Mimeographed.)

[53]Ibid.

processes. It is important to recognize the dynamism of physical and biological processes, and more important, that these affect man and are affected by his intervention.[54]

Natural processes represent social values. An ecological inventory reveals natural processes and these processes constitute social values. For instance, geological data may be reflected in foundation savings or in scenic values and climatic factors may explain population migration to California and Florida, or successful agriculture. A recognition of these social values which are inherent in the natural processes are basic before any prescription is made for the utilization of natural resources.[55]

Each area has intrinsic suitability for human use. Once it has been accepted that the place is the sum of natural processes and that these processes constitute social values, inferences can be drawn regarding the utilization of the place to ensure its optimum use and enhancement. It is possible to identify those attributes of land, water, and air most favorable for every prospective land use. When these are found, there is revealed the intrinsic use or value of the land.[56]

Certain areas are suitable for multiple co-existing land use. Most natural processes are inherently suitable for a multiplicity of human uses. Flat well-drained land with deep soil is intrinsically suitable for active recreation as well as commercial and industrial development. The choice among the multiple uses may result in a conflict but can be

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[54] Ibid.

[55] Ibid.

[56] Ibid.

resolved in a number of ways. For instance, certain resources, because of their scarcity and vulnerability, may represent such high value that other uses should be excluded. While in other areas, multiple uses may be permitted if intrinsic values are not compromised.[57]

McHarg asserts that his approach will not produce a plan:

> a plan includes the entire question of demands and the resolution of demand relative to supply, incorporating the capacity of the society or institution to realize its objective. In order to be a plan, it is necessary to calculate the demand for the constituent land use and the location and formal requirements of these, and to recognize the instruments available to society in both the public and private doman.[58]

His method will produce a guide or basis for plan preparation.

His study of the Township of Medford, New Jersey can serve as an example. This study was oriented not to the preparation of a plan, but to the formulation of ordinances. It provided the content for those ordinances desired by the township and the evidence to justify their passage.[59] It should be noted that this study is considered by some as a turning point in land use planning--a turning point in that it was so thorough that it supplied not one but half a dozen rationales for every proposed ordianance--which made it much less vulnerable to legal attacks.[60]

McHarg considers his method to be rational and explicit.[61] It is rational in that the evidence is derived from an exact science.

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[57] Ibid.

[58] Ian L. McHarg, Design with Nature (Gordon City, New York: The National History Press, 1969), p. 1.

[59] Juneja, op. cit., p. 3.

[60] Constance Holden, "Ian McHarg: Champion of Design with Nature," Landscape Architecture, 1977, p. 156.

[61] McHarg, op. cit. p. 105.

The statements made on environmental features--geology, hydrology, etc.--are collected from substantial sources and are unlikely to contain major errors. The method is explicit because any other person, accepting the procedure and evidence, is likely to reach the same conclusion demonstrated in his studies. This is in direct contrast to the bulk of conventional planning where the criteria are often obscure and covert. Moreover, this method permits one most important improvement in planning methodology, i.e., the community can establish its own value system.

According to Raymond Belknap, McHarg's procedure for inventory and analysis consists of three major steps.[62] Below is an outline of this procedure and Figure 2 shows the procedure in diagram form.

1. Natural and Cultural Resources Are Inventoried and Mapped.
2. Inventory Data Is Interpreted to Reveal Dominant Prospective Land Use for Each Discrete Area.
   A. Data Relevant to Prospective Land Uses Is Interpreted.
   B. Intrinsic Suitability Maps Are Produced.
3. A Value Is Attributed to Every Land Area for All Prospective Land Uses.
   A. A System of Rating Intrinsic Resources Is Established.
   B. Compatible and Incompatible Land Uses Are Grouped.
   C. Data Is Synthesized into a Combined Suitability Map.

The first step deals with inventorying and mapping the natural and cultural resources. McHarg stresses that the resource data be collected

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[62] Raymond Belknap, et al., Three Approaches to Environmental Resource Analysis (Washington, D.C.: The Conservation Foundation, 1967), pp. 65-70.

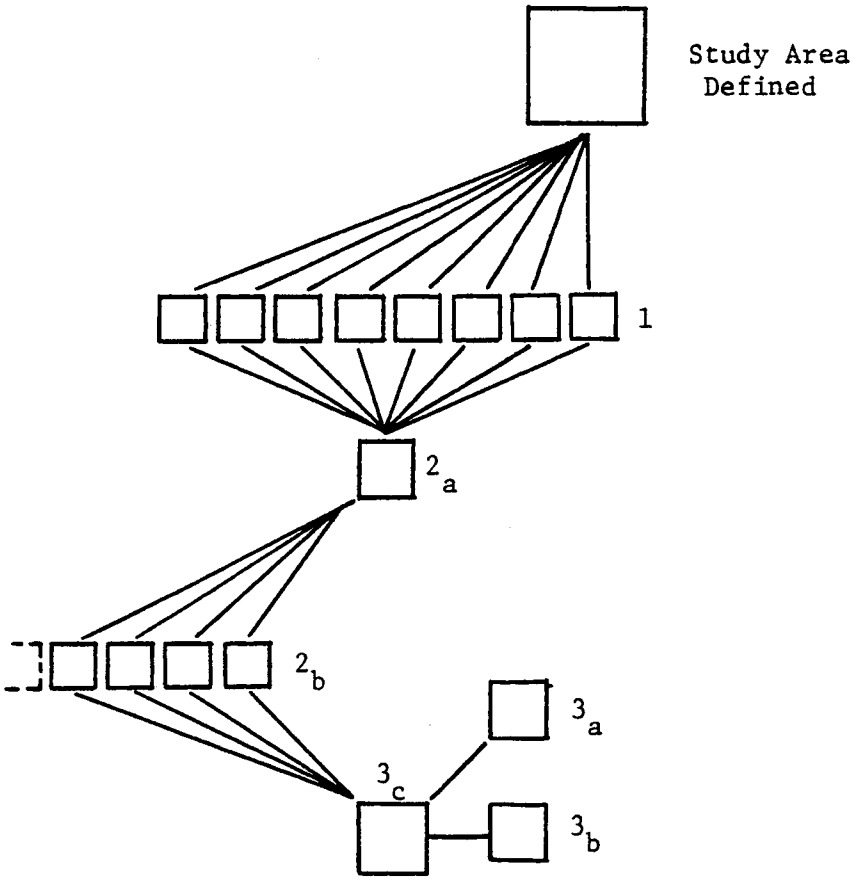

Figure 2

Ian McHarg: Diagrammatic Outline of Analysis Procedure

Source: Raymond Belknap and John Furtado, Three Approaches to Natural Resource Analysis (Washington, D.C.: The Conservation Foundation, 1967, p. 64.

in a sequence because it suggests a concept of causality. Furthermore, by using a sequential procedure, he feels that the analysis can be based on historical reasons for an area's identity and the pattern and occurrence of its resources. The inventory data is to be collected in the following sequence: climate, historical geology, physigraphy, hydrology, soils, vegetation, wildlife, and land use.

The second major step involves interpreting the data to reveal dominant prospective land uses for each discrete area. This step is composed of two additional steps. First, an interpretation of data relevant to prospective land uses are made. The prospective land uses are compiled into land use groups which include several land uses. For instance, production may be a land use group and composed of such related land uses as agricultural, forestry, wildlife propagation, and mineral extractive industries. The resource data are then examined to reveal their positive, negative, and neutral effects on these prospective land uses. This procedure is followed until each resource data factor (e.g., poor drainage, steep slopes, etc.) is examined with respect to the prospective land uses. The second additional step involves preparing intrinsic suitability maps for each resource data factor on transparencies in tones of different colors from most to least suitable for each land use. The maps are then overlaid to indicate the best individual dominant use for each area within the overall study area.

The third and final major step establishes a set of values attributed to every land area for all prospective land use groups. This step involves three additional steps. The first develops a system of rating the value of each intrinsic resource. Ratings are usually based

on a scale from one (1) to five (5) with one being the highest and five representing the lowest.

The second additional step groups all prospective land uses to determine their compatibility and/or incompatibility to each other. The grouping of land uses is derived by constructing a matrix to show the major existing and prospective land use classifications in relationship to each resource data inventoried. Each land use is then evaluated in terms of its impact on the ecosystem. Multiple uses of a given sub-area are considered if the combination of uses are suited to the ecological character of the area.

The final step of McHarg's procedure involves synthesizing the data into a combined suitability map. The objective is to reveal the maximum conjunction of co-existing, compatible land uses that can be sustained by every sub-area in the total study area. The final result is a generalized land use suitability map for the total study area which may be refined by examining the unique characteristics of specific sites utilizing the same data and evaluation procedure.

Some notable observations about McHarg's methodology are made by Raymond Belknap, et al.[63] McHarg's view of the degree to which natural processes should be "deterministic" is questionable. Determinism, as he views it, suggests that development should respond to the operation of natural processes. He accepts this as planning determinants and as constraints and gives much less consideration to the human and cultural

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[63]Ibid., pp. 84-91.

processes or how they shape values and affect natural processes. In light of this, supplementary methods must be developed for early incorporation of social factors into the natural process.

Furthermore, he seems to exclude the behavior aspects of man from his total ecological approach. He sees his work as producing the physical supply of resources and the work of economics as relating the nature and the location and spatial characteristics of demand. He views the initial work of both disciplines in isolation and later compared and combined to make final resource management recommendations.

Phillip H. Lewis. Lewis' work is based on visual observation of environmental features made by a professional, usually a landscape architect, and is referred to as visual landscape analysis. Although there are other leaders in the field, such as K. D. Fines and R. Burton Little, Phillip Lewis is considered the pioneer.

The objective of his analysis is to incorporate ecological factors into the planning process to identify prime lands for recreation and conservation purposes. To achieve this, he identifies and evaluates various landscape features which contribute to the aesthetic quality of the environment.

Lewis contends that much can be done to create a new design form from a region's landscape pattern and to blend all forms of development with the quality of these patterns. He proposes that this be achieved by conducting an inventory of a region's ecological features and then integrating a broad scientific and perceptual understanding of the landscape patterns with recognized aspects of planning. The design form

which evolves from this systematic approach will be a functional expression consistent with the inherent qualities of the landscape.[64]

His methodology focuses on identifying landscape resources on the basis of their contributions to visual contrast and diversity and dividing them into those resources possessing intrinsic values (natural environment perceptually pleasing to man) and those having extrinsic values (qualities added to the environment by man). The major intrinsic resources inventoried are wetlands, water bodies, floodplains, sandy soils adjacent to water bodies, significant topographic views, major highways, and vegetation. Soil surveys are employed to base a determination as to their suitability for recreational uses. Once these resources are identified by professionals, local agencies and residents are recruited to identify additional resources of intrinsic and extrinsic value.[65]

Once all the resources are identified, they are mapped as points, lines, and areas on overlays. The resources tend to overlap in linear or lattice type patterns, which he calls environmental corridors. These corridors usually follow streambeds, ridges, and steep slopes. More concentrated resources are then identified within the environmental corridors and priorities among them for acquisition or protection are determined.

A more detailed account of Lewis' method of inventory and analysis can be found in a study prepared by Raymond Belknap, et al.[66] An outline of Lewis' analysis procedure is shown in Figure 3.

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[64] Ibid., p. 34.

[65] Kaiser, op. cit., p. 131.

[66] Belknap, op. cit., pp. 31-55.

Figure 3

Phillip H. Lewis: Outline of
Analysis Procedure

A. Given a Total Study Area

B. Uses to be Planned for are Identified, and Use Criter are Established.

C. A Case Study Area is Selected in Which:

1. Resources that meet the use criteria are identified.
2. Major resources are inventoried and located on transparent overlays.
3. Patterns of major resources from each overlays are combined into one pattern.
4. Additional resources are inventoried and located on transparent overlays.
5. A variety of patterns may be identified for special purposes from additional resources.
6. Additional resources are combined into a single pattern.
7. Patterns of major and additional resources are compared and correlated.

D. Major Resources are Inventoried for the Total Study Area.

E. Additional Resources are Inventoried for the Total Study Area.

F. Points are Assigned to Major and Additional Resources.

G. Points are Totaled to Identify Relative Priority Areas.

H. Demand for Planned Uses is Established, and Final Priorities and Areas are Defined.

I. Limitations of Each Priority Area to Specific Uses are Identified and Specific Uses are Assigned.

Source: Raymond Belknap and John Furtado, Three Approaches to Environmental Resource Analysis (Washington, D.C.: The Conservation Foundation, 1967), pp. 36,37.

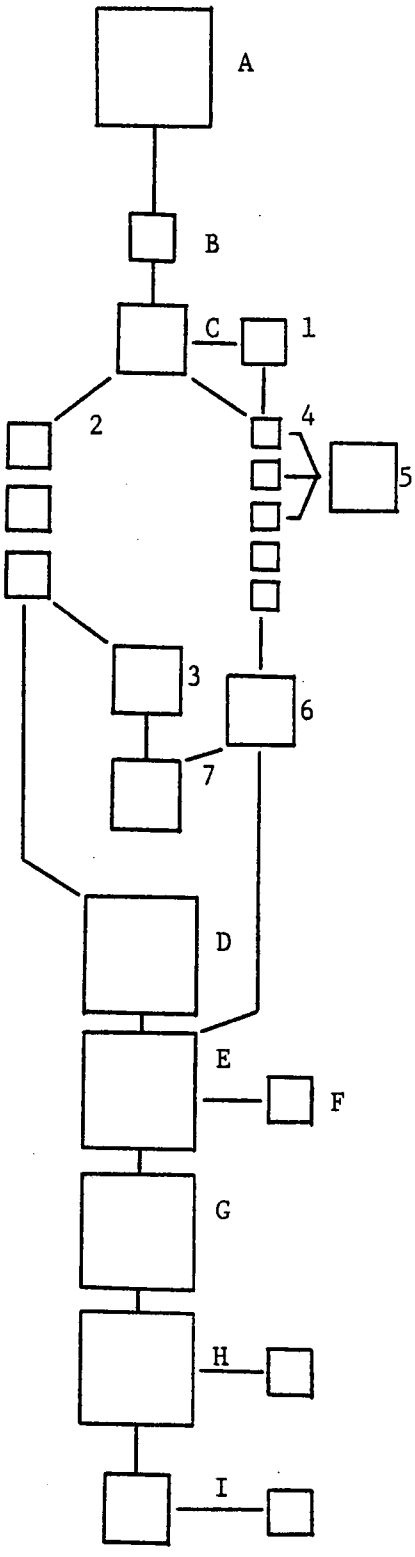

Figure 3.

Since his work is mainly confined to the midwestern states, questions arise regarding the transferability of his approach to other geographical areas. The underlying principal of his work is that natural resources tend to fall into linear patterns of concentration often forming nodes and linkages which he calls environmental corridors.

As noted by Raymond Belknap, et al.:

> one may question whether Lewis's approach could handle an area like Vermount, which would appear to be all corridors, or relatively undeveloped areas such as northern Ontario, with vast and seemingly undifferentiated landscapes of glaciated land and water bodies.[67]

Ohio Department of Natural Resources . In October, 1972, the Ohio Department of Natural Resources initiated the development of an aid to the land use planning process called "land capability analysis." To develop such an analysis, it established the Land Capability Planning Section (hereinafter referred to as the Planning Section) charged with developing a method of evaluating the ability of the land to accommodate various types of development and incorporating this evaluation into the planning process.[68]

The Planning Section contends that land use allocation should not be made solely on the basis of physical capability. Other considerations, such as the location and nature of the existing transportation network, public utilities and services, are also important. A suitability analysis

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[67] Ibid., p. 87.

