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AN ANALYSIS OF PRIVATE LAND FRAGMENTATION BY LAND HOLDINGS OF LESS THAN 11 ACRES IN MICHIGAN

Michigan State University PH.D. 1981

AN ANALYSIS OF PRIVATE LAND FRAGMENTATION BY LAND HOLDINGS OF LESS THAN 11 ACRES IN MICHIGAN

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Resource Development

1981

ABSTRACT

AN ANALYSIS OF PRIVATE LAND FRAGMENTATION
BY LAND HOLDINGS OF LESS THAN
11 ACRES IN MICHIGAN

By

Francis Oliver Arthur

Subdivision of land into parcels of less than 11 acres (parcellation) is on the increase in Michigan. Counts of the actual acreages included in non-platted subdivisions in 30 counties of the state between 1963 and 1977 indicate that the total of these subdivisions increased from around 673,000 to 1,200,000 acres during the period.

Differences do exist in the amount of acreages and the rate of increase in these subdivisions among and within counties, districts and regions. High levels of parcellation are significantly related to socio-economic activities but the high rate of increase is also associated with environmental conditions and institutional factors such as the Subdivision Control Act (SCA) of 1967.

This study examined the spatial distribution and the time trends of non-platted and approved subdivisions in Michigan in an attempt to provide empirical evidence about small-tract land parcellation. The study also projected parcellation trends to the year 2000. A method was developed

to classify counties and regions into highly, moderately and least affected parcellation areas.

Two regions were primarily affected by the process of small-lot parcellation; these are rural lands, fringing urban centers and countrysides with clean environmental conditions. Two types of demand were, therefore, noted -- job oriented demand and recreational demand for homesites.

Correlation and multiple regression analyses revealed that the most important factors which contributed to the spatial and trend variations in the parcellation process were: (a) personal incomes, (b) population concentrations and movements and associated demand for homesites, (c) demand for recreational and environmental amenities and (d) certain public land use policies. Serial Correlation analysis, based on quasi-experimental design, indicated that the Subdivision Control Act of 1967 contributed significantly to the increased parcellation of land into 10 and 10+ acres, especially after 1970. Its impact on 10-acre parcels and on approved subdivisions was not significant. A simple linear extrapolation projection to the year 2000 would result in a total and acreages of about 200,000 holdings and 1,100,000 acres of these non-platted parcels in another 20 years.

Parcellation data were obtained by counting all small tracts of non-platted subdivisions less than 11 acres for

465 townships of 30 counties, systematically selected from all regions of the state. County Atlas and Plat Books provided the sample frame and figures covering a period of 15 years with 1963, 1970 and 1977 as the study periods. The linear extrapolation projection technique was based on ceteris paribus assumption.

The importance of clearly identifying the parcellation process is emphasized by the study. A policy such as the Subdivision Control Minimum acreage provision would not necessarily discourage relatively large-lot parcellation and the creation of idle lots. It is, therefore, recommended that the 10 acre minimum lot size provision in the Subdivision Control Act, either be removed or the minimum be increased to a higher acreage level such as 40-60 acres.

ACKNOWLEDGEMENTS

The study was funded by the Michigan State University Agricultural Experimental Station through the Research Directorship of Dr. Raleigh Barlowe of the Department of Resource Development. I would like to express my deepest gratitude to Dr. Barlowe for obtaining support for the study and for his untiring effort to direct the whole dissertation even after he retired from active professorial duties.

Sincere thanks to all my other Committee members, Dr. M.H. Steinmueller, Dr. D.E. Chappelle, Dr. W.J. Kimball, and Dr. Anthony Koo who in one way or the other -- academic, economic, psychological and social, contributed to my study at MSU and to this dissertation.

I would also like to make a special mention of Mrs. Joann Silsby who prepared this document and Mr. Paul Schneider for his excellent graphics and advice on dissertation formats. Special thanks are also extended to my friends and colleagues, Mr. Essama Nssah and Mr. Kwabena Abeka Whyte of University of Michigan and Michigan State University respectively, for their contribution to the statistical and computer aspects of this thesis. Mr. Robert Burke also offered invaluable constructive criticisms and heated discussions on various subjects -- thanks Bobby.

Acknowledgement is also due to Mr. Richard Lomax of Michigan Treasurer's Department, Plat Section, for allowing me access to Plat files, data, and documents. It is not possible to mention all the names of County Extension Directors who responded to the feedback survey letters; my sincere gratitude to all of them for their invaluable information.

Acknowledgement is due to Rockford Map Publishers, Inc., whose Land Atlas and Plat Books were used as a sample frame. Hardly can I fully thank individuals in the Resource Development Department and the Department as a body for all the roles they played in making my academic career at MSU a success. My three year study in the Department will always conjure happy memories.

