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ABSTRACT

Regional analysis is central to applied geographic research, contributing to better planning and policy development for a variety of societal problems facing the United States. The development of energy policy serves as an illustration of the capabilities of this type of analysis. The United States has had little success in formulating a national energy policy, partly because it has failed to consider that various energy forms have regional patterns of need, availability, acceptance, and cost effectiveness. A successful policy must reflect this regional variation. Policy formulation should involve classification, mapping, and spatial analysis of regional characteristics as they relate to population densities, transportation systems, and socioeconomic variables. Several volumes on geographic data processing systems and computer programs are available to facilitate such analysis. Geographic analysis of local factors such as urban clustering are also relevant to energy policy formulation. Implementation of planned settlements would enable energy saving measures such as transportation cost cuts and district heating systems. Because of the uses of regional analysis in applied geography, greater emphasis should be given to this approach in graduate and undergraduate programs, both in methodology and substance courses. The paper includes samples of regional analysis maps and computer programs. (LP)

THE SIGNIFICANCE OF REGIONAL ANALYSIS IN APPLIED GEOGRAPHY

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The accelerating demands of growing populations are putting greater and greater pressure upon the available space and finite resources of all countries and regions of the world. As the complexity of societal issues grows, groupings, classifications and regionalizations of resource and socio-economic variables are crucial to the understandings that may lead to potential solutions of real world problems. The variables characterizing societal issues at various scales -- macro, meso, micro -- can be classified and regionalized in order to gain valuable insights and generalizations at the different levels. However the type of analysis, the statistical techniques used, and the results likely to be obtained may be quite different from place to place depending on the size and complexity of the problem and the nature and interplay of socio-economic characteristics of a given geographical area. The development of policies for the different levels of scale and the various types of regions will be more and more useful in dealing with existing and future real-world issues such as energy analysis and energy policy development.

The fact that the delineation of regions is primarily a classification process and that regions are essentially areal classes sets the stage for the application to regional problems of a number of grouping and generalizing techniques and theories. These include set theory, Thiessen polygons,

discriminant analysis, distance-minimization functions and graph-theory. In these and other methods, classification is an integral part of the approach utilized in applied geographic research. The classes identified can be analyzed by various model building, quantification and systems analysis techniques; thus increasing the scope and analytical power of the applied research. The computer facilitates the employment of these sophisticated techniques and permits the manipulation of large amounts of data. The result is a view of relationships and covariations of complex variables within regions--a view that gives new insights into the perplexing issues resulting from people utilizing any given earth space. This paper proposes that the contributions of regional analysis are central to applied research and result in better planning and policy development on a variety of significant societal problems facing the United States, its regions, states, and local communities. Thus the thorough development of skills in understanding and utilizing the regional approach needs to be a key part of the training of the geographer wishing to apply the methods and techniques of the discipline to issues facing individuals, groups, enterprises and governments. Energy patterns and policy development in United States will

be utilized in this discussion to illustrate the significance of regional analysis as an important component of applied geography.

Role of Regional Analysis in the Development of Energy Policy

A rational energy policy needs to take into consideration regional characteristics of energy forms, the varying energy needs of people and activities in different areas, the cost differentials of various geographic areas and energy types, and the socio-economic variabilities that change energy use from region to region. An efficient energy policy should encourage usage of fossil fuels and renewable energy sources as available on a cost effective basis in various parts of the country and, over the short and long term, would result in the best use of the nation's resources. Energy policy thus would vary from region to region, from state to state, and within states in order to take best advantage of the distributional and cost characteristics of energy forms in relation to the demand variations and would be compatible with desirable conservation practices.

The Development of National Level United States Energy Policy

Congressional acceptance of a workable national energy policy has been difficult to attain. This should come as no surprise since current energy production and requirements as well as the future potential and needs differ radically from state to state and from region to region in the United States. The distribution of the exploitable fossil fuels, for instance, varies greatly from county to county as well as from region to region in the country. The places--ports, for example, or pipelines where imported sources of liquid fossil fuels enter the U.S. make that kind of energy more easily available and less expensive in some locations and more costly in others depending upon accessibility to the transportation facilities. The renewable forms of energy -- wind, biomass, solar thermal, and small-scale hydro -- also vary greatly in their occurrence and usable concentrations. Solar thermal, for instance, is much more reliable and abundant as a source of heat in the Southwest than in the industrial Midwest and Northeast. Exploitable geothermal power is more concentrated in the intermontane basins of the West than in other parts of the country. The liquid fossil fuels with large net energy gains can be transported long

distances economically, and thus can stand the costs of moving from production areas to consuming areas. The diffuse renewable and geothermal forms of energy, however, with low net energy gain must be used near the source of energy. Thus, it seems practical to move towards a policy that would encourage the development and use of solar and geothermal energy in those areas where it can be most efficiently collected and used.