[68] Ohio Department of Natural Resources, Land Capability Analysis: The Wolf Creek Project (Columbus, Ohio: Ohio Department of Natural Resources, Division of Planning, 1974), p. 1.

is the linking element that combines these man-made aspects of the environment with the results of the capability analysis.[69]

The Planning Section's challenge is to meet the needs of the future with the least harm to the environment. This requires the consideration of such common problems as increased population and pollution, increased noise and visual disorders, and misuse of natural and cultural resources. The major solution is to plan for the future through considering such plan elements as residential, industrial, recreational, agricultural, and conservation needs. The results of its planning efforts should be: properly located residential developments and adequate housing; preservation of prime farm lands from developmental pressures; the application of conservation principles to natural hazard areas; industrial location with respect to environmental and aesthetic needs; and adequate recreational and open space located to serve the greatest need.[70]

In one of its initial reports, the procedure for inventory and analysis consist of the following five (5) basic steps:[71]

1. Define Geographic Area.
2. Inventory Physical Data.
3. Assign Values to Physical Information.
4. Project Land Use Needs.
5. Prepare Composite Suitability-Capability Map.

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[69]Ohio Department of Natural Resources, Madison County Planning Resource Study (Columbus, Ohio: Ohio Department of Natural Resources, Division of Planning, 1974), p. 27.

[70]Ohio Department of Natural Resources, A New Approach to Land Use Planning, op. cit., p. 3.

[71]Ibid., pp. 8-19.

The first step defines the geographical area to be studied. This generally corresponds with counties, groups of counties and/or incorporated communities.

The second step, inventory of physical data, inventories such general subject areas as climate, historical geology, physiography, hydrology, pedology, vegetation, wildlife, and existing land use. After studying these data items, the most important aspects, features and interrelationships are emphasized on maps. For instance, maps would be drawn to indicate the level of bedrock beneath the grounds surface or areas of underground water recharge. This inventory represents not only a gathering of physical and cultural data, but a synthesis of the most important physical properties and features of the planning area.

In the third step, values are assigned to physical information (criteria of suitability). The physical features and their interrelationship are rated in terms of values, which are expressed in terms of suitability on maps. For instance, the criteria of suitability for residential development would include: (a) the proposed sites should be conducive to the placement of underground utilities; (b) the proposed sites should not be located in hazard-prone areas; and (c) the sites should not conflict with existing or proposed industrial development, etc. Suitability maps can be drawn for other land use categories such as industrial, recreation, agricultural, conservation, transportation, etc. Each map would require its own set of criteria to guide the selection of suitable areas or sites for each major category of land use.

Population and economic projections are the basis for determining land use needs in the fourth step of this procedure. If population is

projected to increase, employment must be available to support additional families. It is possible to broadly determine the percentage of the population engaged in various types of employment, such as industry, commercial, service, professional, etc. It is also possible to roughly define industrial space needs based upon past experience on an acre to acre basis. Future space needs can be defined in general for all major land uses.

The final step involves preparing a composite suitability/capability map of all proposed development representing the best selections for each major land use category. This is achieved by analyzing the suitability maps, prepared in step three (3), in light of the space needs projected in step four (4). For instance, the residential suitability map may indicate many areas suitable for development but the population forecasts and projected space needs may require that only a certain amount of land will have to be converted for future residential usage. In this case, the community can select the best or most desirable land for future residential growth.

The Planning Section discussed several limitations or problems in their land capability analysis.[72] The first concerns the use of the terms most capable, capable and not capable. These terms do not accurately describe the restraints in land use posed by the physical properties of a given area. For instance, when an area is mapped as not capable of accommodating residential development, it implies that houses cannot be built in the area, rather than that houses should not

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[72]Ohio Department of Natural Resources, The Wolf Creek Project, op. cit., pp. 17-22.

be built there. The terms that are more precise are: severe limitations, moderate limitations, and slight limitations. Furthermore, closely related to the problem of terminology is determining the point at which moderate limitations become severe.

A second problem, and one seen as having no immediate remedy, focuses on the best way to combine variables to perform an analysis. Instead of concentrating on the development of a particular function, such as residential, they plan to focus on three classes of problems which land development presents. First, there are on-site problems which could be of structural (e.g., ability of the subsoil to support foundations) or non-structural nature (e.g., landscaping). Second, there are area-wide environmental problems that land development could present (e.g., development affecting runoff and resulting in flood hazards elsewhere in the drainage basin). Third, there are resource loss problems which affect the general public as well as an individual or group (e.g., development destorying an important wildlife habitat which affects more than the individual).

The last limitation concerns the question of how to best present the final product for maximum usefulness by local or regional planners. Instead of producing maps of residential or industrial capability, basic data maps and analysis maps might be better. For instance, an analysis map would combine several kinds of land uses, such as places where foundation instability is likely to occur.

Kirk Wickersham, et al. Kirk Wickersham, Roger Hansen and Albert Melcher have developed a system which integrates systematic, interdisciplinary environmental analysis into land use planning and develops a

plan implementation process which depends on and utilizes the interdisciplinary analysis.[73] This system is called a Land Use Decision-Making System (LUDMS). One of the components of LUDMS which is of importance to this research is the Environmental Resource Inventory and Analysis (ERIA). This analysis forms the scientific and technical basis of the system. It is conducted by an Interdisciplinary Team (IDT), another component of the system, which is composed of professional specialists in such fields as geology, climatology, sociology, economics, etc.

The ERIA process is intended to be of adequate depth and breadth, oriented toward the principles of ecology, but avoiding excessive complexity and cost which may render it unacceptable at local levels of governmental application. In essence, it attempts to avoid the major deficiencies that it contends are associated with most other ERIA methodologies.[74] One of these deficiencies is that most other methodologies are independent of the decision-making system, and therefore, the results and data can be ignored whether or not relevant to the decision being made. The LUDMS system establishes a Citizen Advisory Committee (CAC) to avoid this pitfall.

Another deficiency is that other methodologies are multidisciplinary as opposed to interdisciplinary. Various experts will analyze separate environmental components but may not deal with the ecological

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[73]Kirk Wickersham, et al., A Land Use Decision Methodology for Environmental Control (Denver, Colorado: Rocky Mountain Center on Environment, 1975), p. 1.

[74]Ibid., p. 88.

interrelationships between these components. One of the major tasks of the IDT is to deal with these interrelationships.

A final deficiency common to other methodologies is that they do not achieve a balance between complexity and simplicity. Some studies are so complex with enormous amounts of data (and perhaps with computer programs and maps) that they become unintelligible to public officials or citizens for whom they are intended.

The basic objectives of ERIA, which are also at the heart of LUDMS, are:[75]

1. To conduct a valid inventory of the existing environment which can be affected by, or which will affect, the use of land.
2. To understand key ecological and social processes operating in the existing environments and the interactions between various components of the environment.
3. To understand the values of human communities, as manifested by public participation in decision-making.
4. To assess alternative courses of action and their relationship to the environment, i.e., how they may impact the environment, and the nature and extent of environmental constraints and opportunities.
5. To determine the location, design, and operation of land use changes so as to avoid or minimize adverse environmental effects.

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[75] Ibid., p. 90.

The ERIA procedure involves the following four (4) basic steps:

1. Review of Existing Data.
2. Resource Inventory and Analysis.
3. Analysis of Land Suitability.
4. Report on ERIA and Land Suitability.

The first step involves developing a data base from existing inventories of the environment. If good hydrologic studies have been done by the U.S. Geological Survey, for example, this work need not be repeated by the IDT. Various reports and maps available are reviewed to determine their completeness and reliability and based on this review, estimates are made regarding the amount of additional information needed to conduct a thorough inventory and analysis. The IDT and CAC work together to articulate the concerns of the public as related to the existing environment.[76]

The second step begins the inventory and analysis of environmental components. These components are classified as biophysical (e.g., geology, soils, vegetation, etc.) and sociocultural (e.g., land use service infrastructure, social services and public health, etc.). The actual components to be inventoried and analyzed must be determined with the aid of the CAC, especially the sociocultural component.[77]

The third step, analysis of land suitability, is composed of two parts. The first, component analysis, involves identifying and mapping limiting factors, constraints and opportunities for each component. In order to recognize those component characteristics which pose constraints

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[76] Ibid., p. 31.

[77] Ibid., pp. 98-102.

and opportunities, a rating system must be derived. A rating system which is acceptable and understandable by laymen is one which describes areas as: (P) prohibited to development; (R) restricted to certain types of development; (O) no special environmental values and no constraints to development; and (D) desirable, no prohibitions or restrictions. Of importance here, is the geographic display of where certain kinds of development can and cannot occur based on an analysis of scientific data.[78]

The second part of this third step is an analysis of interrelationships of the existing environment. This is considered the more difficult yet the most important portions of any interdisciplinary study since it identifies the interactions and significant relationships between the components of the environment. This analysis should be limited only to critical components and relationships because a complete analysis of all relationships would be prohibitive in terms of time, money, and complexity. A matrix should be employed to show the interrelationships of the components.[79]

The fourth and final step is the preparation of a report on the ERIA and land suitability. Specifically, the report contains the following: (a) base data describing the natural environment in maps, tables, and text form, (b) an identification of the limiting factors and constraints which restrict or prohibit land uses, and how and where these factors operate, for components and for interactions between

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[78] Ibid., p. 96.

[79] Ibid., pp. 103-110.

components, (c) a description of the opportunities for land uses which meet community goals and enhance the community, and (d) policy program recommendations relative to land use, i.e., what should be done to preserve or wisely use the environment.[80]

Since the Land Use Decision Making System (LUDMS) proposed by Wickersham, et al., is relatively new, no sources are available which point out any of its limitations. Nor does Wickersham, et al., highlight any of the system's limitations in their report.

One observation made by the researcher of this thesis focuses on the Interdisciplinary Team (IDT). The system as proposed appears too time consuming and costly to be applied by small and medium size metropolitan and regional agencies. For instances, the IDT, who is charged with conducting the environmental inventory and analysis, must be composed of no less than 11 and not more than 20 professional specialist. It is questionable whether a small or medium size agency could afford a team of this size.

III. IAN MCHARG, ET AL., AND THE COMPREHENSIVE PLANNING PROCESS

A major criticism leveled at the traditional comprehensive planning process has been that it has failed to adequately incorporate environmental considerations. The principal source of this criticism comes from the natural sciences with landscape architects playing an important intermediary role. In particular, they argue that traditional

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[80] Ibid., p. 38, 92.

land use planning fails to recognize and understand that the urban environment is composed of a complex set of interdependent natural and man-made elements and that ecological processes constitute natural determinants of land uses. The need, as they see it, is to integrate a natural resource data base into the comprehensive planning process, to be used in conjunction with economic and other criteria for determining optimal land use allocations. The goal should be land use based on land capability and awareness of the potentially adverse environmental consequences of unstable urban uses.[81]

This need to incorporate a natural resource data base into the comprehensive planning process is also expressed by Michael J. Meshenberg. In particular, he contends that much of the analysis necessary prior to the development of individual projects such as residential subdivisions and industrial parks can be avoided if detailed inventory and analysis of natural resource data are included within the scope of comprehensive planning. The main purpose of the analysis would be to determine the capacity of each area to absorb development and at the same time determine which areas should not be developed.

Some of the specific problems resulting from ignoring natural environmental factors have been:[82]

•Property loss from development on flood plains.

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[81]Abt Associates, Inc., Intégration of Environmental Considerations in the Comprehensive Planning and Management Process (Cambridge, Massachusetts, Abt Associates, Inc., 1977), p. 56.

[82]Meshenberg, op. cit., p. 5.

- Siltation of reservoirs from poor soil management protection.
- Pollution and depletion of groundwater supplies from development on aquifers and their recharge zones.
- Loss of agricultural land to urban sprawl.
- Property damage from building in active geologic zones.

Since it is evident that a need to incorporate environmental considerations into comprehensive planning does in fact exist, the question that arises regards what procedure, method, approach, etc. should be employed to satisfy such a need. Edward Kaiser reveals two approaches in which comprehensive planning is being redefined or reorganized to incoroporate environmental conditions.[83] The first is the additive approach which adds a new sector to the total planning program which specifically focuses on environmental system. The second approach, realignment of objectives and assumptions, involves a fundamental realignment of all community objectives in light of a new awareness of environmental implications. These two approaches will be the focus for this last section of the chapter.

The Additive Approach

This approach adds a new element or separate agency to the comprehensive planning program to specifically focus on environmental concerns. The planning element can be initiated at the state, county, or local level. At the state level, cities and counties in California are required by law to adapt a conservation element in their general

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[83] Kaiser, op. cit., p. 111.

plans.[84] In Los Angeles, the Conservation Plan is designed to serve as an official guide for the conservation, development, and utilization of the natural resources located within its boundaries. Their plan is intended to protect and enhance the public health, safety, welfare, and the quality of the environment. Additionally, it is intended to establish uniformity of policy and direction within the local government concerning conservation of natural resources; and provide a basis for decision-making on proposals which, if implemented, will have a significant impact on the city's natural resources.[85]

The Comprehensive Plan for Sarasota County, Florida contains six major planning elements: (1) population, (2) community facilities, (3) housing, (4) environment, (5) public expenditures, and (6) land use.[86] Due to the complexity of environmental factors, the Environment Element was separated into four distinct phases. Each phase builds upon the former phase but is not inclusive. Listed below and shown in Figure 4 are the four phases of the county's environmental element.[87]

Phase 1 - includes identification of environmental factors and a county overview of each, including Sarasota's niche in the statewide scheme of environmental things.

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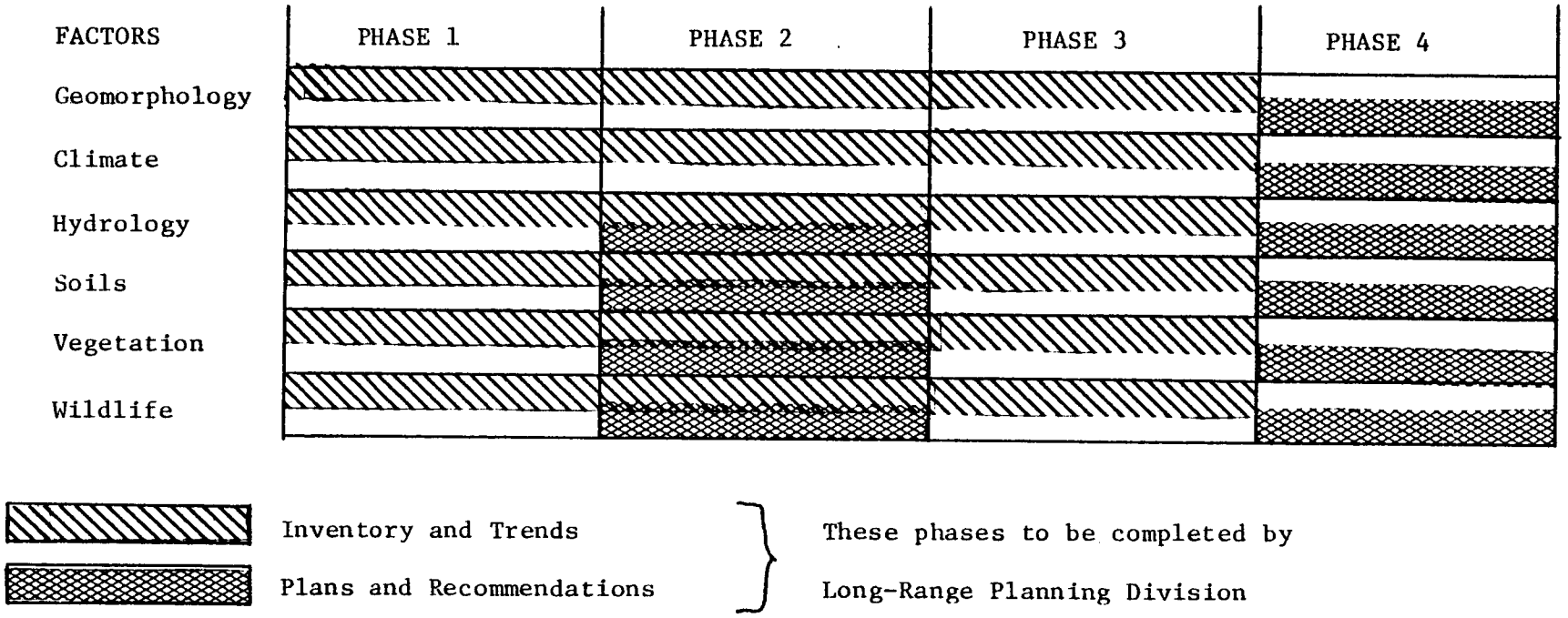
[84]Department of City Planning, Los Angeles, California, Conservation Plan (Los Angeles, California: Department of City Planning, 1973), p. 1.