Finally, last but not least, special gratitude to my patient and devoted wife, Gyamfua-Amonu, who has spent almost 12 years out of our 17 years of married life waiting on an almost professional student and for taking upon herself the responsibilities of a father towards his children in addition to her own maternal duties. Her patience, moral and psychological support in the face of extreme financial hardships, sometimes baffled me, her wisdom confounding. Thanks, darling.

This acknowledgement would be incomplete if I do not mention my little boy who was born during my graduate

study days and hence had to bear the blunt of paternal neglect for a while. To Kwame and his brothers in Ghana, I say, cheer up kids, dad will now make up all losses to you!

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CHAPTER ONE

INTRODUCTION

Parcelling of private land holdings into smaller tracts has been a common practice with privately owned lands in Michigan and the nation for many years. Major contributing factors include urbanization and suburbanization of rural and semi-rural lands, the recent phenomenon of reversed migration which involves urban dwellers reaching out for homesites in a rural environment, seeking of recreational amenities, and other socio-economic factors such as escape from the social problems of most American cities. These determinants (and others) explain the demand side of the fragmentation process.

On the supply side, land owners have offered more and more land as demand has increased and real estate prices have gone up. The conditions in the real estate market have served as a "pull force" that has attracted land owners and encouraged them to parcel out their lands to individual developers or home builders.

Other factors have served as a "push force" to reinforce the pull factors. Some land owners have been burdened by increasing property taxes associated with

increasing expected market values of their properties which in turn have resulted from increasing urban and suburban pressures on rural lands. Ripening costs on such urban fringed lands have soared and owners have adjusted to this added burden by selling all or parts of their lands prematurely to developers and others.

In sum, the process of land fragmentation and parcellation must be examined in the light of the "push" and "pull" forces operating on both the supply and demand sides of the real estate market. Forces that exist on the demand side may also be categorized as "push" and "pull". Increasing general affluence has brought an increase of emphasis on the "quality" as compared with the "quantity" components of individual levels of living. Urban conditions (socio-economic) associated with oversized cities or diseconomies of size and negative externalities of population, economic and social localization are the major "push" forces. "Pull" factors are the perceived environmental or ecological amenities of the rural areas, lower land values, and in general, "better quality" of life associated with rural areas.

A recent Michigan Public Opinion Survey, conducted at Michigan State University, indicated that about 41% felt that the government should spend more tax revenues on protecting "prime" or "important" lands from urban

developments.[1] The report of Governor William Milliken's Community Development Cabinet indicates that agriculture in the state is threatened by the increasing amount of farmland lost to urban developments. The report calls for a number of measures to bolster agriculture in the state, including special tax incentives, zoning regulations, "right-to-farm" legislation and economic assistance to the food and fiber industries.[2]

The Problem

Urbanization and suburbanization have created a tremendous demand for new residential building sites. The "urban exodus" of the last decade has added greatly to the these demands. Developers have been providing the lots, but in many cases the development process has not been orderly and has involved the creation of larger lots or parcels than appear either necessary or desirable.

Typical lots in suburban communities call for one-third to one-half acre per house. General observations,

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[1]Kimball, W. J. et. al., Report on Results of the Michigan Public Opinion Survey, Michigan Citizens Speak Out on Community Problems, Preferences and Government Spending. Michigan State University, Agricultural Experiment Station (East Lansing, Development and Public Affairs, No. 378, July 1979).

[2]Report of the Community Development Cabinet to Governor William G. Milliken, on "Agricultural Preservation Strategy for Michigan" by Tim Noworyla, Policy Analyst (Lansing, Michigan. November 1980).

however, indicate that large numbers of lots are larger than one acre and that many are 10 acres or slightly larger. Two explanations are often given for the 10 acre lots. Local zoning ordinances often use a minimum 10 acre size presumably as a means of discouraging the development of certain areas. The Subdivision Control Act of 1967 also affects the situation with its requirement that subdividers go through the formal platting process when they divide land holding into five or more tracts of less than 10 acres.

General observations indicate that many subdividers have circumvented the intent of both the zoning ordinances and the Subdivision Control Act by creating and selling 10+ acre lots. The main results are: (1) an ignoring of the benefits that platting process should bring to both the community and the land purchaser; (2) a wasteful use of land when buyers could or would be content with smaller holdings; and (3) possible higher costs to local governments in providing services.

Increasing numbers of the Michigan citizenry have been expressing concerns about these trends in land use, specifically to the extent that the process is affecting important agricultural and forest lands. Yet, no statistical evidence, so far, exists about the level and extent of land parcellation in the state.