Various forms of energy have regional patterns of availability, acceptability, and cost effectiveness. A national energy policy needs to take into consideration the regional characteristics of available energy forms, the differing needs of the people of diverse areas, and the socio-economic variations from region to region. A national energy policy should foster the local or regional usage of fossil fuels and renewable forms of energy as differentially available in various parts of the country. It seems obvious, for instance, that the Southwest should make use of major solar thermal power for heating of homes and water, and that fossil fuels in that area should primarily be for motor vehicles and for other uses where solar thermal energy is not feasible. This kind of a policy assumes that the costs for utilizing oil and solar energy for heat in the

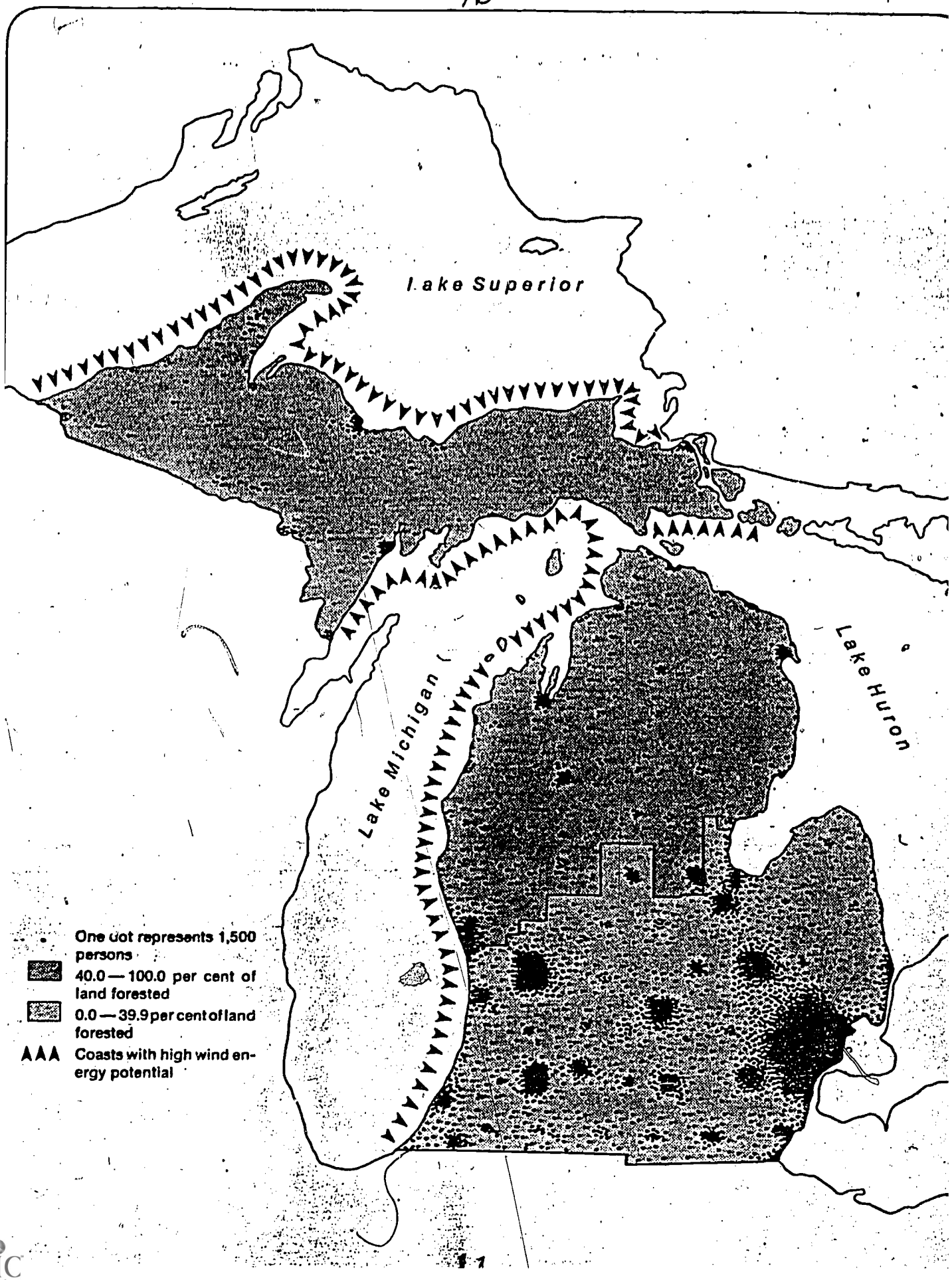
Southwest would be competitive or would be subsidized to make them competitive. In other areas, where geothermal heat is easily available, it should be used instead of fossil fuels for heating homes and water. Thus each part of the country would use renewable energy forms as available and as practical in a particular region. Finite fossil fuels thus could be conserved. Energy policy would vary from region to region or from state to state in the United States in order to take advantage of most effective distribution of energy forms in relation to the varying power needs of the entire country and its parts. The national energy policy framework must be broad and flexible enough to encompass the considerable regional variations in energy availability, variety, and demand while at the same time encouraging efficiency and conservation.