[85]Ibid., p. 5.

[86]Sarasota County Planning Department, Environmental Element Phase I (Sarasota, Florida: Long Range Planning Division, Sarasota County, Planning Department, 1974), p. 1.

[87]Ibid., p. 2.



Phase 1 - general overview of environmental factors.

Phase 2 - factor specifics; intracounty spatial summary; general plans and alternatives.

Phase 3 - designation of critical variables and critical areas; factor interrelationships.

Phase 4 - specific plans; priorities; implementation alternatives.

Figure 4

Sarasota County Comprehensive Plan: Environmental Element

Source: Sarasota County Planning Department, Environmental Element Phase I (Sarasota, Florida: Long Range Planning Division, Sarasota County Planning Department, 1974), p. 3.

Phase 2 - investigates each factor more specifically and interprets the spatial distribution of each throughout the county. The results of this investigation will be a series of general plan and policy recommendations. This phase and Phase 1 will constitute the "inventory" procedure as called for in the county's comprehensive plan format.

Phase 3 - interprets the various interrelationships among the six environmental factors (geomorphology, climate, hydrology, soils, vegetation, and wildlife) and designates critical variables and areas. This phase constitutes the "projection" and "needs" sections of the Element as described in the county's comprehensive plan format.

Phase 4 - includes the "alternatives" section of the county's plan and presents various appropriate specific plans and recommendations.

With respect to creating a separate agency to focus on environmental concerns, the Ohio Department of Natural Resources, in 1972 established the Land Capability Planning Section to deal with this concern. The Department contends that many comprehensive plans have ignored the physical environment in determining where development should take place. These plans have not taken into consideration such physical realities as flood-prone areas, high seasonal water tables, or shallow bedrocks, each of which presents its own special problem for housing, industry, or agriculture. Consequently, comprehensive planning has often lacked the

logical or defensible basis which an evolution of the physical setting could provide.[88] It is therefore the overall objective of the Department's land capability analysis process to establish the use of physical data as an integral part of the comprehensive planning process in order to avoid significant environmental and economic problems.

Since it is the function of local or regional agencies to design the orderly development of their area, the Department supplements these agencies' resources by assisting them in providing a good physical foundation for their plan. Figure 5 illustrates the interaction between the Department and the local or regional agency requesting assistance to produce an effective comprehensive plan. Several projects have resulted from the Department's involvement with these agencies.[89]

Realignment of Objective and Assumption

This approach to incorporating environmental considerations into the planning process involves a more fundamental realignment of all community objectives in light of an awareness of environmental implications. Harold Wise observes that:

> comprehensive plans will become more environmentally sensitive and this sensitivity will prevade the whole planning process and not be dealt with as an element to be set aside as one goes on to transit, sewers, or jobs.[90]

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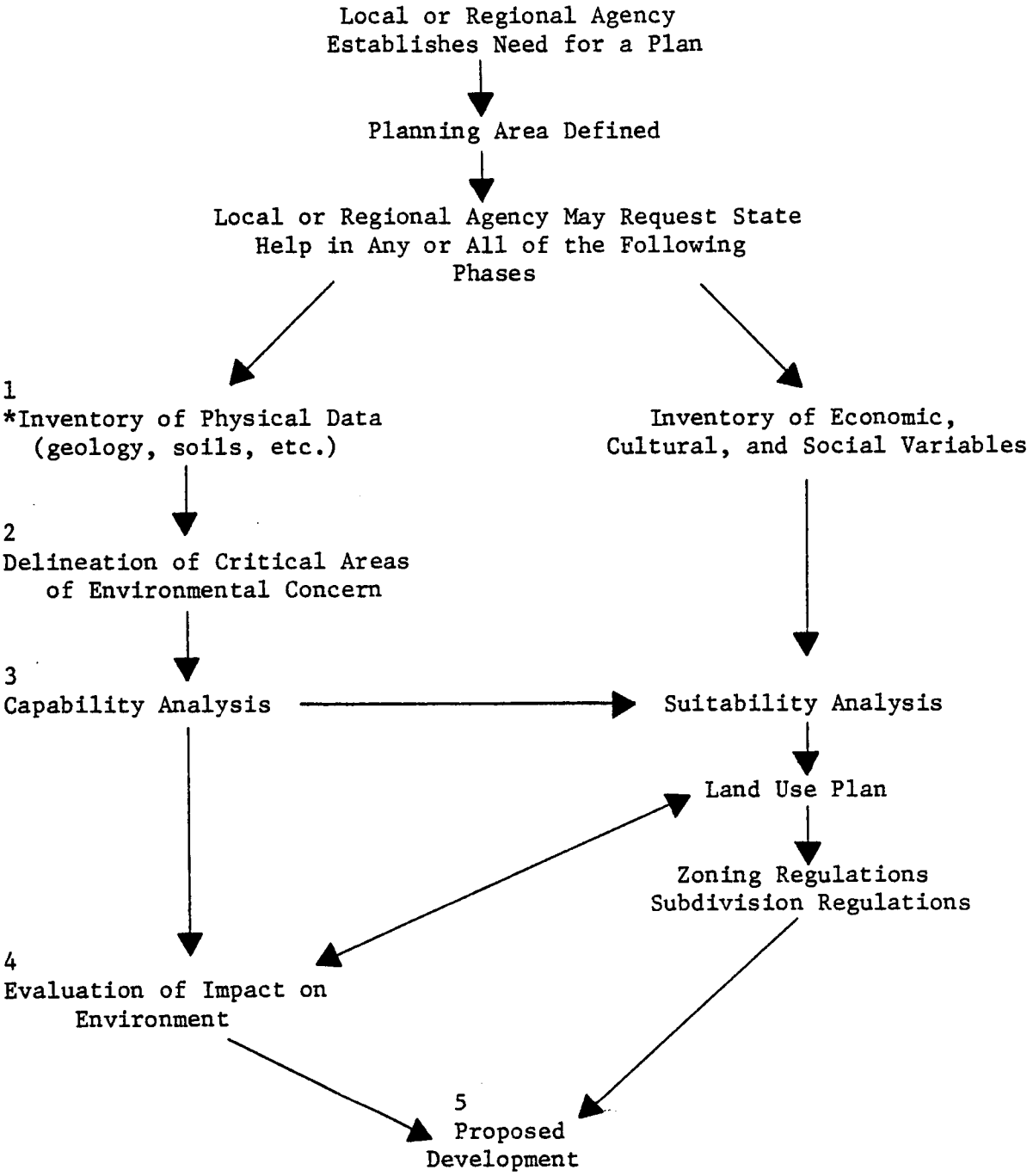
[88] Ohio Department of Natural Resources, A New Approach to Land Use Planning, op. cit., p. 1.

[89] Ohio Department of Natural Resources, A New Approach to Land Use Planning in Ohio, January, 1973; Massie Township, Warren County Ohio, Land Use Plan and Report, May, 1973; Land Capability Analysis: The Wolf Creek Project, February, 1974; Madison County Planning Resource Study, November, 1974 (Columbus, Ohio: Ohio Department of Natural Resources).

[90] Harold Wise, "The Environmental Impact Statement and the Comprehensive Plan," in Future Land Use, edited by Robert W. Burchell



*Numbers refer to steps listed for land capability analysis projects.

Figure 5

Interaction between Ohio Department of Natural Resources and Local or Regional Planning Agencies

Source: Ohio Department of Natural Resources, Land Capability Analysis: The Wolf Creek Project (Columbus, Ohio: Ohio Department of Natural Resources, Division of Planning, 1974), p. 5.

A good example of this observation and approach is the comprehensive plan and process for Sanibel Island in Lee County, Florida.

Adopted in July, 1976, the Comprehensive Plan for Sanibel Island resulted from a total community effort which involved extensive interaction among citizens, government officials and consultants. The planning commission's chief consultant was the planning firm of Wallace, McHarg, Roberts, and Todd, Inc. (WMRT).

At the invitation of private citizen organizations (particularly the Sanibel-Captiva Conservation Foundation), the Conservation Foundation participated and contributed to the planning process by establishing a team of natural scientists. This team was assigned the job of inventorying and analyzing the natural systems of the island.[91]

The Conservation Foundation (CF) undertook the study not only to help the local citizens protect their natural system, but also in an effort to improve the methodology of conservation, i.e., to demonstrate the contribution that a thorough study of the natural environment can make to the local planning process.[92]

The first priority of WMRT and CF was to identify and classify the subsystem of Sanibel's ecosystem. These subsystems were termed "ecological zones" in the plan and furnished the basis for the permitted uses, density limits, and performance standards.

Previous zoning for Sanibel by the Lee County Board of Commissioners would have allowed a total of 30,000 dwelling units. This level of

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and David Listokin (New Brunswick, New Jersey: Center for Urban Research, 1975), p. 226.

[91]Clark, op. cit., pp. 1-305.

[92]Ibid., p. vi.

development would have severely degraded the natural environment and also made it impossible for the island to be serviced by safe streets, adequate water, or sewage disposal facilities. And furthermore, under the Lee County plan Sanibel's economic base as a resort offering unspoiled beaches, a wildlife refuge, and a quiet ambience of a small village would have been lost.[93]

WMRT presented options to the planning commission that allowed the city to consider alternative levels of commitment of public funds to provide for alternative levels of future population growth. The options that were tested were 6,000, 8,000, 16,000, and 24,000. On the basis of projected impact, a ceiling of 7,800 dwelling units was established in the plan. Currently, there are approximately 5,300 units that are either built, under construction, or permitted.[94]

Once the limits on dwelling units were established allocation among the various ecological zones were made. The final product of this task was densities allocated to all land on the island varying from one dwelling unit per 33 acres to five dwelling units per acre. Lower densities were allocated to environmentally fragile or hazardous lands and higher densities to areas where the environment could tolerate change and where support systems were available.

While WMRT, CF, and the planning commission were working on density limits, the legal consultants (Ross, Hardies, O'Keefe, Babcock

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[93]Ibid., p. 86.

[94]Tom Gorton, "Sanibel Island Tries to Control Runaway Growth," Planning (February, 1979), p. 31.

and Parsons) were drafting a set of comprehensive performance standards for the environmental protection of each ecological zone. The standards covered such areas as setbacks from the beach and water bodies, restrictions on clearance of vegetation and topographic disturbance for home building, and limits on the size of area covered by impervious materials (in order to insure groundwater recharge). Strict controls for on-site sewage disposal were also proposed to supplement state and local health requirements.

Environmental factors influenced several elements of the adopted plan but were focused primarily in the section called "Protection of Natural, Environmental, Economic, and Scenic Resources."

Since the plan was adopted in July, 1976, an indication of the citizen's reaction to the plan was reflected in their expressions at the polls during the November, 1976 city and county election. Duane White, chairman of the Planning Commission, filed for the vacant seat in the City Council as did a representative of the Concerned Property Owner's Association, an organization highly critical of the plan. The contest was viewed as a referendum on the newly adopted plan. The voters gave Duane White more than 70% of the vote. Duane White is presently the Mayor of Sanibel. In the county elections, the voters replaced those members of the County Board of Commissioners who were strongly opposed to the plan.[95]

A brief description of another example of this approach is the planning effort of the Metropolitan Washington Council of Governments.

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[95]Clark, op. cit., p. 92.

When the Council was designated as the comprehensive planning body for the Washington Metropolitan Area, most of its policies were based on plans developed by other agencies. The policies were very general and did not directly consider the natural features of the metropolitan area. This was due to a lack of a metropolitan-wide ecological data base. In order to overcome this shortcoming, the Council conducted a study with one of its purposes being to assemble available natural features data to be incorporated into its planning policies.[96]

In the Policy Section of the study, a natural features composite map was developed to illustrate how natural features data can assist in the planning process. As a composite of various natural features data, the map showed some of the areas where the limitations or opportunities inherent in the physical environment should be reflected in public policy. For instance, in poorly drained areas, as in shallow bedrock areas, the study noted urban development should be allowed only where public sewage is available. Shallow bedrock is generally more restrictive to urbanization than is poor drainage because excavation problems and cost are typically greater. Nevertheless, public utility demands imposed by poor drainage areas should be a factor in the determination of public development policy.[97]

The areas established by the Council as areas where public policy should be reflected are: shallow depth to bedrock; poor drainage areas; mineral resource potential; landslide potential; and floodplains and severe slopes.

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[96]Metropolitan Washington Council of Governments, op. cit., p. 41.

[97]Ibid., p. 42.

Kaiser notes that these two approaches (addition and realignment of objective and assumption) need not be viewed as mutually exclusive. That is, a planning agency may be engaged in both a short-term, action oriented planning program aimed at specific environmental standards as well as a long range and continuous reassessment of community direction. Both approaches may be necessary for a particular planning agency to achieve its goals and could therefore be undertaken simultaneously.[98]

IV. SUMMARY

This chapter discussed the basic objectives of environmental studies, the key natural environmental features inventoried, various methods of inventorying and analyzing environmental features and the basic approaches employed to incorporate environmental considerations in the planning process. There are two basic objectives of environmental studies. The first objective seeks to determine environmental constraints to development and places highest priority on urban system demands. The starting point for studies of this nature is the action itself. The studies seek only to identify any environmental condition that conflicts with that action. The second objective focuses on protecting the environment from development and places highest priority on nature and its demands. The starting point for studies with this objective is the area or environment itself and the many different ways in which it could be used.

The most common environmental features inventoried are soils, geology, slopes and hydrology. However, some studies reviewed in this

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[98]Kaiser, op. cit., p. 118.

research conduct inventories covering a wider range of environmental features. The environmental features inventoried are a function of the objectives of the study. For instance, a study which seeks to determine environmental constraints to development will only inventory those particular features that are considered as constraints to the proposed development. In constrast, studies whose objective is to protect the environment will inventory all the environmental features in the study area.

Most of the methodologies for inventorying reviewed in the course of this research are influenced in some way or the other by the works of Ian McHarg and his associates. The primary distinction among the methodologies is in the analysis or data interpretation stage and the geographic scale of inquiry.

Finally, this chapter discussed two approaches to incorporating environmental considerations into the comprehensive planning process; the additive approach and the realignment of objectives approach. The former approach adds a new element or planning section to specifically focus on environmental concerns, whereas the latter involves a fundamental realignment of objectives in light of an awareness of environmental implications. These two approaches need not be viewed as mutually exclusive, they can be employed simultaneously to achieve the goals of a community.

CHAPTER III

STATE OF THE ART: AS PRACTICED IN TENNESSEE

I. UTILIZATION OF ENVIRONMENTAL DATA IN TENNESSEE

The Survey and Questionnaire

In order to determine how environmental data is used in Tennessee, a survey of planning agencies and non-planning bodies was conducted utilizing two questionnaires. Although both questionnaires contained basically the same types of questions. However, the questions were carefully phrased to solicit responses reflecting the views and practices of the agencies and bodies rather than the views of the individual answering the questionnaire.

In designing the questionnaire which focused on planning agencies, it was hypothesized that small locally oriented agencies would not possess the necessary resources of time, money, and expertise to conduct environmental inventories. Therefore, the following four categories of planning agencies were formulated to participate in the survey: regional (Tennessee Valley Authority); state (the six state planning offices); regional councils (the nine development districts); and metropolitan (the four major metropolitan areas). These agencies, by category, are listed in Appendix A.