An ongoing study of parcels in excess of 10 acres in Shiawassee county by Mentius has indicated that most lot purchasers would prefer smaller lots if they were available.[1] Consumers are forced by circumstances to buy lots in excess of 10 acres. These lots, being too large for standard single family housing units, are often underutilized and, in general, part of the property is usually left idle. Furthermore, it is argued that the 10 acre limitation is contributing to premature parcellation and leap-frogging of residential developments, particularly in counties and townships where zoning regulations are not strictly enforced. One danger of the process is that it is taking large areas of prime agricultural land that should be retained in their present use.

Purpose of Study

The lack of empirical evidence and the scantiness of statistical data base on less than 11-acre parcels of non-platted lots in the state motivated this study. The objectives of this study, therefore, are:

1. To indicate the extent and trends of small, non-platted lot parcellation in the state;

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[1]Mentius, F. S., "Venice Township: A Study of Land Fragmentation by 10.1 Acre Parcels, 1968-1978." Preliminary Research Report, 1978.

2. To examine the interrelationships between land parcellation and certain ecological, social, economic and institutional factors as they affect the spatial distribution and time path of the process;
3. To examine trends in approved subdivisions; and
4. To relate small lot parcellation to needed changes in state land use regulations. An attempt also is made to project trends in parcellation to the year 2000 A.D. under the ceteris paribus assumption.

Definitions

The words "fragmentation", "parcellation" and "land partitioning" are used interchangeably in this study. They all connote the dividing or subdividing of tracts of land into smaller parcels—rural holdings of less than 40, 80, or 160 acre survey units.

The term "small lots" and "large lots" are used in this dissertation to refer to nonplatted parcels less than 10 acres and 10-10.9 acre parcels respectively. They are relative and not meant to compare with any other parcels outside the cut-off point (larger lots, 11 acres and above, are also created in the state). The term "level" of parcellation means amount of parcellation as measured by

number of holdings; "extent" of parcellation connotes amount of parcellation as measured by acreage and "degree" of parcellation refers to amount of parcellation weighted by population and land area—it is referred to as Weighted Parcellation Density (W.P.D.). The term "subdivision" in this dissertation refers exclusively to parcellation of land into tracts as provided in the Subdivision Control Act—also referred to as approved parcellation as opposed to non-approved parcellation.

Non-platted subdivisions are not usually submitted to local, county or state authorities for official approval, and should be distinguished from subdivisions that are formally platted. The parcellation process involves individual plots or parcels sold or leased. Over periods of several years, the process can involve the "chipping" away of numerous smaller tracts from larger units of land. A "parcel" of land as treated here, therefore, means any holding less than 11 acres.

Limitations of the Study

The use of land atlas and plat books as sample frame confines most analysis and inferences to counted parcels. No attempt was made to interview or reach land owners and developers through questionnaires to determine their perceptions about the process of land parcellation. Thus,

motives underlying both the demand and supply sides of the real estate market could not be ascertained adequately to reflect on the data that were obtained. Information about the supply of and demand for small parcels was obtained from secondary sources. This limits the scope of the study to the primary data that were collected.

Organization of the Dissertation

This dissertation deals with land parcellation in Michigan; its current level and spatial distribution; its trends over time, past to present, and to future. The dissertation also tries to provide explanations for the parcellation levels and distributions over time and space and finally attempts at relating trends to needed policies in land use. Chapters are organized to follow this logical sequence. Research methods and analytical techniques are discussed in Chapter Two, where the dependent variable is explicitly described. Chapter Three provides a general background to the study and factors influencing the process of parcellation are discussed. Chapter Four states the various hypotheses to be tested and formulates statistical models which establish relationships between the dependent and independent variables. Research findings are presented in Chapter Five and results of statistical tests are used to explain findings. Chapter Six provides a

summary and recommendation for both future land use policies and land use research.

CHAPTER TWO

RESEARCH METHODS AND ANALYTICAL FRAMEWORK

Analytical Approach

The process of land parcellation is theoretically conceptualized as a four-dimensional problem, involving quantity (number of parcels or acres of land), value (price of parcels), spatial distribution (counties) and time (dynamic). The analytical approach, therefore, includes static economic analysis, (value and quantity), comparative static analysis (value, quantity and discrete time periods) and dynamic locational analysis (quantity distribution over space and over time). Figure 2-1 illustrates the analytical approaches to the problem of land parcellation.