Local Level Energy Policy Development

Even at the state or county level, the ease of availability and cost variations of different forms of energy are such that flexible local energy policies are necessary to gain the most economical energy use and foster conservation practices. Local energy policies must take into consideration regional differences in energy production

and need as related to the demands of populations with varying densities, types of economic activities, and economic success as indicated by purchasing power and life styles. In the state of Michigan, for instance, the most reliable wind power is along the shores of Lake Michigan and Lake Superior; the best areas for locally available wood energy are in the forested northern two-thirds of the state; there is no competitive coal production; and some petroleum and natural gas are produced in various areas of the Lower Peninsula. The under utilized forest biomass represents a real opportunity for the immediate and long-term as a renewable energy resource (Figure 1). The urban waste of the heavily urbanized southern one-third of Michigan represents a power and heat potential that, if fully utilized, would help solve a growing problem in waste elimination as well as provide a source of much-needed power in an energy poor area with great urban-industrial intensity. A classification, mapping and spatial analysis of the regional character of the existing and potential energy sources in relation to population densities, transportation systems and significant socio-economic variables is crucial to developing an energy policy in Michigan. Counties, or groups of counties, need to collect

Figure 1. The relationships of population distribution and biomass and wind energy sources in Michigan. Source: Sommers, Lawrence M. "The Potential Impact of Increased Use of Renewable Resources on Land Use Patterns and Policy: The Case of Michigan," Applied Geography Conference, Vol. 2, 1979, SUNY-Binghamton, p. 66.


Lake Superior
Lake Michigan
Lake Huron
One dot represents 1,500 persons
40.0 — 100.0 per cent of land forested
0.0 — 39.9 per cent of land forested
Coasts with high wind energy potential

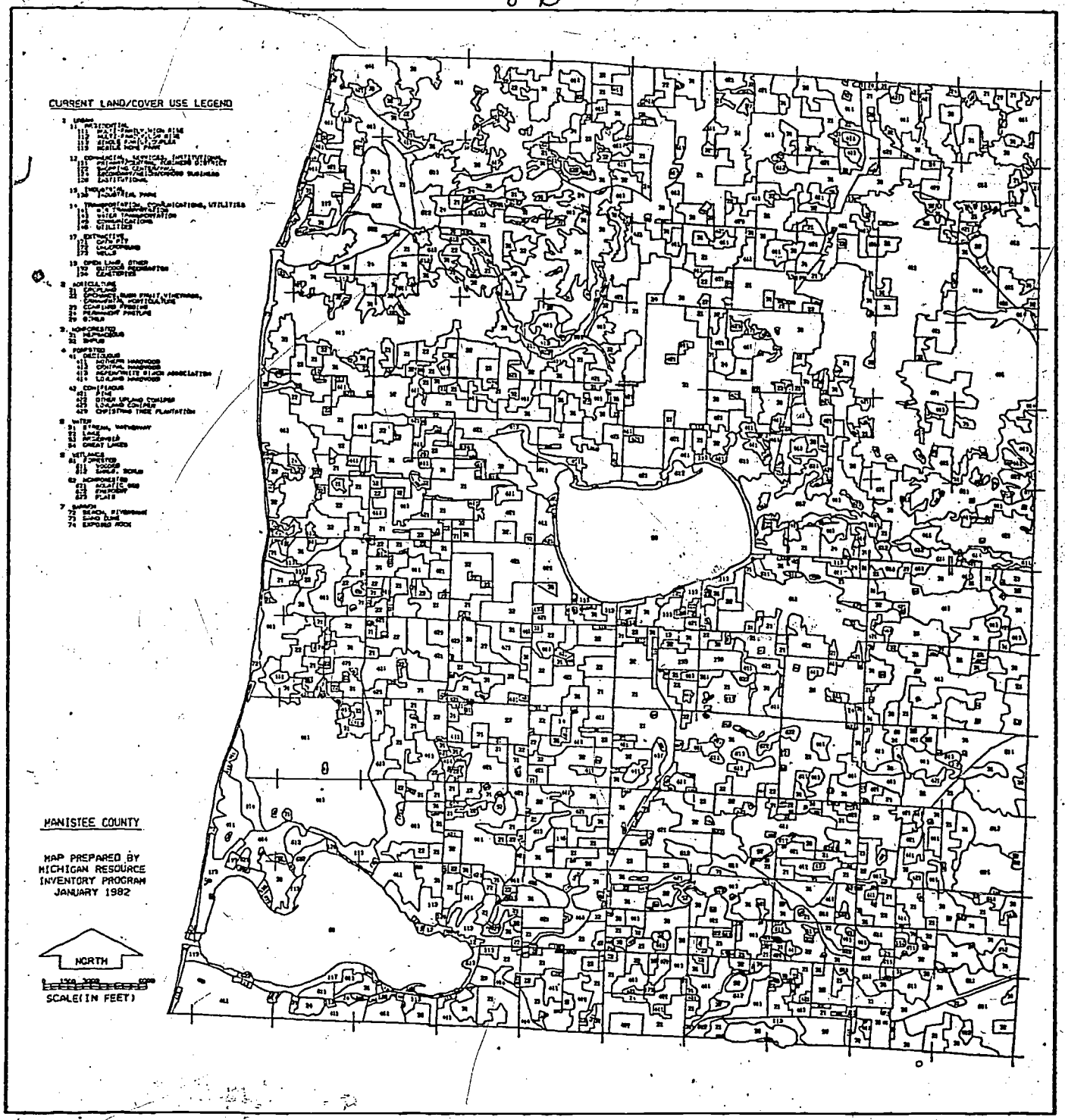
and analyze pertinent data in order to determine the best energy policy.