In an interview with Bill Chandler of the Energy, Environment, and Resources Center, University of Tennessee at Knoxville, a list of non-planning bodies was formulated. It was perceived that these bodies, listed in Appendix A, would have an interest in this research.

The questionnaires were designed to obtain information on the approaches to incorporate environmental considerations in planning; the degree of involvement in the inventory and analysis process; the environmental features of most concern to the agencies and bodies; and the ways they utilize environmental data. The questionnaire also pursued the following questions in an open-end manner: the methodology employed to analyze environmental features; and the importance of environmental features in environmental studies conducted. The questionnaire and cover letter are shown in Appendix B.

Twenty-five questionnaires were mailed; 20 to planning agencies and 5 to non-planning bodies. By the cut-off date only 16 responses were received. A second letter and the original questionnaire was mailed to the nine agencies and bodies that failed to respond by the initial cut-off date. Six of the nine questionnaires were received resulting in an overall response rate of 88%.

The Survey Findings

The literature revealed that two types of approaches exist to incorporate environmental considerations in planning. These two approaches are: (a) the additive approach, which essentially adds a new sector to the total planning program to specifically focus on environment considerations; and (b) the realignment of objectives and assumptions which involve a more fundamental realignment of all community objectives in light of an awareness of environmental implications. These two approaches were discussed in Chapter II. The planning agencies were asked to identify which of the two different types of approaches or any other approach they

employ in their planning process. The non-planning bodies were asked to identify the approach they felt should be employed by planning agencies at the state, regional, and metropolitan level.

The total response of the planning agencies, as shown in Table 1, does not reveal a clear direction toward either approach; seven (41%) employed the realignment approach, six (35%) the additive approach, and four (24%) combined both. This lack of overall direction runs counter to an observation noted in the previous chapter by Harold Wise, i.e., that environmental considerations will pervade the whole comprehensive planning process and not be dealt with as a new element as the additive approach dictates. However, the responses among the metropolitan agencies seem to be headed toward the realignment approach with two (50%) employing this approach and one (25%) each employing the additive and combinations of both approaches.

The response among non-planning bodies regarding the approach they would prefer employed at the state, regional, and metropolitan levels of planning, all (100%) concurred that the state should employ the realignment of objectives approach. Their response, however, runs counter to what is actually practiced, two (50%) of the four state agencies that responded employ both approaches. The non-planning bodies responses are shown in Table 2.

Table 3 shows the response of the agencies regarding their involvement in inventorying and analyzing environmental features. Half of the state and metropolitan agencies indicated they are involved either directly or indirectly. Direct involvement would indicate that the necessary resources to conduct environmental studies are available to them. Also, this response gives some indication regarding their land planning activities.

TABLE 1

APPROACHES EMPLOYED TO INCORPORATE ENVIRONMENTAL CONSIDERATIONS IN THE PLANNING PROCESS

Type of Approach	Type of Planning Agency (#/%) Regional	State	Regional Council	Metropolitan	#/% of All Responses
Additive		2/50	3/37.5	1/25	6/35
Realignment of Objective		2/50	3/37.5	2/50	7/41
Both	1/100		2/25	1/25	4/24
N =	(1)	(4)	(8)	(4)	(17)

TABLE 2

APPROACHES TO INCORPORATE ENVIRONMENTAL CONSIDERATIONS AT THE STATE, REGIONAL, AND METROPOLITAN LEVELS AS PERCEIVED BY NON-PLANNING BODIES

Types of Approaches	Approaches at Different Levels of Planning. (%) State	Regional	Metro
Additive	-	25	25
Realignment of Objectives	100	25	25
Other	-	-	-

TABLE 3

DEGREE OF INVOLVEMENT IN INVENTORYING AND ANALYZING ENVIRONMENTAL FEATURES

Degree of Involvement	Type of Planning Agency (#/%) Regional	State	Regional Council	Metropolitan	#/% of All Responses
Direct	1/100	2/50	3/38	2/50	8/47
Indirect		2/50	5/62	2/50	9/53
N =	(1)	(4)	(8)	(4)	(17)

A majority (62%) of the eight regional councils responding and all of the non-planning bodies are involved indirectly. Both rely on existing inventories prepared by other agencies such as Tennessee Valley Authority, Soil Conservation Services, and U. S. Geological Surveys.

When the agencies were asked to identify the environmental features inventoried, the most common were soils, bedrock geology, slopes, and surface hydrology. Three observations can be made regarding this response. First, these features constitute those inventoried by planning agencies of the past. However, what separates the inventories of past planning practices from the practices of today are the degree of interpretation and broader application.

The second observation concerns the features inventoried by McHarg, et al, and those identified as significant by the non-planning bodies. Inventories by McHarg, et al, include those mentioned above and the following: plant association, sub-surface dydrology, air quality, climatology, vegetation, and wildlife. This latter group of features

compose those of most concern to the non-planning bodies and should be incorporated directly in the land planning activities of planning agencies.

The question that probably comes to mind at this point is why the features inventoried by the agencies are not the same as those identified by the non-planning bodies as significant. The answer to this question constitutes the third and final observation, i.e., the objective of the environmental studies conducted by the agencies. Shown in Table 4, ten (58%) of all agencies indicated their objective is to determine environmental constraints to development with highest priority on urban system demands. Three (75%) of the state agencies and five (63%) of the regional councils subscribe to this objective

TABLE 4

OBJECTIVES OF ENVIRONMENTAL STUDIES

	Type of Planning Agency (#/%)				
Objectives	Regional	State	Regional Council	Metropolitan	#/% of All Responses
Determine Constraints		3/75	5/63	2/50	10/58
Protect Environment			1/12	2/50	3/18
Both	1/100	1/25	2/25		4/24
N =	(1)	(4)	(8)	(4)	(17)

which, among other things, reflects the development consciousness of the small local governments they provide planning assistance to. Half of the metropolitan agencies also subscribe to this objective and the other half, as well as the non-planning bodies, subscribe to the objective which protects the environment with highest priority on nature and its demands.

Table 5 is a composite showing the most common environmental studies conducted by type of planning agency and the importance of environmental features associated with these studies. Of the six types of studies listed on the questionnaire, four were indicated as being conducted most often. The other two, ecosystem analysis and critical areas analysis are seldom conducted.

With respect to the importance of environmental features, the Table reveals that a feature ranked very important (1) by an agency in one type of study can very well be considered moderately important (2) or of slight importance (3) in another study. As noted by one regional council, the features soils, slope, and surface hydrology are very important in a land suitability and land capability analysis because they are vital to measuring impacts of proposed development.

The literature search revealed various ways in which environmental data is being applied outside the state. These applications were made a part of the questionnaire to determine whether there was a consensus among the planning agencies surveyed and McHarg, et al. Table 6 indicates such consensus exists since a clear majority of each type of agency, especially state and metropolitan, applied environmental data in each of the ways listed. The following section will discuss this subject in some detail.

TABLE 5

IMPORTANCE OF ENVIRONMENTAL FEATURES IN THE MOST COMMON ENVIRONMENTAL STUDIES (ANALYSES) CONDUCTED BY TYPE OF PLANNING AGENCY

Environmental Feature:	Most Common Types of Environmental Studies											
	Land Capability			Land Suitability			Critical Areas			Natural Resource		
	S	R	M	S	R	M	S	R	M	S	R	M
Soils	1	1	1	1	1	1	1	1	1	2	1	1
Slope	1	1	1	1	1	1	1	1	1	2	2	1
Bed-Rock Geology	1	2	2	1	2	1	2	2	2	3	3	1
Plant Association	2	3	2	3	3	2	2	1	3	2	2	1
Surface Hydrology	1	1	2	1	1	1	1	1	1	3	1	1
Sub-Surface Hydrology	1	2	3	2	1	2	3	3	2	3	1	2
Air Quality	1	3	3	2	3	2	3	1	2	2	1	2
Climatology	1	3	3	3	3	2	3	3	3	3	3	2
Aquatic Life	2	3	3	2	3	3	3	1	3	2	2	1
Wildlife	2	3	3	2	3	3	3	2	2	2	2	1
Vegetation	2	3	3	3	3	2	3	2	3	2	1	1

Ranking: 1 = Very Important; 2 = Moderately Important; 3 = Slight to Not Important

Agency Type: S = State; R = Regional Council; M = Metropolitan

TABLE 6

APPLICATION OF ENVIRONMENTAL DATA
BY AGENCY TYPE

Application of Environmental Data	By Planning Agency (#/%) State	Regional Council	Metropolitan
Assess Impact(s) of Development	3/75	6/75	3/75
Subdivision Review Process	4/100	2/25	4/100
Basis for Environmental Impact Statement (EIS)	3/75	3/38	3/75
Basis for Lane Use Plans	4/100	7/88	4/100
Basis for Growth Management Program	4/100	2/25	2/50
Other Decision-Making Capacities (e.g., A-95 Review)	3/75	4/50	-
N =	(4)	(8)	(4)

II. DIFFERENCES AND SIMILARITIES IN THE APPLICATION OF ENVIRONMENTAL DATA BETWEEN IAN MCHARG, ET AL., AND THE TENNESSEE PLANNING AGENCIES

Although the methodologies of McHarg, et al., and the Tennessee planning agencies are very similar, the difference that exist between the two is not in the application of environmental data but in the type of environmental features inventoried and analyzed. McHarg, in particular, inventories the following types of environmental features in all his studies: climate, geology, physiography, hydrology, soils, vegetation, wildlife and land use. He also emphasizes that the

analysis of these features should proceed in a sequence, as listed, because it suggests causality.

The types of environmental features inventoried by Tennessee planning agencies varies and are not analyzed in any particular order. For instance, a land use survey and analysis prepared by the West Tennessee Section of the Tennessee State Planning Office (TSPO) only inventoried geology and climate.[99] Another study prepared by the East Tennessee Development District (ETDD) to identify the physical determinants affecting development in the district inventoried major groundwater intake areas, major water run-off areas, agricultural and forest soils, minerals, steep slopes, air drainage patterns, floodplains and scenic features.[100] The results of the literature search and the survey reveals that the predominant features inventoried and analyzed by these agencies are soils, slope, bed-rock geology, surface hydrology and climate.

Tennessee planning agencies are applying environmental data in their land planning efforts in similar fashion as McHarg, et al. Reviewing Table 6 clearly shows the numerous ways these agencies apply environmental data. The literature search revealed several types of

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[99]Tennessee State Planning Office, Land Use Survey and Analysis (Jackson, Tennessee: West Tennessee Section, Tennessee State Planning Office, 1975), p. 37-50.

[100]East Tennessee Development District, Part II Of the Land Use Plan: Physical Determinants Effecting Regional Development (Knoxville, Tennessee: East Tennessee Development District, 1971), p. 9-32.

studies and reports prepared by these agencies and the most common type undertaken focused on providing a basis for land use plans.[101]

III. INCORPORATION OF ENVIRONMENTAL DATA BY TENNESSEE PLANNING AGENCIES

Selected studies covering such areas as water quality management planning, natural environmental analysis, and capability studies can serve as examples of how the Tennessee agencies incorporate environmental data. The studies were selected because of their comprehensive analysis of environmental data.

In water quality management planning, the Knoxville-Knox County Metropolitan Planning Commission conducted a land capability analysis to examine the physical capability of the land to absorb development as a function of water quality and to aid in the general planning process.[102] The specific objectives of the study were:[103]

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[101]For further studies prepared by Tennessee Planning Agencies see: Upper Cumberland Development District, Existing Land Use Survey and Analysis (Cookeville, Tennessee: Upper Cumberland Development District, 1974); Scott County Regional Planning Commission, Comprehensive Plan (Scott County, Tennessee: Scott County Regional Planning Commission, 1971); Tennessee State Planning Office, Greene County Land Use Plan (Johnson City, Tennessee: Upper East Tennessee Section, Tennessee State Planning Office, 1974).

[102]Knoxville-Knox County Metropolitan Planning Commission, Land Capability Analysis: 208 Areawide Water Quality Manage-Plan (Knoxville, Tennessee: Knoxville-Knox County Metropolitan Planning Commission, 1977), p. 6.

[103]Ibid.

1. To identify, by specific geographical location, those areas where a high potential for water quality degradation will exist in conjunction with selected land uses.
2. To identify, by specific geographical location, those areas possessing physiographic compatibilities or incompatibilities with general urban and suburban development.
3. To combine 1 and 2, above, in such a manner that specific geographical areas can be defined in terms of both water quality and general development concerns.
4. To structure analysis outputs so that the specific factor(s) causing any incompatibility can be easily identified.
5. To assess the accuracy of the methodology to determine its range of valid use and its needs for further improvement.

In order to meet these specific objectives five outputs were formulated, each in terms of those individual data characteristics or interpretations most likely to affect the capability for defined use. Individual data characteristics are defined as "single factors"; outputs produced by the combination of single factors are defined as "composites."[104] Listed below are the five outputs. Figure 6 shows the general relationships among single factors and composite outputs.

1. Septic Field Capability - To identify areas where failures will most likely occur.

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[104]Ibid., p. 7.

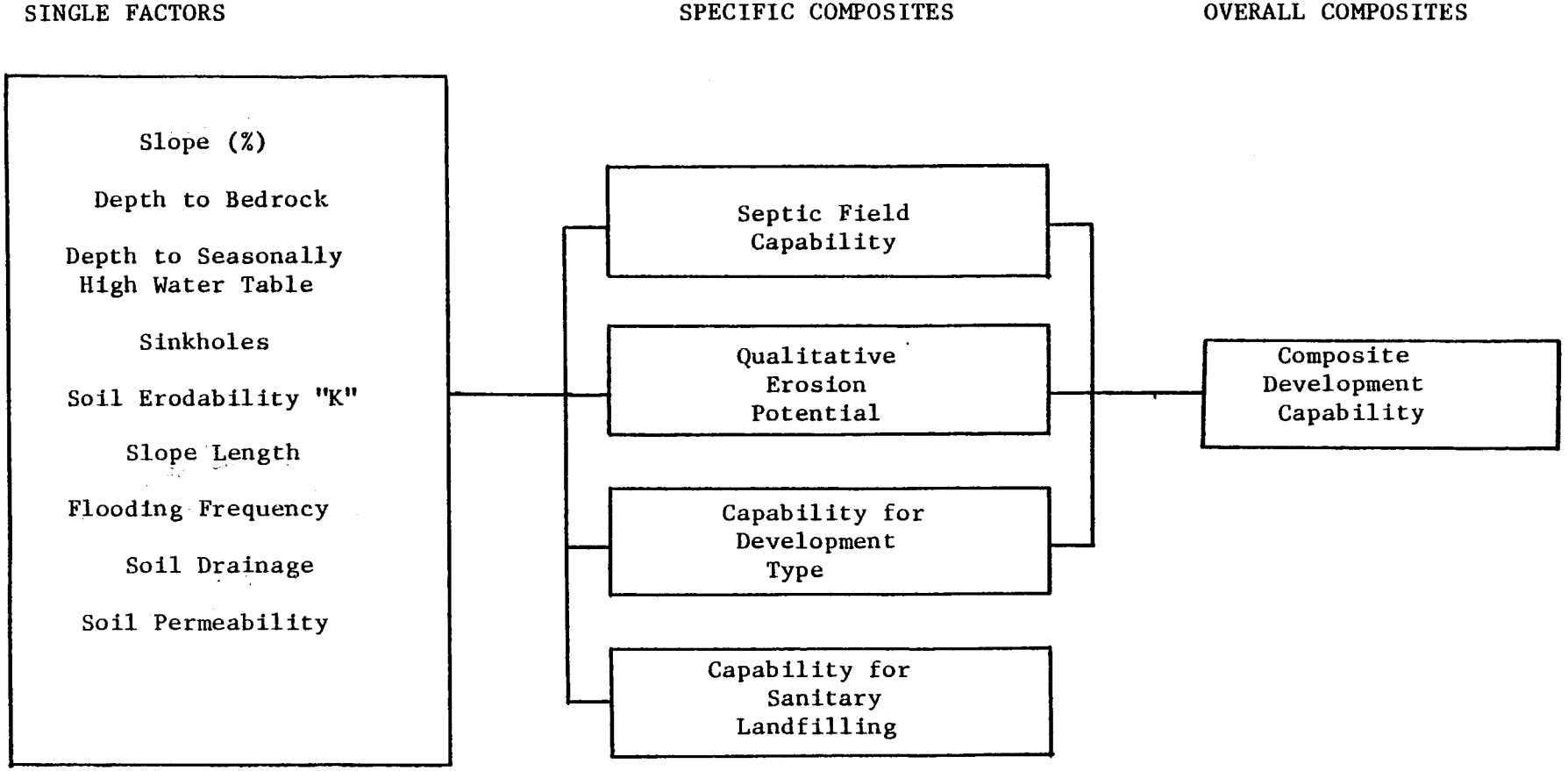

Figure 6

Land Capability Factor Relationship

Sources: Knoxville-Knox County Metropolitan Planning Commission, Land Capability Analysis: 208 Areawide Water Management Plan (Knoxville, Tennessee: Knoxville-Knox County Metropolitan Planning Commission, 1977), p. 8.