The problem can conceptually be likened to a cuboid moving through time and space. In Figure 2-1 the four important conceptual aspects of parcellation are shown. Q refers to the quantity of parcels existing at any point in time and place, V refers to the value of a parcel of land (unit price), S refers to the location of the parcels or the spatial distribution of parcels and t is the time period of analysis (in the dissertation, 1963, 1970 and 1977 are the discrete periods).

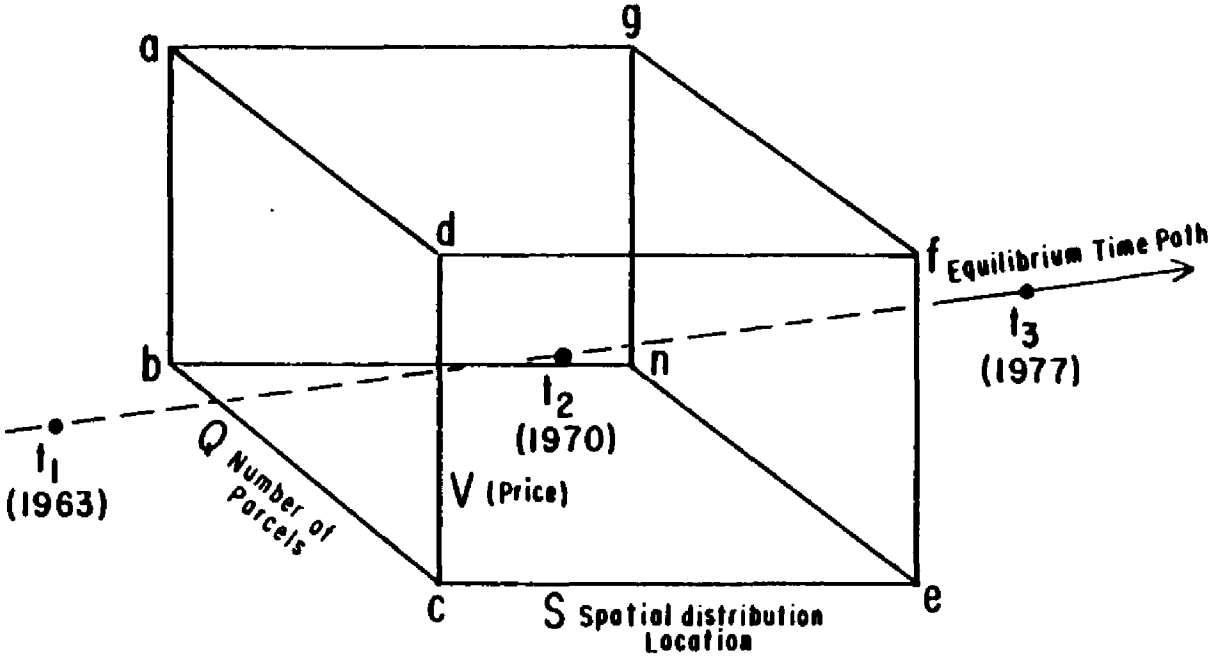

FIGURE 2-1

ANALYTICAL FRAMEWORK

Classical economists have treated land as an economic commodity or factor of production within the V-Q space or quantity-price dimension. Ricardo, Adam Smith, and even Marshall, all dealt with land from a two-dimensional, static perspective. The price of land indexed by land productivity was usually related to the quantity of land available at any point in time, given quality and all other factors.

Most land economists start with this two-dimensional approach, but also recognize that land use decisions involve spatial and time considerations.[1] This dissertation follows this pattern by relating land values to the quantity of parcels created at three given points in time at various locations in the state.

To provide a clear perspective of the land parcellation phenomenon, it is important to determine what has happened over an extended time period. This study, therefore, goes beyond the three-dimensional approach by adding the time variable. The discrete time periods provide a comparative static analysis of land parcellation in the state. These equilibrium points (1963, 1970 and 1977) are compared with the initial condition defined for 1963 as the zero base year. The equilibrium path is then projected to the year 2000.

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[1]Barlowe, R. Land Resources Economics: The Economics of Real Estate, 3rd Edition, Prentice Hall, N.J. (1978).

Projection of the equilibrium time path usually involves assumptions about initial conditions. In this dissertation the assumption was that conditions will behave as they have been doing during the 15-year period of study. The weakness of such an assumption is clearly recognized, but this study does not aim at exactly predicting or forecasting the future; the projection of the equilibrium time path of land parcellation is not a best judgment estimate of what will actually exist at the turn of the century. Rather, it is most useful in providing a boundary notion of where the present trends are likely to lead in the absence of significant changes in the underlying forces. It is recognized, however, that changes not yet anticipated will occur eventually. Despite its recognized limitations, time analysis may prove useful for long-term planning by land developers, agribusiness and governmental institutions.