The state of Michigan has embarked on the development of a computerized data system for each of the counties of Michigan. This system is being developed by the Department of Natural Resources in Lansing with two regional offices to service the Upper Peninsula and the northern Lower Peninsula. The data is (or will be) available at township and county levels and allows instant display and computer printouts of correlations of variables appropriate to a variety of needs and policy development. Figures 2 and 3 illustrate the system, a sample of the data available, and a printout of orchard regions for Manistee County, Michigan.

Most states have population-resource disparities and other regional differences similar to Michigan's. The development of state, regional, county, city, and township energy policies must take into consideration these regional disparities. Energy policy development lends itself to the regionalization approach and the tools, techniques and theory of the geographer. The use of inventories, classifications, mapping techniques, model development, and sophisticated quantitative regional analysis can greatly assist the work of the applied geographer in contributing to

Figure 2. The land classification system of the Michigan Resource Inventory Program as applied to Manistee County. (Courtesy of the Michigan Department of Resources, Lansing).

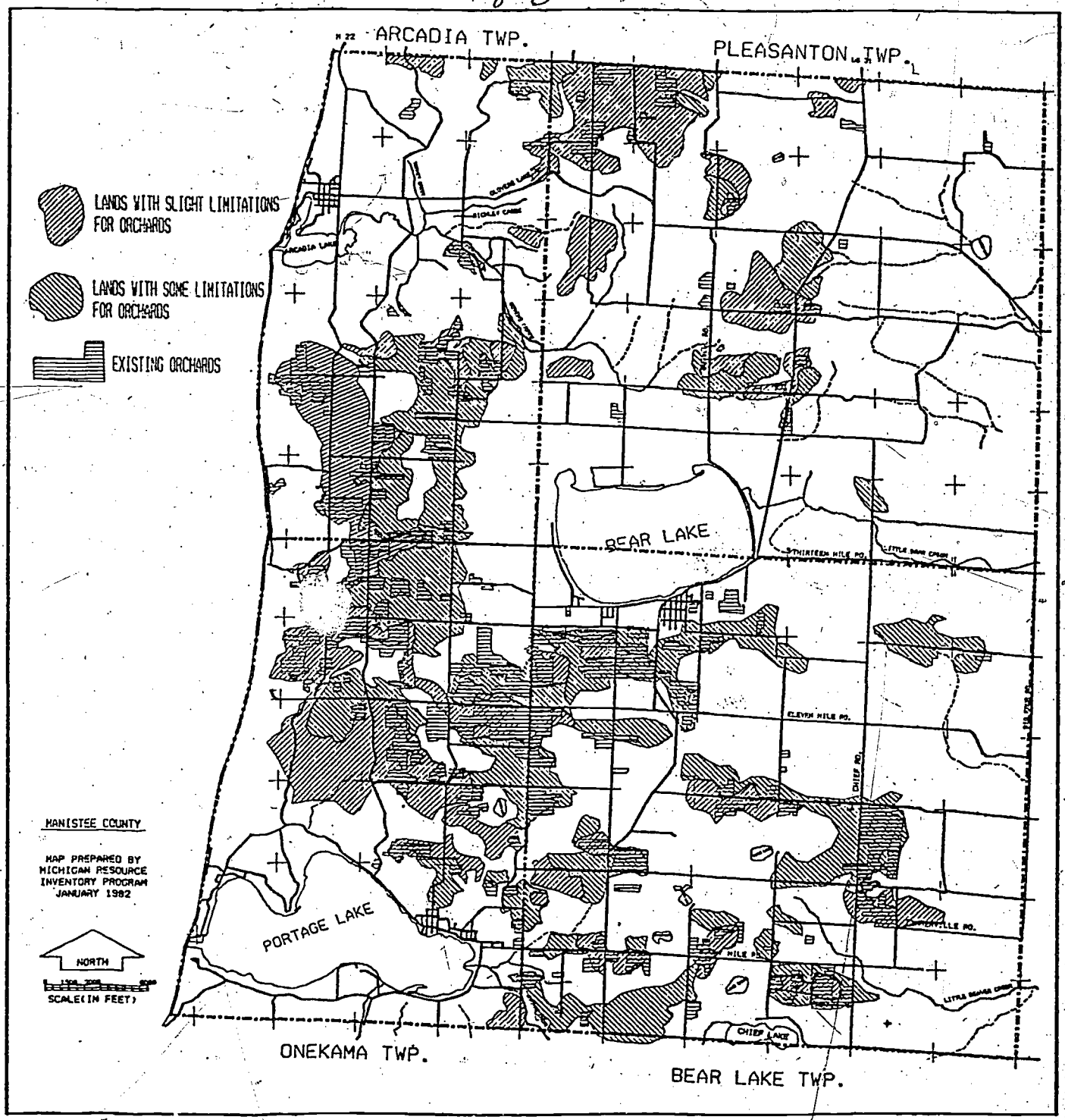
8-B


CURRENT LAND/COVER USE LEGEND
MANISTEE COUNTY
MAP PREPARED BY
MICHIGAN RESOURCE
INVENTORY PROGRAM
JANUARY 1982
NORTH
SCALE(IN FEET)

8-C

Figure 3. Orchard regions and orchard potential in Manistee County. (Courtesy of the Michigan Department of Resources, Lansing).

8-D


ARCADIA TWP.
PLEASANTON TWP.
LANDS WITH SLIGHT LIMITATIONS FOR ORCHARDS
LANDS WITH SOME LIMITATIONS FOR ORCHARDS
EXISTING ORCHARDS
BEAR LAKE
PORTAGE LAKE
ONEKAMA TWP.
BEAR LAKE TWP.
MANISTEE COUNTY
MAP PREPARED BY MICHIGAN RESOURCE INVENTORY PROGRAM JANUARY 1982
NORTH
SCALE(IN FEET)

the solutions of this important issue facing society, whether at the local or national level.

Quantification and Regional Analysis