2. Qualitative Erosion Potential - To delineate areas especially vulnerable to soil loss during development.
3. Capability for Development Type - To delineate areas as a function of their ability to support differing development intensities from both physical and financial perspectives.
4. Composite Development Capability - To delineate areas as a function of their ability to satisfy the composite constraints of the first three outputs.
5. Capability for Sanitary Landfilling - To delineate areas as a function of their ability to support sanitary landfill operations.

Finally, the study identified several potential uses to which these outputs could be applied to aid in meeting comprehensive planning objectives.[105] Some of these applications include:

1. Utilization of the "Composite Development Capability" outputs to aid in the definitions of areas with the least physical limitations to development for (a) physical evaluation of current county-wide land use plans and (b) formulation of new or modified county-wide land use plans.
2. Utilization of the "Capability for Development Type" outputs to aid in the formulation of new Small Area Plans.
3. Utilization of several outputs to aid in the formulation and evaluation of Open Space Plans by (a) identifying and evaluation of Open Space Plans by (a) identifying areas with severe development limitations and (b) identifying areas of unique biotic or physiographic character.

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[105] Ibid., p. 77.

The second study focuses on an analysis of the natural environment of Davidson County prepared by the Nashville-Davidson County Metropolitan Planning Commission. As part of an effort to approach urban planning comprehensively, the study sought to provide a factual basis and a beneficial perspective to the planning process by surveying the community's natural environment. Furthermore, the study sought to provide investors and developers with an insight into the hazards and damages that could occur if environmental features are not carefully considered.[106]

The primary focus of the study was to inventory and analyze environmental features to determine their constraints on and opportunities for urban development-type land uses. The features studied are physical geography, climate, hydrology, geology, soils, vegetation, and conservation with respect to urban development.

In order to prove itself useful as a guide to both public and private action, the study analyzed the environmental features, above, in a descriptive manner. For instance, in its analysis of soils, it analyzed the different types of soils present in the county; it presented the physical and engineering properties of each soil type; it rated soils with respect to such land use capabilities as conservation, passive and active recreation, residential uses, etc.; it showed how a detailed soil map could be used as a guide to development; and it

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[106]Planning Commission Metropolitan Government of Nashville-Davidson County, Tennessee, Natural Environmental Analysis (Nashville, Tennessee: Planning Commission Metropolitan Government of Nashville-Davidson County, Tennessee, 1973), p. ix.

reviewed some of the soil problems related to development in the county.[107]

The last study is a capability analysis prepared by the Chattanooga-Hamilton County Regional Planning Commission. The purpose of the study was to collect, analyze, and present data essential to providing the optimum use of the land in the county. Additionally, it sought to encourage particular types of development in areas where they are most compatible with the natural environment and where they will provide the best utilization of the land to both the developer and ultimate user.[108]

The study consists of five volumes each focusing on one of the following types of development: residential with septic tank; residential with central sewage; developed recreation; heavy construction; and agricultural. These development types were chosen mainly because they are the major types considered by either private or public developers. When an area is found to be unsuitable for any of the above types, the area is set aside as natural recreational or open space.

The environmental features inventoried and analyzed are soils, slope, bedrock, and flooding. Each feature was analyzed and mapped according to the limitations they impose on each of the development types.

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[107] Ibid., p. 55-73.

[108] Chattanooga-Hamilton County Regional Planning Commission, Land Capability Study, 5 vols. (Chattanooga, Tennessee: Chattanooga-Hamilton County Regional Planning Commission, 1974), p. 1.

The methodology employed was Ian McHarg's approach to inventory and analysis as outlined in his publication Design With Nature.[109]

Lastly, potential applications of the study were listed.[110] Some of these applications are:

1. Development of the General Plan
   - ·identifying areas suitable for residential, industrial, commercial, and recreational uses.
   - ·identifying areas most suitable for cultivation, which should remain in agricultural usage.
   - ·guiding growth and non-growth (Greenbelts and open spaces).
2. Subdivisions
   - ·Developer--locating the site most suitable for development and identifying problems that may have to be overcome, e.g., assessing land development cost.
   - ·Land Owner--determining the potential for development of his land and identifying problems that may have to be overcome.
   - ·Planning Commission--reviewing subdivisions based on the effect of the development on the environment.
   - ·Buyer--this provides one aspect of consumer protection by letting the buyer know something about the natural environment around his new home.
3. Utility Extension
   - ·indication of areas likely to be developed and needing utilities.
   - ·identifying problems in extending utilities.

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[109] McHarg, op. cit.

[110] Chattanooga-Hamilton County Regional Planning Commission, op. cit., p. 9-10.

IV. SUMMARY

The primary objective of this chapter was to ascertain how selected Tennessee planning agencies and non-planning bodies incorporate environmental considerations into their planning efforts. To accomplish this, a survey was conducted utilizing questionnaires. The survey revealed that no consensus exists among the agencies regarding the type of approach they employ to incorporate environmental considerations. Seven (41%) of these agencies identified with the realignment of objective approach, six (35%) employ the additive approach and four (24%) employ both approaches.

Two observations can be made regarding this lack of consensus. First, the approach employed is a function of the time frame in which the goals and objectives are to be accomplished as well as the goals themselves. As discussed in the previous chapter, the additive approach focuses on short-term, action oriented planning programs, whereas the realignment of objectives approach is oriented toward achieving long-term goals.

The second observation concerns the objective of environmental studies conducted by these agencies. Ten (58%) of the 17 planning agencies responding conduct environmental studies aimed at determining environmental constraints to development. This reflects the pro-development consciousness of the local governments which they provide planning assistance to.

Nine of the 17 planning agencies and all of the four non-planning bodies surveyed indicated that they are not directly involved in the inventory and analysis process. They rely on existing inventories

prepared by such agencies as Tennessee Valley Authority, Soils Conservation Services and the U. S. Geological Services. The remaining eight planning agencies are directly involved in the inventory and analysis process.

The essence of the survey reveals that the Tennessee planning agencies are responding to the need to incorporate environmental considerations by collecting environmental data and preparing environmental studies to be used in conjunction with economic and other criteria for determining optimal land use allocations. However, there is no evidence to show how effective this data is being used in the development process or its actual impact on the decision making process.

This chapter also discussed the differences and similarities in the application of environmental data between Ian McHarg, et al, and the Tennessee agencies. The difference that exist concerns the type of environmental features inventoried rather than the application of the data. For instance, McHarg inventories climate, geology, slopes, hydrology, soils, vegetation, wildlife and historic land use in all of his studies. The type of features inventoried by the Tennessee agencies varies from study to study due to such things as staff expertise, time and fiscal constraints and the objective of the particular study.

Finally, this chapter reviewed three studies prepared by three Tennessee metropolitan planning agencies (Knoxville-Knox County, Nashville-Davidson County and Chattanooga-Hamilton County) which serve as examples of how they incorporate environmental data in their planning efforts. These studies were selected because of their comprehensive treatment of environmental data.

CHAPTER IV

MODEL BUILDING

I. THE MODEL DEFINED

The methodology employed to build a model which incorporates environmental considerations in planning begins with an outline of the traditional comprehensive planning process as shown in Figure 7. The outline is transposed into a Program Evaluation and Review Technique (PERT) diagram which becomes a model of the traditional process. Some of the components of this model, shown in Figure 8, will be modified in accordance with the prevailing thoughts as revealed in the literature search. The main components to be modified are: base studies; evaluation of selected alternative; master plan; and implementation.

The element within the base studies component that deserves modification is urban land. This is where natural features should first be given strong and detailed attention. According to Stuart Chapin, the urban land studies seek to describe the salient features and facts about land in the urban area and its surroundings. These studies should provide information on the physical setting that accommodates the economic activity, and the people and their activities.[111] However, of the nine types of urban land studies discussed by Chapin, three (vacant land survey, hydrology and flood potential study, and the study of aesthetic features) give considerations to natural features, but only in a superficial sense.

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[111] F. Stuart Chapin, Urban Land Use Planning (Chicago: University of Illinois Press, 1972), p. 254.

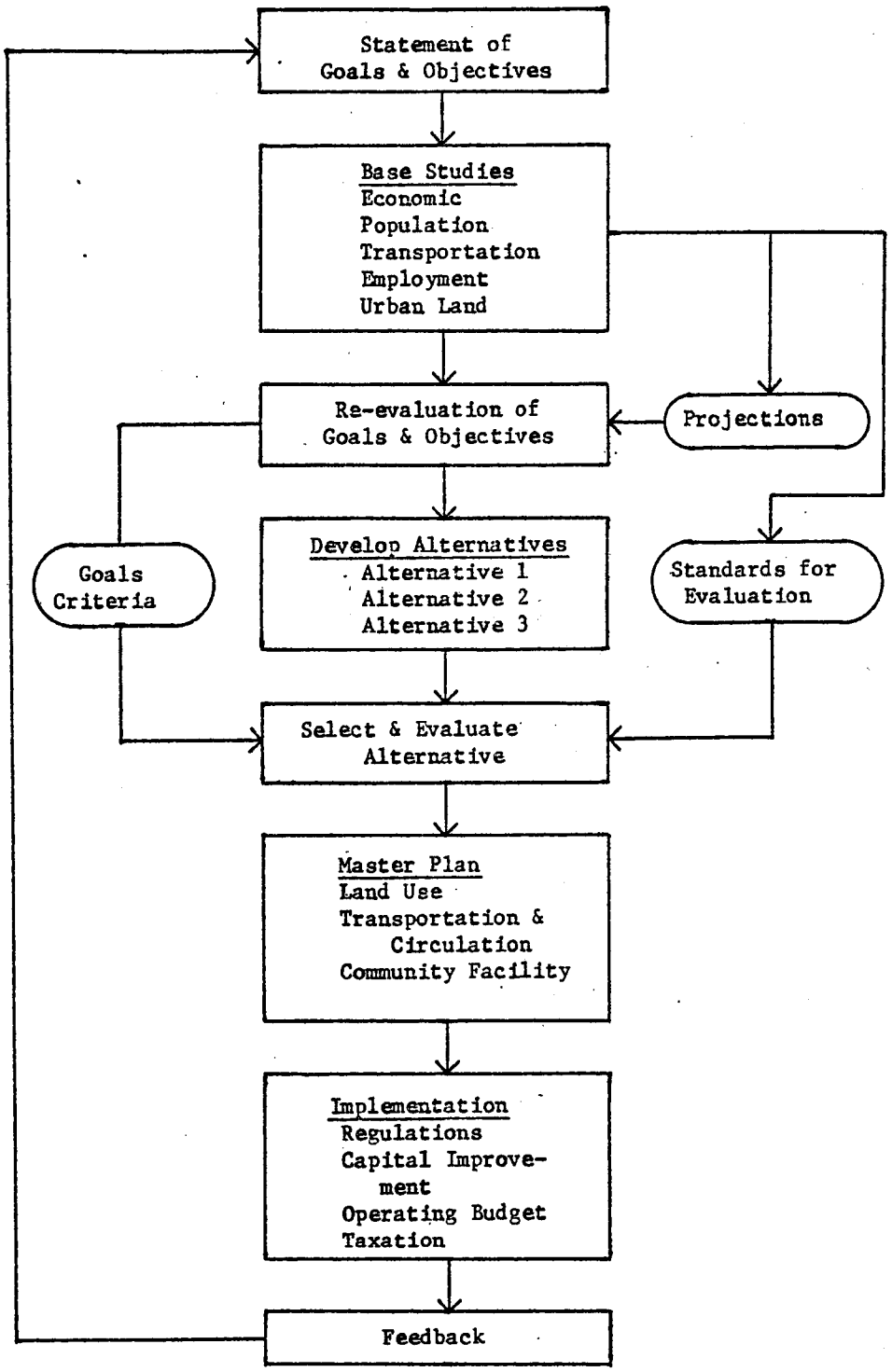

Figure 7

Outline of Traditional Planning Process

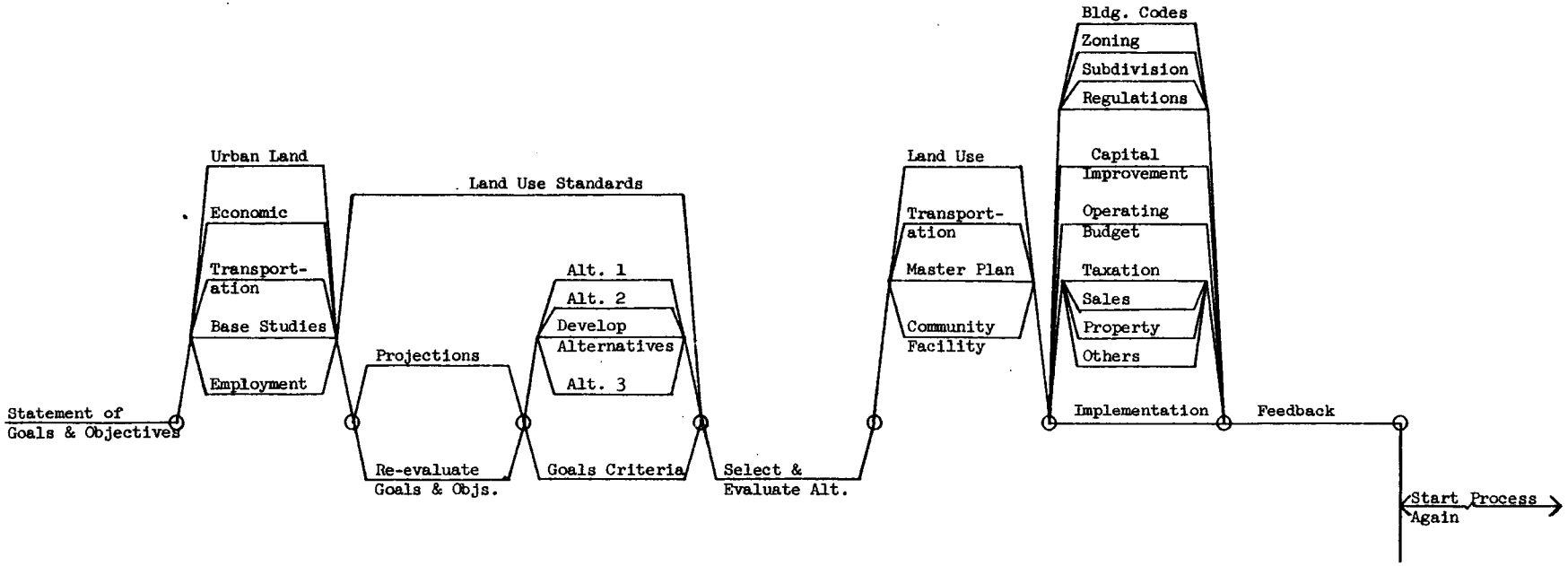

Figure 8

Traditional Planning Model

In other words, such environmental features as soils, slopes, floodplains, and other natural features are considered in the traditional process but only insofar as they affect the stability of the land to accomodate urban development.