Quantitative methods and model building techniques plus the manipulative and analytical power of the computer have greatly advanced the spatial researcher's ability to provide data, conclusions and policy of value in seeking solutions to major as well as day-to-day problems of society faced by the decision-maker at all levels. The number of computer software programs for the manipulation and analysis of various forms of spatial data has multiplied rapidly in a number of fields including geography. The Commission on Geographical Data Sensing and Processing of the International Geographical Union, has developed three valuable volumes dealing with geographical data processing systems and computer programs. Volume I produced by the Commission lists 85 full geographic information systems (Table 1). Data in these systems are stored according to various sized cells, grids, or actual geographic units like townships or census tracts, and thus are very useful in "managing" data and analyzing various kinds and sizes of regions.

TABLE 1

Geographic Information Systems

South Dakota Automated Geographic Information System (AGIS)

Area Resource Analysis System (AREAS)

Alabama Resources Information System (ARIS)

Canada Geographic Information System (CGIS)

Computer Mapping for Land Use Planning (COMLUP)

Geo-Data Base System (GDBS)

Geographical Resource Analysis Software Package (GRASP)

Illinois Resources Information System (IRIS)

Land Use Mapping Program (LUMP)

Map/Model Planning Information (MAP/MODEL)

Maine Information Display Analysis System (MIDAS)

National Coal Resources Data System (NCRDS)

Oak Ridge Regional Modeling Information System (ORRMIS)

Regional Environmental Assessment Program (REAP)

Wildland Resource Information System (WRIS)

[1] The above are selected samples of 85 full geographic information systems listed in Calkins, H. (Coord.) and D. F. Marble (ed.) 1980. Full Geographic Information Systems, Volume 1, Ottawa, Canada: International Geographic Union, Commission on Geographical Data Sensing and Processing.

The Commission on Geographical Data Sensing and Processing developed a second volume on Data Manipulation Programs (Table 2) and a third volume on Cartography and Graphics (Table 3). These publications summarize the automated systems, approaches and techniques for data handling that are invaluable to the geographer in a consulting firm, local or state agency, environmental management firm, land use analysis research firm, and similar enterprises engaged in searching for solutions to problems in geographic units or regions of various sizes.