Another component to be modified is the evaluation of the selected land use alternatives. One of the major shortcomings of this component is the absence of an environmental basis on which to evaluate the selected alternative. The main criteria employed in the traditional process to evaluate the alternative is based on economics. For instance, the main concern about environmental features in this component focuses on how these features might affect and constrain development thereby limiting economic growth and development. Little consideration is given here concerning how the selected alternative land use pattern might affect and degrade the natural environment.

The master plan document designed as a guide for growth and development of urban areas is being challenged on the grounds that it is not the only tool available to incorporate environmental considerations in the planning process. In the discussion below concerning the modeling implications of Kaiser, et. al., some options to the master plan will be discussed. These options can be used to ensure that the actions of the decision-makers are more in harmony with the needs and sensitivity of the natural environment.

The last main component of the traditional model that will be modified is implementation. The traditional tools of implementation are: regulations such as zoning, subdivision regulations, building and health codes; capital improvement programs; operating budgets;

and taxation measures such as sales and property tax, user charges, and special assessments. These tools acting alone are ineffective for promoting a quality environment mainly because they were not originally designed with an environmental consciousness. However, when coupled with more innovative measures, such as differential taxing policies on farmland, they can be very effective tools.

II. MODELING IMPLICATIONS OF IAN MCHARG, EDWARD KAISER, AND THE TENNESSEE PLANNING AGENCIES

Ian McHarg

McHarg's major input in modifying the traditional model begin with the base studies component. Here he modifies the traditional process by inventorying and mapping natural environmental features which lays the foundation for modifying other components. His methodology for inventorying and mapping is discussed in Chapter II. From his inventory, interpretations are made, intrinsic suitability maps are prepared, and environmental matrices are devised all of which are fed directly into various components of the traditional model. Figure 9 shows McHarg's additions to the traditional model.

From the inventory, the environmental data collected are interpreted for their relevence to the different prospective land use groups or categories. The eight types of environmental data (climate, geology, slopes, hydrology, soils, vegetation, wildlife, and historic land use) are examined for their positive, negative, or neutral effects on each prospective land use. For example, agriculture or recreation, high precipitation would have a positive effect on forestry but a negative

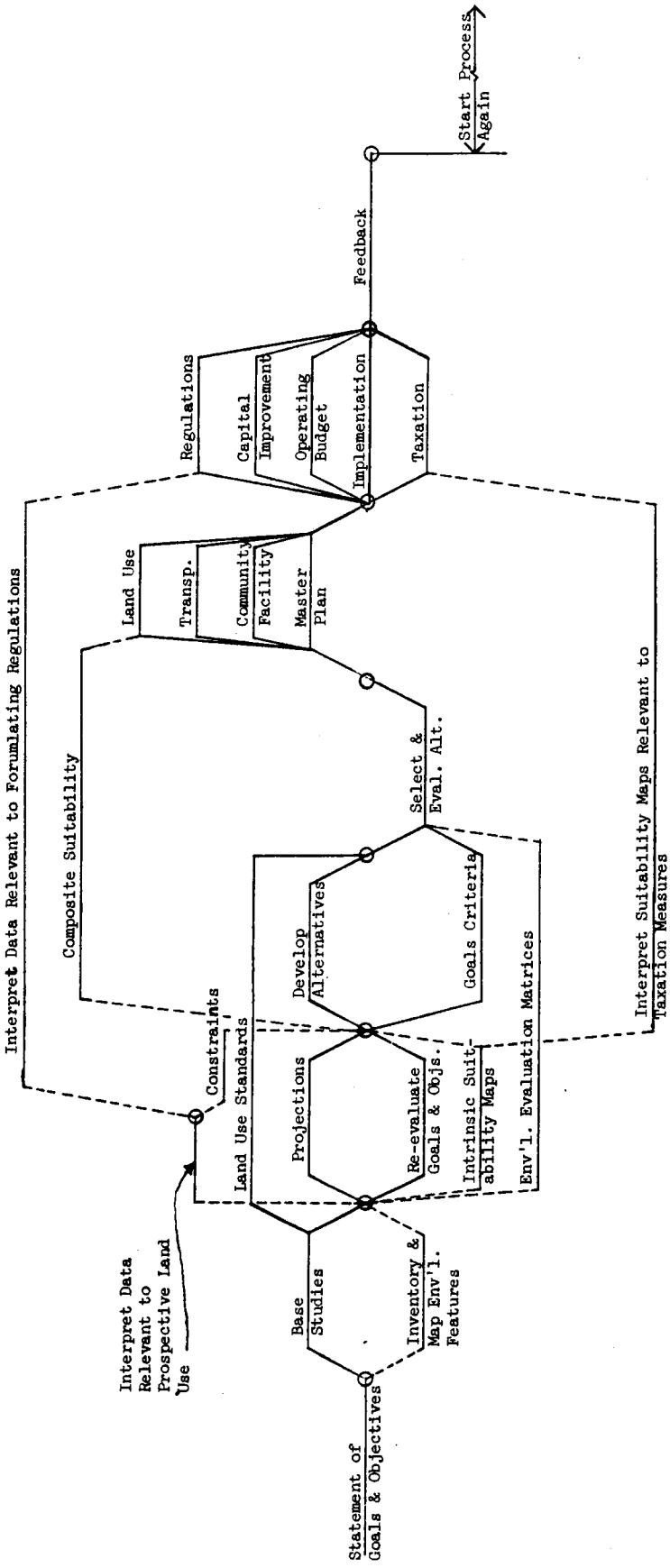

Figure 9

Ian McHarg's Additions to the Traditional Planning Model

effect on recreation. From the interpretation of this data, the various constraints to development can be defined and used as criteria for developing alternative land use schemes. Also, an interpretation of the data is made to reveal its relevance to the formulation of land use regulations, which are elements of the implementation component. McHarg's study for Medford Township can serve as an example of how environmental data can be used to provide a basis for land use regulations.[112]

Another output of his inventory is intrinsic suitability maps prepared for each prospective land use group. These maps can be fed directly into the taxation element of the implementation component. Here, innovative taxation measures can be developed based on these intrinsic suitability maps which reveal areas that: should be preserved such as wilderness and agricultural areas; are environmentally sensitive and critical such as wetlands and aquifer recharge areas; and are environmental hazards such as floodplains.

These maps can be synthesized to form a composite suitability map which can provide the basis for the land use plan element of the master plan component. McHarg's report prepared for Amelia Island, Florida serves as an example of how environmental data can be used to formulate a community's land use plan.[113]

The final output of his inventory, and final input into the modification of the traditional model, are environmental matrices.

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[112]Juneja, op. cit.

[113]Ian McHarg, et. al., A Report in the Master Planning Process For a New Recreational Community, Amelia Island, Florida (Hilton Head Island, South Carolina: The Sea Pines Company, 1971).

These matrices are fed directly into the selection and evaluation component where they are employed to aid in selecting a land use alternative. Their purpose is to match all natural phenomena with each land use to discover whether it is suitable, moderately suitable, or unsuitable with respect to the characteristics of the particular environmental factor.[114] These matrices were used in McHarg's Amelia Island study.

Edward Kaiser, et al.

In a study prepared by Kaiser, et. al., a land use guidance system was developed with the ultimate aim to infuse goals and environmental information into the urbanization process. The guidance system consists of a series of planning activities and outputs that establish a rational framework for decision-making and produce various policies, plans, regulations, and incentives to guide the urbanization process toward environmental quality and other goals. The key outputs of the system are decision guides and action instruments. These outputs enable the process to extend beyond planning activities and emphasize means for implementation.[115]

The components of the guidance system that will be employed to modify the traditional model are decision guides, action instruments and environmental monitoring devices. As shown in Figure 10, the components of the traditional model directly affected by the guidance system (dashed lines) are development of alternative land use schemes, master plan, implementation and feedback.

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[114] Ibid., p. 7.

[115] Kaiser, op. cit., p. 4.

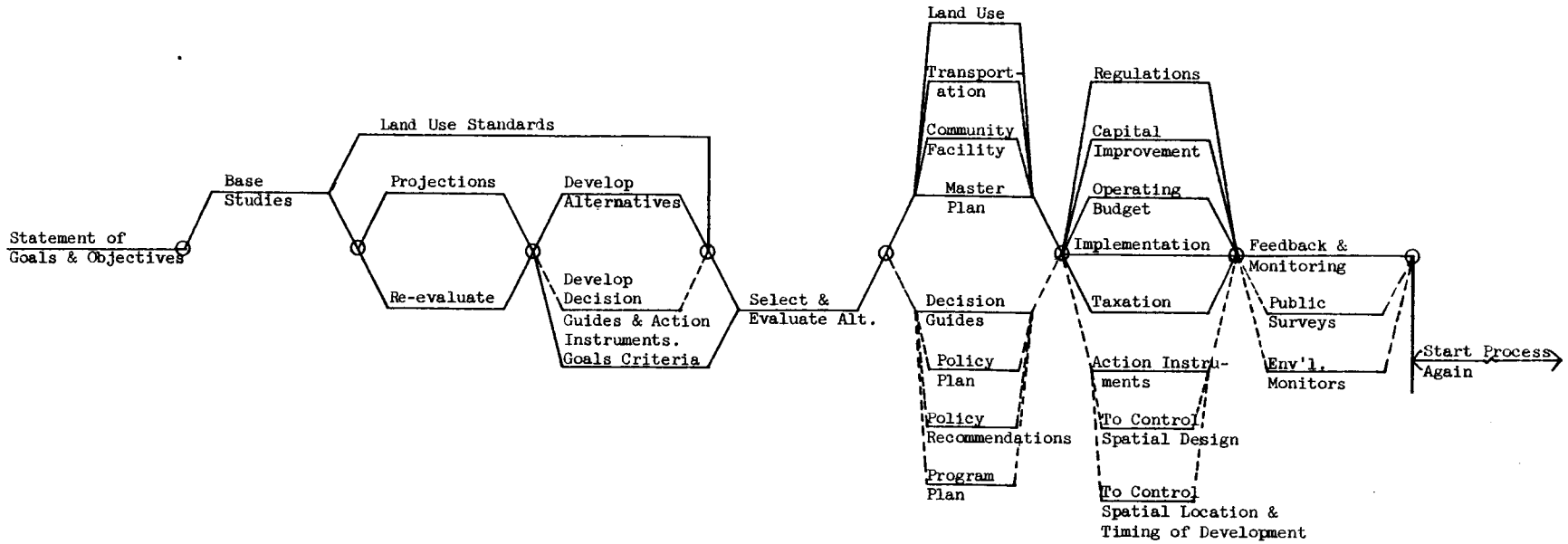

Figure 10

Edward Kaiser's, et al., Additions to
the Traditional Planning Model

In addition to the development of alternative land use schemes, Kaiser suggests that specific decision guides and action instruments be developed and incorporated into this phase of the traditional model. Dicision guides are those plans and policies developed by planning staffs to aid local governing bodies in their policy-making capacity. Traditionally, the land use plan and master plan, along with its transportation and community facility elements, has served as decision guides. Insofar as the land use plan presents a visual interpretation of physical characteristics for twenty years hence, it has not always been the most effective context of information and objectives for evaluating the implications of day-to-day decisions affecting land use.[116] Therefore, such decision guides as policy recommendations, policy plans, and program plans which focus on specific issues within a shorter time frame can be studied and developed as options to the traditional land use and master plan document.

Once the decision guides are developed, they are then fed into the master plan component whereby one or a combination of these guides are employed to aid in the orderly growth and development process of the area.

Action instruments may be categorized as direct and indirect. Direct action instruments to achieve environmental quality goals are those public investments such as sewer systems, water supply systems, transportation systems, and the like which impact directly on the environment. Indirect action instruments are those regulations and

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[116]Ibid., p. 137-143.

incentives which establish a framework of rules and conditions for public and private development such as zoning, subdivision, building codes, taxation policies, etc.

These instruments can be further divided to achieve two fundamental objectives: to control the spatial location and timing of development, and; to control the spatial design characteristics at the site. The action instruments employed to control the spatial location and timing of development are: zoning; taxation; and public investments.[117]

Zoning. Various types of zoning can be used to control the location and timing of development. Such types are large lot zoning, agricultural zoning, conservation zoning, and impact zoning. Large lot zoning can be formulated to designate areas that are considered valuable for their natural resources, agricultural potential or simply open space or for very low density single-family use.

The intent of agricultural zoning is to facilitate the long term use of lands that are best suited for agricultural production.

Conservation zoning is applied to areas exhibiting high sensitivity to development because of a variety of factors interrelated as an ecosystem.

Impact zoning dispenses with traditional zoning practices in that it prescribes various criterion (e.g., the amount of impermeable coverage of a site and required services within a given proximity) aimed to foster conservation of the natural environment and development spatial pattern without being abitrary and inflexible.

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[117]Ibid., p. 152-164.

Taxation. Innovative taxation measures to control the location and timing of development are closely related to attempts to establish and retain conservation and agricultural zones. Two of the major innovative measures are differential taxation on farmland (e.g., preferential assessment, deferred taxation and restrictive agreements) and development impact tax (a tax on real property and its improvements).[118]

Public Investment. Innovations in the area of public investment have been characterized by an increased recognition and use of public utility and transportation systems to shape urban growth patterns. Such systems considered effective control strategies involves the location of: major highway and improvements, trunk water lines and trunk sewer lines.[119]

Kaiser notes three action instruments that can be employed to protect the environment by controlling the spatial design characteristics of development: density zoning or planned unit development ordinances; inclusion of critical environmental provisions in zoning, subdivision, building or health ordinances; and requirements of environmental impact analysis on proposed development as a prerequisite to granting rezoning, subdivision plots or building permits.[120]

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[118]Russel W. Thibeault, "Managed Growth and the Property Tax: Cases and Prospective," Paper presented at the Annual American Institute of Planners Conference (Washington, D.C., 1974), p. 3-8.

[119]Kenneth B. Kenney, Urban Water Policy and An Input in Urban Growth Policy in Kaiser, et al., op. cit., p. 162.

[120]Kaiser, op. cit., p. 168-171.

Density zoning and planned unit development offer the developer flexibility in designing the site as long as an overall density restrictions and other improvements are met. Through site review, assurance can be made that optimum site design and construction practices, from an ecological perspective, have been met.

Environmental provisions are conservation oriented and can be developed as separate ordinances or incorporated into existing ones. The provisions cover such environmental features as floodplains, coastalplains, wetlands, stream banks, shoreland and steep slopes.

Requiring an environmental impact analysis on proposed development would tend to shift the ultimate responsibility for environmentally sound development practices to the developer. Futhermore, such public disclosure provides a pressure point for public officials to suggest necessary remedial action to be taken by the developer.

Once all of the above action instruments are studied and developed in the development of alternative land use schemes component of the traditional model, they are fed directly into the implementation component as tools for implementing the master plan and/or other decision guides.

The last traditional component that Kaiser adds to is the feedback component. Here he adds two monitoring devices; public surveys and environmental monitors.[121] Public surveys are used to assess the environmental objectives of local government officials since the objectives often change as public demand for a high quality environment

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[121]Kaiser, op. cit., p. 171-172.

increases. Surveys can also be used to periodically monitor the general public's concern with and perceptions of environmental quality.

Environmental monitoring devices may be used to assess the performances of various components of the planning process. Such devices that may be designated and monitored are air quality, water quality, open space acreage and public accessibility to open space. The reports prepared by Dale Keys[122] and Schaenman and Muller[123] should be consulted for information on performing environmental monitoring tasks.

Tennessee Planning Agencies

Based on the survey of Tennessee planning agencies discussed in the previous chapter, these agencies subscribe to the traditional planning model with one exception. This exception is the inclusion of environmental inventories as an additional component to the base studies component of the traditional model. Since these inventories are based on the methodology prescribed by McHarg, it was considered unnecessary to develop a model to show this one addition to the traditional model since it is discussed above in the modeling implication of McHarg.