Energy Policy and The Urban Region

Rational energy policy development is crucial in assuming necessary fuel needs at the urban regional level. The dense population concentrations in these areas and the present inefficiency of the highly specialized and linear patterns of activity nodes make the urban areas, including the nonmetropolitan areas surrounding them, prime targets for change. This change is often energy inefficient. The automobile and its flexibility has fostered urban sprawl and splatter on a grandiose scale. Little in the way of clustering, grouping or regionalizing of human activities or facilities is found in the current metropolis (Figure 4).

10-A

TABLE 2

Data Manipulation Programs

Area-Based Apportionment of County Variables to Cells, Polar Grid (APORT)

Aggregation of Areal Units (GRAFAG6)

Extraction and Manipulation of Census Data (WCMS-1)

Variable Manipulation in a Cellular Data Base (CELNDX)

Ecological Mapping with Three Dimensional Estimates (ECOMAP)

Nearest-Neighbor Discriminant Analysis (NEARNBR)

Contiguity Measures (VALRATI)

Gravity Model Fitting (GRAVITY1)

Spatial Interaction Model (SPATIALBIN)

Spatial Demographic Accounts for Aggregate Regional Populations (SDAT)

Land Use and Market Area Model (LANDUSE)

Simulation of Urban Residential Segregation (SIRES)

Transportation and Air Shed Simulation Model (TASSIM)

Earth Resources Inventory System (ERIS)

[1] The above are selected samples of 229 data manipulation programs listed in Pequet, D. J. and D. F. Marble (ed.), 1980. Data Manipulation Programs, Volume II. Ottawa, Canada: International Geographical Union, Commission on Geographical Data Sensing and Processing.

TABLE 3

Cartography and Graphics Programs

Choropleth Mapping System (CMSS)

The City of Toronto Planning Board Computer Mapping System (TPB)

Geographic Data Display System (GDDS)

Geographic Information Manipulation and Mapping System (GIMMS)

Thematic Mapping Package (THEMAP)

Wisconsin General Purpose Computer Mapping Program (WISMAP2)

Graphic Data Display (GPLOT)

Dot Distribution Mapping Program (DOT.MAP)

Population Maps (POPMAP)

Mapping System for Statistical Data (GEOMAP7)

Choropleth Mapping on a Calcomp Plotter (CHMAP)

Ecological Mapping (ECOMAP)

Computation and Plot Thiessen Polygons (THIESS)

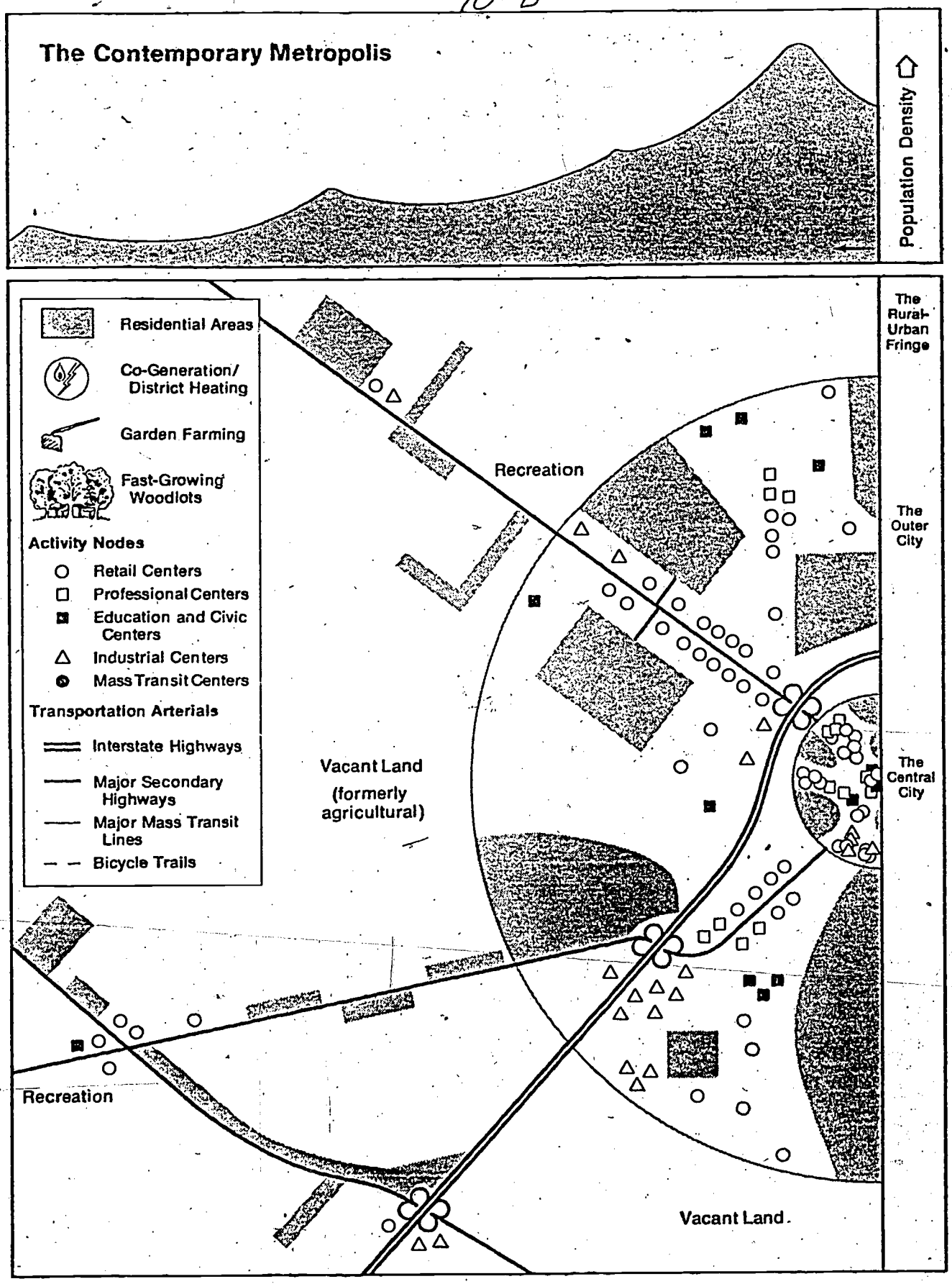
Location of Major Oil Refineries in the U.S., Canada and South America (OILREF)