The output of their planning process most often takes the form of land use plans based on environmental inventories and implemented with the traditional tools of zoning, subdivision regulations, building codes, etc.

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[122]Dale I. Keys, Land Development and the Natural Environment (Washington: The Urban Institute, April 1976).

[123]Phillip S. Schaenman and Thomas Muller, Measuring Impact of Land Development (Washington: The Urban Institute, November 1974).

Various components of the traditional planning model have been modified to produce the Environmental Planning Model, shown in Figure 11. The major contributors to this modification process are Ian McHarg and Edward Kaiser. The approaches of the Ohio Department of Natural Resources, Phillip Lewis and Kirk Wickersham were not included in this composite model because their contributions would be basically the same as McHarg and Kaiser.

McHarg adds the following five components for the following reasons. The first and foremost is the inventory and mapping of environmental features. This is added to the base studies component of the traditional process to develop a natural features information base which may be used as a rationale for determining optimal space allocations for land use. The second component is the preparation of intrinsic suitability maps. These maps are prepared for the purpose of identifying those attributes of land and water that are most favorable for prospective land uses. These maps provide the basis for the development of alternative land use schemes and such innovative taxation measures as differential assessment on farm land. The third component is the interpretation of environmental data relevant to prospective land uses and is also added to the projection phase of the process. The data is interpreted to reveal important constraints that must be considered while developing alternative land use schemes. Furthermore, the data is interpreted and subsequently incorporated into such land use regulations as zoning, subdivision and building codes. The fourth component, an environmental evaluation matrix, is prepared in the projection and alternative phase of the process. This matrix is employed in the evaluation phase to evaluate the selected

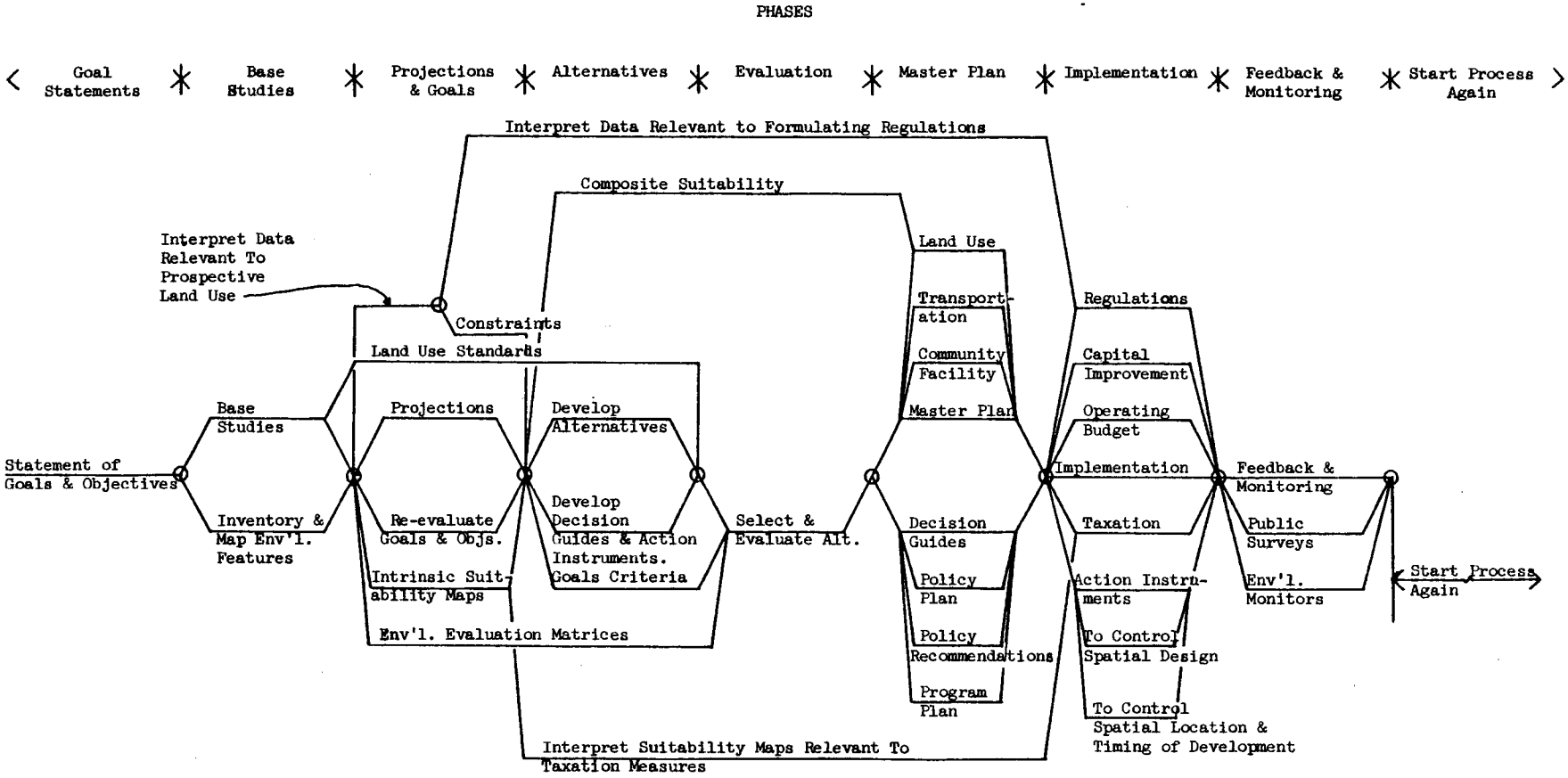

Figure 11

Environmental Planning Model

alternative land use scheme from an environmental perspective, i.e., to indicate the environmental constraints and opportunities for each land use. use. The final component involves preparing a composite suitability map which provides an environmental basis for the land use plan element of the master plan.

Kaiser adds the following three components to the traditional model. The first component is the development of decision guides in the alternative phase. Since the traditional land use plan has a time horizon of 10 to 20 years, such decision guides as policy plans, policy recommendations and program plans are formulated to supplement the land use plan to focus on more specific day-to-day issues. The second component is the development of action instruments. These instruments are carried out in the implementation phase of the process to effectively bring the development process in line with environmental quality goals by controlling the spatial design characteristics for a site and controlling the spatial location and timing of development. The final component added is monitoring. Two monitoring devices are added: public surveys and environmental monitoring devices. The surveys are used to assess local government official's and the general public's concern with and perceptions of environmental quality. Such environmental monitoring devices as water quality, air quality, open space acreage, etc. are used to assess the performance of various components of the model.

With these components added, the traditional planning process is improved to fully consider the effects environmental features may have on the urbanization process and vice versa.

The Environmental Planning Model shown in Figure 11, page 98 operates in the same fashion as a PERT diagram. The circles represent the beginning and/or end of a particular phase. Each phase is composed of various components and each component is composed of several elements (to avoid unnecessary detail some elements are not shown). For example, the master plan phase is composed of two components: master plan and decision guides. The elements of the master plan component are community facilities plan, transportation and circulation plan, and land use plan. The elements of the decision guides component are policy plan, policy recommendation and program plan.

Certain activities (components) can be carried on simultaneously while others must be carried out one after the other. For instance, the work required to prepare the composite suitability (component) map begins in the alternative phase but is not scheduled to be completed until the beginning of the master plan phase. Other activities (components) that can be carried on simultaneously are: development of alternative land use schemes; development of decision guides and action instruments; and the formulation of goals criteria. However, the preparation of the land use plan, an element of the master plan component, cannot start until the composite suitability map is prepared.

This procedure is followed for each phase, component and element shown in the model.

III. SUMMARY

This chapter focused on the primary objective of the research, i.e., the building of a model which planning agencies could employ to incorporate environmental considerations into the comprehensive planning

process. The methodology utilized in building the model consisted of modifying the traditional planning model, shown in Figure 8, page 85, in light of the research findings of the previous chapters.

The Environmental Planning Model developed as a result of this research, shown in Figure 11, page 98, is a composite of the works of Ian McHarg, Edward Kaiser, et. al., and the Tennessee Planning agencies. Moreover, this model represents a combination of the additive approach and the realignment of objectives approach undertaken simultaneously.

McHarg's modifications to the traditional planning model, shown in Figure 9, page 88, and the Tennessee agencies' modifications focus on the preparation of a plan and land use regulations. Kaiser's modifications, shown in Figure 10, page 91, focuses on the implementation of the process regardless of the form of the processes output, e.g., traditional master plan, policy plan, or others.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

I. CONCLUSIONS

State of the Act

The basic assumption of the traditional land use planning process is that economic growth can best be fostered by designing land use patterns to minimize development cost and maximize economic activity. Within this process, environmental features were given consideration only insofar as they affected the suitability of the land for urban development. This limited consideration and an over-emphasis on economic growth have resulted in the failure of the traditional process to recognize that the urban environment is composed of a complex set of interdependent natural and man-made elements and that ecological processes constitute natural determinents as well as opportunities for various types of land uses.

The output of the traditional planning process has resulted in such mistakes as locating residential development in flood prone areas, scheduling industrial development in areas where soils exhibit a low bearing strength, and projecting increased residential densities in areas where it would be impractical or too costly to extend underground utilities due to the level of bedrock.

Such practices have created a need to incorporate environmental considerations into the comprehensive planning process and employ them in conjunction with economic and other criteria for determining optimal land use allocations. The goal of the process should be land use based on the capability and suitability of the land and an awareness of the

potential environmental consequences of unsuitable land uses. The main purpose of such consideration would be to determine the capacity of each area to absorb development and at the same time determine which areas should not be developed.

Communities have reacted to this need in basically two ways. A majority of them, unfortunately, have relied on and continue to rely on the efforts of the federal and state governments (such as the enactment of NEPA and its environmental impact statement and legislation at the state level equivalent to NEPA) which mandates environmental studies. Reliance of these efforts does have limitations. For example, NEPA and its impact statement are applicable only when an agency of the federal government is involved and its proposed action is determined to be both "major" and "significantly affecting the quality of the human environment". In contrast, there are only a few states that have enacted NEPA type legislation, Tennessee being one of those that has not.

The other direction that communities are taking to respond to this need is by preparing, or retaining planning consultants to prepare environmental studies as a means to gaining an indepth understanding of the natural environment and a recognition of the environments implication for urban development. Once this understanding has been attained, natural features can be properly incorporated into the comprehensive planning process.

One of the primary objectives of this research has been to investigate this latter course as a means to incorporating environmental considerations into the comprehensive planning process. The investigation began by reviewing the works of planning agencies and consultants outside

the state of Tennessee. This phase of the investigation focuses on the basic objectives environmental studies seek to accomplish, the fundamental features of these studies, and the approaches employed to incorporate environmental considerations in planning.

There are two basic objectives which environmental studies seek to accomplish. The first objective seeks to determine constraints to development and places highest priority on urban system demands. The starting point for a study of environmental constraints is the action and the study seeks only to identify any environmental conditions that would conflict with that action. The most common types of environmental studies employed to achieve this objective are land capability and land suitability analysis.

The second objective of environmental studies focuses on protecting the environment from development and places highest priority on nature and its demands. The starting point for studies of this nature is the area or environment itself and the many different ways in which it could be used. The types of environmental studies employed to achieve this objective are: land capability analysis, land suitability analysis, visual landscape analysis, natural resource analysis and critical areas analysis. These studies must be comprehensive in order to protect the natural values and functions of the environment and seek the wisest and most appropriate use of the land.

The fundamental features of environmental studies are the key natural environmental features inventoried and the method of inventorying and analyzing these features. The most common features inventoried in the various studies examined are soils, geology, slopes and hydrology.

An examination of these and other features revealed such information as engineering properties, the effects they have on development, why they are important in land use planning and some of the problems associated with these features.

Since his publication of Design With Nature, Ian McHarg's methodology for inventorying and analysis has gained him prominence as a leader in preparing environmental studies which emphasize protecting the natural environment. The majority of studies are influenced by his work. The output of these environmental studies are incorporated into various phases of the comprehensive planning process. The initial phase, base studies, is the most common wherein inventories are conducted to provide a sound environmental basis for the master plan. They have also been utilized to provide the foundation for the formulation of land use regulations.

Two approaches are available for incorporating environmental considerations. The first is the additive approach which adds a new element or separate agency to the total planning program to specifically address environmental concerns. The second approach involves a fundamental realignment of all community objectives in light of an awareness of environmental implications.

These two approaches need not be viewed as mutually exclusive. A planning agency may be engaged in both a short-term, action oriented planning program aimed at specific environmental standards as well as a long-range and continuous reassessment of community direction. Therefore, both approaches may be necessary for a planning agency to achieve its goals and could be undertaken simultaneously.

The second phase of the research focused on planning agencies and non-planning bodies in Tennessee to ascertain how they incorporate environmental data in their planning process. In order to accomplish this, a survey of these agencies and bodies was conducted utilizing questionnaires. It was hypothesized that small locally oriented agencies would not possess the necessary resources of time, money, or staff expertise to prepare environmental studies. Therefore, the survey was directed to regional, state, regional council, and metropolitan planning agencies.

Survey Results

Based on the first phase of the research, which reviewed the works of planning agencies and consultants outside Tennessee, the questionnaires were designed to obtain such information as: the approaches the Tennessee agencies employ to incorporate environmental considerations in their planning process; their degree of involvement in the inventory and analysis process; the objectives of their environmental studies; and how they utilize environmental data in their planning efforts.

The following are pertinent findings of the survey. The planning agencies did not reveal that a consensus regarding the type of approach taken to incorporate environmental considerations. Seven agencies (41%) identified with the realignment of objectives approach, six agencies (55%) employ the additive approach, and four agencies (24%) employ both approaches. The non-planning bodies indicated that they preferred the state agencies employ the realignment of objectives approach. This runs counter to what is actually being practiced, i.e., two agencies (50%) of the four state agencies responding employ both approaches.

Two observations can be made about the lack of consensus with respect to the approach the planning agencies employ. First of all, the particular approach employed is a function of the time frame in which the goals and objectives of the community are to be achieved as well as the goals themselves. As noted above, the additive approach focuses on short-term, action oriented planning programs aimed at achieving specific environmental objectives. Whereas the realignment of objectives approach is oriented toward achieving long range goals and a continuous reassessment of community direction regarding environmental concerns.

The second observation focuses on the objectives of the environmental studies conducted by these agencies. The survey revealed that a majority, ten agencies (58%), of the 17 planning agencies responding conduct studies aimed at determining environmental constraints to development. This reflects the pro-development consciousness of the local governments which the regional, state, and regional council agencies provide planning assistance to as well as the governments which the metropolitan agencies serve.

Of the 17 planning agencies responding, nine (53%) of these agencies and all of the four nonplanning bodies indicated that they are not directly involved in inventorying and analyzing environmental features. Instead, they rely on existing inventories prepared by other agencies such as Tennessee Valley Authority, Soils Conservation Services, and U. S. Geological Services. On the other hand, eight (47%) of the planning agencies are directly involved in the inventory and analysis process.

The most common environmental features inventoried are soils, slopes, bedrock geology, and surface hydrology. Once these and other natural features are inventoried, they are applied in various phases of the planning and development process. Such applications are: assessing impacts of proposed public and private development projects; subdivision review process; basis for environmental impact statement, land use plans, and growth management programs; and A-95 review.

The essence of the survey reveals that the Tennessee planning agencies are responding to the need to incorporate environmental considerations by collecting environmental data and preparing environmental studies. However, there is no evidence to show how effectively this data is being used in the development process or its actual impact on the decision-making process. These issues were not the focus of the survey which was structured to ascertain how the planning agencies utilize and incorporate environmental data in the comprehensive planning process.

The Environmental Planning Model

The third and final phase of the research, and one of its primary objectives, focused on building a model which planning agencies could employ to incorporate environmental considerations in the comprehensive planning process. The methodology employed to build the model entails modifying the traditional planning process model, shown in Figure 8 (page 85), in light of the research findings of planning agencies and consultants outside the state of Tennessee and the Tennessee planning agencies surveyed.

Ian McHarg's contribution to modifying the traditional model begin with an inventory and mapping of natural environmental features. From this inventory, interpretations are made, intrinsic suitability maps are prepared, and environmental matrices are devised, all of which are fed directly into various phases of the traditional model. McHarg's additions to the traditional model are shown in Figure 9, page 88.

Edward J. Kaiser, et al., developed a land use guidance system which is aimed at infusing goals and environmental information into the urbanization process. The system consists of a series of planning activities and outputs that establish a rational framework for decision-making and produces various policies, plans, regulations, and incentives to guide the urbanization process toward environmental quality and other goals. The outputs of this system are decision guides and action instruments. These guides and instruments are used to modify the traditional model to extend the planning process beyond planning activities and emphasize means for implementation. Kaiser's addition to the traditional model are shown in Figure 10, page 91.

The Tennessee planning agencies basically subscribe to the traditional model with one exception. This exception is the inclusion of environmental inventories in the base studies phase of the traditional model. Since these inventories are based on the methodology prescribed by McHarg, it was considered unnecessary to develop a model to show this one addition since it is shown and discussed in the modeling implications of McHarg.

McHarg, Kaiser, and the Tennessee planning agencies all advocate the use of environmental inventorying and mapping as the basis for the planning process. McHarg's and the Tennessee agencies' modifications to the traditional model focus on the preparation of a plan and land use regulations whereas Kaiser's modifications focus on the implementation of the process regardless of the form of the process' output, i. e., traditional master plan, policy plan, etc. When the modeling additions of McHarg and Kaiser are combined, the result is the Environmental Planning Model, shown in Figure 11 (page 98), which incorporates environmental considerations into each phase of the comprehensive planning process.

In summary, the primary focus of the traditional planning process on economic growth has created a need to incorporate environmental consideration into the comprehensive planning process. In light of this need, this research had two main objectives. The first objective was to review the works of planning agencies and consultants outside the state of Tennessee and selected Tennessee planning agencies to ascertain how they incorporate environmental considerations into the comprehensive planning process. The second objective was to build a model based on the findings of the literature search and the survey, which could be employed to incorporate environmental considerations into the planning process.

To accomplish these objectives, the research investigated the works of Ian McHarg, Edward Kaiser, John Clark, Ohio Department of Natural Resources, selected planning agencies in Tennessee, and others. The investigation revealed that the basis for the desired model should

be an inventory and analysis of various natural environmental features. Therefore, the research looked into the basic objectives of these inventories, the natural features to be inventoried and why, the methodologies employed to prepare them, and the approaches used to incorporate the environmental data into the comprehensive planning process.

Based on the above findings, a survey of selected Tennessee planning agencies, using a questionnaire instrument, was conducted to ascertain how they utilize environmental data in their planning efforts. The findings of the survey revealed that these agencies are either conducting environmental inventories or using existing inventories prepared by other agencies to be incorporated into their planning efforts, mainly in preparing land use plans.

II. RECOMMENDATIONS

In light of the findings of these two investigations, the research focused on the building of a model which incorporates environmental considerations into each phase of the comprehensive planning process. The Environmental Planning Model developed as a result of this research, shown in Figure 11, page 98, represents a combination of the additive approach and the realignment of objectives approach undertaken simultaneously. This model should be given serious consideration by the various Tennessee planning agencies for their employment.

A limitation of the model is that it does not account for the economic and political pressures which are applied to land in rapidly developing areas. For instance, a parcel of property may be presently zoned for agricultural use in accordance with the inventory and mapping

component of the model but due to political and economic pressures, the property is rezoned to a more intense use such as commercial or industrial.

Two important issues have developed as a result of this research that should be the focus of other research efforts. The first issue concerns how the environmental data is actually being used in the decision-making process. Such questions to be answered by this issue are:

1. Are decisions regarding public investments made based on an analysis of the environmental data collected?

2. Are zoning ordinances and subdivision regulations being written or amended to include such environmental provisions as floodplains, erosion control, etc.?

The second issue concerns the effectiveness the data is having on the urbanization process. Such questions to be answered by this issue are:

1. Are developers submitting plans which adhere to the demands of the environment?

2. Once land use plans are prepared based on environmental inventories, are other plans and policies adopted by local governments to reinforce the dictates of the environmentally conscious land use plan?

In light of the need to incorporate environmental considerations into the planning process and employ such considerations in conjunction with economic and other criteria, it has been the primary objective of this research to develop a model which responds to this need. It is the recommendation of this research that Tennessee planning agencies

employ the Environmental Planning Model, shown in Figure 11, page 98, and discussed in Chapter IV, as the model for incorporating environmental considerations into each phase of the comprehensive planning process.

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APPENDICES

APPENDIX A

PLANNING AGENCIES AND NON-PLANNING AGENCIES SURVEYED

PLANNING AGENCIES:

Regional -

Tennessee Valley Authority

State (Tennessee State Planning Office--TSPO)

East TSPO Section
Middle TSPO Section
Southeast TSPO Section
Upper Cumberland TSPO Section
Upper East TSPO Section
West TSPO Section

Regional Councils (Development Districts--DD)

Northwest Tennessee DD
Mid-Cumberland COG/DD
Upper Cumberland DD
East Tennessee DD
First Tennessee-Virginia DD
Mississippi-Arkansas-Tennessee COG/Memphis Delta DD
Southwest Tennessee DD
South-Central Tennessee DD
Chattanooga Area Regional COG/Southeast Tennessee DD

Metropolitan (Planning Commission--PC)

Knoxville-Knox County Metropolitan PC
Metropolitan Nashville-Davidson County PC
Chattanooga-Hamilton County Regional PC
Memphis-Shelby County PC

NON-PLANNING BODIES:

Tennessee Heritage Program
Tennessee Department of Conservation
Tennessee Citizens for Wilderness Planning
Tennessee Chapter of Sierra Club
Tennessee Environmental Council

APPENDIX B

COVER LETTERS AND QUESTIONNAIRE INSTRUMENTS

Dear Sir:

I am a student in the Graduate School of Planning at the University of Tennessee in Knoxville. Presently, I am writing my thesis entitled "A Review of Approaches to Incorporating Environmental Considerations in Planning in Tennessee." The basic assumption of my research is that the proper approach is one that inventories and analyzes various natural environmental features which pose constraints on or opportunities for various types of land activity.

The attached questionnaire is a phase of the methodology for this research. The purpose of this questionnaire is to survey planning agencies in Tennessee, such as yours, to gather information regarding the inventory, analysis and/or use of environmental data in the planning process.

If your agency has published or collected any material that might be pertinent to this research, forwarding a copy will be appreciated.

It should be noted that time is a critical factor in this research therefore, I appeal to you for a prompt response. A self-addressed envelop is enclosed to facilitate the return of the attached questionnaire.

Your cooperation is greatly appreciated.

Sincerely,

Treasure H. Rogers, Jr.
Graduate School of Planning

P.S. Please complete and return the attached questionnaire by February 5, 1979.

THE INSTRUMENT

PLANNING AGENCIES

Your cooperation in completing and returning this questionnaire is sincerely appreciated. If the space provided is insufficient for an adequate response, feel free to use the reverse side of each page. Also, if two or more staff members participate in completing this questionnaire please initial the particular question responding to. This is important because it will be a part of the survey findings.

Basic Information of Respondent

Name _____
Present Position/Title _____
Field of Professional Training _____

Name _____
Present Position/Title _____
Field of Professional Training _____

Type of Planning Agency

_____ Regional _____ Regional Council

_____ State _____ Metropolitan

1. What approach does your agency employ to incorporate environmental features (soils, slope, rock, etc.) in its planning process?

A. Additive Approach (addition of a new sector to the total planning program which specifically focuses on environmental features just as other sector planning emphasize transportation, social, economic, etc.)
B. Realignment of Objectives and Assumptions Approach (involves a fundamental realignment of all community objectives in light of an awareness of environmental implications.)
C. Other (Describe) _____
_____
_____

2. Is your agency directly or indirectly involved with inventorying and analyzing environmental features?

A. _____ Directly
B. _____ Indirectly (Please Explain) _____
_____

3. Identify those environmental features your agency inventory.

_____

_____

_____

4. Describe the methodology employed to analyze these features.

_____

_____

_____

5. What is the objective(s) of your environmental study?

A. _____ Determine environmental constraints to development. (High priority placed on urban system demands.)

B. _____ Protecting the environment from development. (Highest priority on nature and its demands.)

6. Select the types of environmental studies your agency conducts which inventories and analyzes natural environmental features.

A. _____ Land Capability Analysis (an analysis of the physical features of the environment to ascertain the degree to which they are capable of being modified without extensive artificial measures to redevelop or maintain a natural balance within the system once the new environment is established).

B. _____ Land Suitability Analysis (an analysis of the natural environment to determine its ability to accommodate various types of land usages without the necessity for extensive artificial measures to develop or maintain the particular land use desired).

C. _____ Ecosystem Analysis (an examination of the living organisms and their non-living environment found in the study area).

D. _____ Visual Landscape Analysis (an inventory of key natural environmental features with emphasis on interpretating their significance in terms of man's visual perception).

E. _____ Natural Resource Analysis (an inventory of environmental features to determine whether their inherent qualities are significant enough to be classed as a natural, historical, cultural, or recreational resource).

F. _____ Critical Areas Analysis (an inventory of such features as flood flood plains, aquifer recharge areas, marshland, etc., which require proper planning and/or protection from development).

G. _____ Other (Describe) _____

_____

_____

_____

7. Rank the following environmental features in terms of their importance to the type of study(s) you identified in question 6. (Ranking: VI=very important; MI=moderately important; and S=slightly or not important.)

Environmental Features:	Type of Environmental Study A	B	C	D	E	F	G
Soils							
Slopes							
Bed-Rock Geology							
Plant Assoc.							
Surface Hydrology							
Sub-Surf. Hydrology							
Air Quality							
Climatology							
Vegetation							
Aquatic Life							
Wildlife							
(Other)							

8. Explain what significant role the above features ranked VI played in the type of environmental study(s) you identified in question 6.

9. Identify the ways you utilize environmental data.

A.____To assess impacts of proposed private and public development
B.____In the subdivision review process
C.____As base data for environmental impact statements
D.____As a basis for Land Use Plans
E.____As a basis for growth management programs
F.____In various decision-making capacities (Specify types of decision making capacities) _____

G.____Other Usages (Specify) _____

10. Please make any additional comments which might be pertinent to this study.

Dear Sir:

I am a student in the Graduate School of Planning at the University of Tennessee in Knoxville. Presently, I am writing my thesis entitled "A Review of Approaches to Incorporating Environmental Considerations in Planning in Tennessee." The basic assumption of my research is that the proper approach is one that inventories and analyzes various natural environmental features which pose constraints on or opportunities for various types of land activity.

The attached questionnaire is a phase of the methodology for this research. The purpose of this questionnaire is to gather information regarding the inventory, analysis, and/or use of environmental data in the planning efforts of environmental organizations such as yours.

If your organization has published or collected any material that might be pertinent to this research, forwarding a copy will be appreciated.

It should be noted that time is a critical factor in this research, therefore, I appeal to you for a prompt response. A self-addressed envelope is enclosed to facilitate the return of the questionnaire.

Your cooperation is greatly appreciated.

Sincerely,

Treasure H. Rogers, Jr.
Graduate School of Planning

P.S. Please complete and return the attached questionnaire by February 5, 1979.

THE INSTRUMENT

ENVIRONMENTAL ORGANIZATIONS

Your cooperation in completing and returning this questionnaire is sincerely appreciated. If the space provided is insufficient for your response, feel free to use the reverse side of each page. Also, if two or more staff members participate in completing this questionnaire, please initial the particular question responding to.

Basic Information of Respondent

Name _____
Present Position/Title _____
Field of Professional Training _____

Name _____
Present Position/Title _____
Field of Professional Training _____

1. What is the focus of your organization?

_____
_____
_____
_____

2. What approach would your organization like to see employed to incorpate environmental features (soils, slopes, rock, vegetation, climate, etc.) in the planning process at the state, regional, and local level?

Approaches:

A) Additive Approach (addition of a new sector to the total planning program which specifically focuses on environmental features just as other sector planning emphasize transportation, social, economic, etc.)
B) Realignment of Objectives and Assumptions Approach (involves a fundamental realignment of all community objectives in light of an awareness of environmental implications.)
C) Other (describe) _____
_____
_____
_____

Levels: Approaches (above)

State _____
Regional _____
Local _____

3. Based on the focus of your organization, identify significant environmental features planning agencies should incorporate directly in their land planning activities.

State _____

_____

_____

Regional _____

_____

_____

Local _____

_____

_____

4. Identify those environmental features your organization is mostly concerned with.

_____

_____

5. Does your organization involve itself with the inventory and analysis of environmental features?

A. ___ Yes (Please Explain) _____

_____

_____

B. ___ No

If you answered yes to question 5, please complete the remaining questions. If your answer to question 5 is no, questions 6 thru 10 may not apply to your organization and are therefore optional. The last question (11) should be completed regardless of your answer in question 5.

---

6. Describe the methodology employed to inventory and analyze the environmental features of concern to your organization.

_____

_____

_____

_____

7. Select the types of environmental studies your organization conducts which inventories and analyzes natural environmental features.

A. ____ Visual Landscape Analysis (an inventory of key natural environmental features with emphasis on interpreting their significance in terms of man's visual perception).

B. ____ Critical Areas Analysis (an inventory of such features as flood plains, aquifer recharge areas, marshlands, etc., which require proper planning and/or protection from development).

C. ____ Natural Resource Analysis (an inventory of environmental features to determine whether their inherent qualities are significant enough to be classed as a natural, historical, cultural, or recreational resource).

D. ____ Ecosystem Analysis (an examination of the living organisms and their non-living environment found in the study area).

E. ____ Land Capability Analysis (an analysis of the physical features of the environment to determine the degree to which they are capable of being modified without extensive artificial measures to re-develop or maintain a natural balance within the system once a new environment is established).

F. ____ Land Suitability Analysis (an analysis on the natural environment to determine its ability to accommodate various types of land usages without the necessity of extensive artificial measures to develop or maintain the particular land use desired).

G. ____ Other (describe) _____

_____

_____

8. What is the objective(s) of your environmental study?

A. ____ Determine environmental constraints to development. (High priority placed on urban system demands.)

B. ____ Determine environmental opportunities for development. (Higher priority placed on nature and focuses on conditions that are suitable for particular kinds of activity.)

C. ____ Protecting the environment from development. (Highest priority on nature and its demand.)

9. Rank the following environmental features in terms of their importance to the type of study(s) you identified in question 7. (Ranking: VI=very important; MI=moderately important; and S=slightly important.)

Environmental Features:	Type of Environment Study A	B	C	D	E	F	G
Soils							
Slopes							
Bed-Rock Geology							
Plant Assoc.							
Surface Hydrology							
Sub-Surf. Hydrology							
Air Quality							
Climatology							
Vegetation							
Aquatic Life							
Wildlife							
(Other)							

10. Identify the ways your organization utilize environmental data.

11. Please make any additional comments which might be pertinent to this research.

VITA

Treasure Haywood Rogers, Jr. was born in South Fulton, Tennessee, on September 2, 1948. He attended primary and secondary schools in that city and graduated from South Fulton High in 1966. The following September he entered Tennessee State University in Nashville, Tennessee, and in June 1971, received a Bachelor of Science degree in Vocational Industrial Education/Building and Construction. In September, 1973, he entered the Graduate School of Planning at the University of Tennessee in Knoxville and received the Master of Science in Planning Degree in August, 1979.

He has been employed by the Tennessee Valley Authority since June, 1971.