World Data Base (WDB)

[1] The above are selected entries of the 357 included in Brassel, R., M. Wasilenko (Coords.) and D. F. Marble (ed.), 1980. Cartography and Graphics, Volume III. Ottawa, Canada: International Geographical Union, Commission on Geographical Data Sensing and Processing.

Figure 4. A Model of the Contemporary Metropolis. Note the linear and non nucleated urban patterns. (Designed by Donald J. Ziegler) Source: (Same as Fig. 5 but page # is 17).

10-D

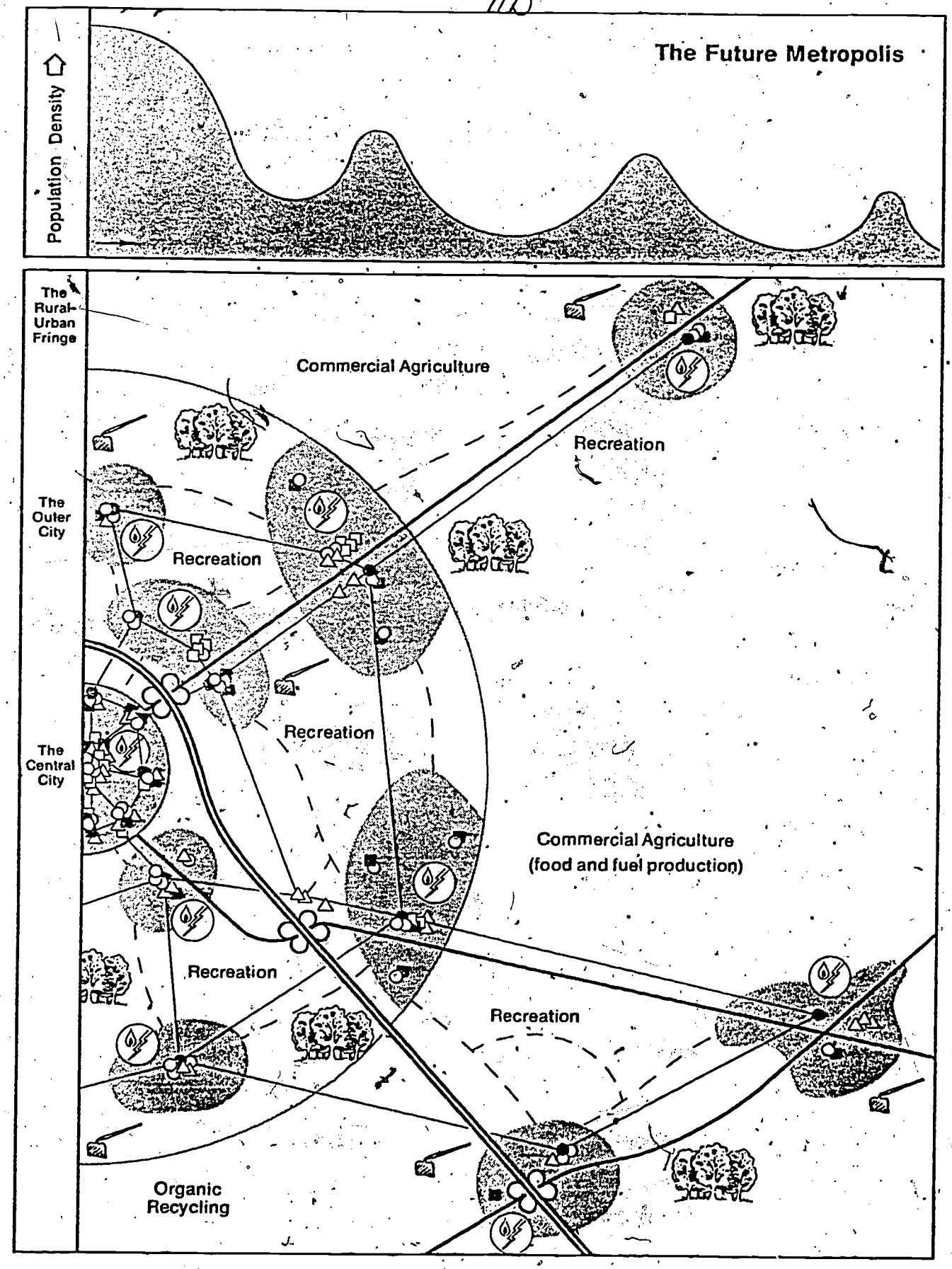

The Contemporary Metropolis
Population Density
Residential Areas
Co-Generation/ District Heating
Garden Farming
Fast-Growing Woodlots
Activity Nodes
Retail Centers
Professional Centers
Education and Civic Centers
Industrial Centers
Mass Transit Centers
Transportation Arterials
Interstate Highways
Major Secondary Highways
Major Mass Transit Lines
Bicycle Trails
Recreation
Vacant Land (formerly agricultural)
Recreation
Vacant Land
The Rural-Urban Fringe
The Outer City
The Central City

This is true in the Central Business District, along the major thoroughfares, in the suburbs, in the metropolitan fringe or in the nonmetropolitan, largely rural areas. The locations of houses, retail activities, services, and even industrial establishments are characteristically rectangular or linear. It is this kind of inefficient settlement patterns that must change if we are to institute energy-saving developments like district heating (cogeneration) and mass transportation. Clustering and regionalizing are the key to these efforts - nucleation of work, residence, service, and recreation locations is involved. In between the sprawl areas in the current metropolis is much vacant or waste space - most being held for land speculation. This includes valuable agricultural land that is now largely unproductive.

In the model future metropolis, the key change is the clustering and nucleation that has taken place (Figure 5). Within the city proper greater relationships exist between the work place, residence, shopping center, service centers, places for recreation, and utilities. Sections of the city begin to hang together as districts or regions, the travel distance is greatly reduced and the kind of transportation used is changed - with greater use of the bicycle, walking,

Figure 5. A Model of the Future Metropolis. Note the nucleated patterns and energy/activity relationships in the central city as well as suburban and non-metropolitan areas. (Designed by Donald J. Ziegler). Source: Koenig, Herman E. and Lawrence M. Sommers, "Energy and the Adaptation of Human Settlements", Michigan State University, 1980, p. 16.

11B


The Future Metropolis
Population Density
The Rural-Urban Fringe
The Outer City
The Central City
Commercial Agriculture
Recreation
Recreation
Recreation
Commercial Agriculture (food and fuel production)
Recreation
Recreation
Organic Recycling

and public transportation. The same principles can be applied to the suburb and to the nonmetropolitan areas. Note the nucleation or clustering of densities of population at varying distances from the central city. Note also the greater relationships between the smaller regional center and the surrounding areas in terms of food production, fuel production, and linkages to other centers and the central city by various kinds of transportation. Hierarchies of regions or urban densities begin to emerge which have significance for private and public sector decision makers. The real estate developer, the banker or mortgage lender, the industrialist, the politician, the school superintendent, the hospital manager, and the planner (among others) must understand and act in ways that bring this nucleation about. The result is regionalization at the micro scale. In these kinds of situations the applied geographer should be able to make important contributions.

The opportunity is increasingly available to demonstrate the real-world problem solving capabilities of the geographic approach. Energy, land and people related developments are only examples of the application of classification and regionalizing techniques, and the utility of the methodology and analysis of the applied geographer.

Conclusions

The region has been in and out of favor in the discipline of geography over the years. The concept currently is being dusted off and is enjoying a revival as a concept in teaching, research, and application. In a more and more complex world, we need devices such as the region which facilitate generalization, simplification, and understanding.

It seems evident that the use of regional analysis is crucial in much applied geographic research. The classifying and regionalizing of variables is a major contribution of the discipline of geography. The full power of the approach needs to be emphasized in the undergraduate or graduate training of geographers wishing to apply their skills to the real-world. Methodology, technique and substance courses need fully to explore and apply the utility of the concept. As the pressure of people upon finite and other resources and space increases, the utility of the idea of the region as applied to societal issues must take its appropriate place. It is our responsibility as professional geographers to see that this happens.

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