At any specific point in time, value, quantity and space are the main framework of analysis and the question of how the equilibrium conditions in, say, 1963 got to 1970 or 1977 are not addressed. Nevertheless, attempt is made to explain the whys of change by examining the factors that are likely to influence the time path of quantity, location and value of land parcels independently and in their combinations as well as their interactions over time.

Sources and Nature of Data

Determination of the exact number of parcels for any given moment on a statewide basis is, of course, an impossibility. New parcels are constantly being created; former parcels are either resubdivided into smaller tracts or reconsolidated into bigger lots or both; existing small lots are being combined with existing bigger holdings; existing big land holdings continue to be "chipped" away, parcel by parcel and old approved subdivisions which never reached a development stage are being sold outright for new uses; these and other forms of combinations and recombinations, partitioning and repartitioning go on constantly and continuously.

Primary Data: Non-Approved Parcels (1963, 1970, 1977)

The counted parcels which were created through subdivisions exempted from the provisions of the Subdivision Control Act of the state reflect the number of such parcels (parcels less than 11 acres) existing in the selected counties during the three specific time periods of study. Any inference drawn from the sample data to provide state estimates for the three periods reflect the actual number of parcels existing in the state assuming that the sample frame reports accurate observations and the estimation technique is valid. However, data are not serially continuous; they are periodic.

The difference between the amounts or numbers of parcellation for any two periods reflect the net additions to the total parcellation figure of the preceding period. The net additions or incremental figures do not show the process of partitioning that resulted in the totals. They provide no indication about the methods of partitioning. The incremental figures are, therefore, representative of all kinds of partitioning processes which result in the creation of parcels less than 11 acres, during some interval periods.

An increase or decrease in the total number of all categories may be the result of several processes operating individually or in their various combinations. Increase may be due to the creation of new parcels entirely from large holdings, excluded from the definition of parcellation in this study or may be due to the repartitioning of the relatively larger parcels (10-10.9) into smaller units (parcels less than 10 acres) or both. A decrease in parcel numbers may be due to a recombination of smaller parcels into bigger ones, which may or may not be included in the definition.

Secondary Data: Approved Subdivisions (1969-1979)

Approved subdivision data were obtained from a secondary source and data are continuous annually from 1969 to 1979 for 30 counties, and from 1970 to 1978 for the

whole state. Therefore, data were truncated at both ends and hence do not reflect the actual total number of subdivisions existing in the state at the terminal year. Annual figures represent solely the newly created subdivisions; they do not include subdivisions awaiting approval, or those in the process of being created or those held at local levels. Each year's subdivision figure represents only the number of new plats approved that year, usually for the fiscal year ending June 30 (up to 1975) and September 30 (1976 onwards). Incremented figures for the period between 1975-1976, therefore, represent a total for 15 months fiscal period.[1]

A cumulative total number of approved subdivisions from 1969 to 1979 reflects total new subdivisions created during the 11 years only. Subdivision data are, therefore, used mainly for time series analysis. Its use for spatial trend analysis is limited since the past subdivision distribution is unknown. Counted parcels are used for both spatial and trend analysis since the number counted at any period in time represent what actually existed at the time. The year 1963 is considered the base and all comparisons are made with reference to that year.

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[1]See State of Michigan, Annual Report of the State Treasurer, October 1, 1977 to September 30, 1978.

Study Variable

The main dependent variable is land parcellation, measured by number of holdings of land less than 11 acres and approved subdivision parcels (Figure 2-2). Number of parcels (non-platted) were counted from Land Atlas and Plat Books[1] on township basis[2] and the resulting figures were aggregated into county, district and regional totals (2-2). Data are both cross-sectional (30 counties) and longitudinal (1963, 1970, 1977).[3]

Figures obtained for the counted parcels in holdings were converted into acreages (Chapter Four, conversion procedure) and then grouped into three size units, viz: (1) parcels less than 10 acres (10- acre parcels), (2) parcels of 10 acres (10 acre parcels) and (3) all parcels in excess of 10, but less than 11 acres (10+ acre parcels). Eleven acres is the cut-off point (all larger parcels

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[1]Land Atlas and Plat Books are published by Rockford Map Publishers, Inc., annually and distributed by various counties. Acknowledgement is due to R.M.P., Inc., 4525 Forest View Ave., P.O. Box 6126, Rockford, IL 61125.

[2]A sample of Land Atlas and Plat Book map is provided in Appendix 2-A.

[3]Other possible sources of data include county deed records, tax records and files on building permits. These were not used because of the time and expense that would have been involved and also because it was felt that the county plat books provided a reliable source of information on land parcels.

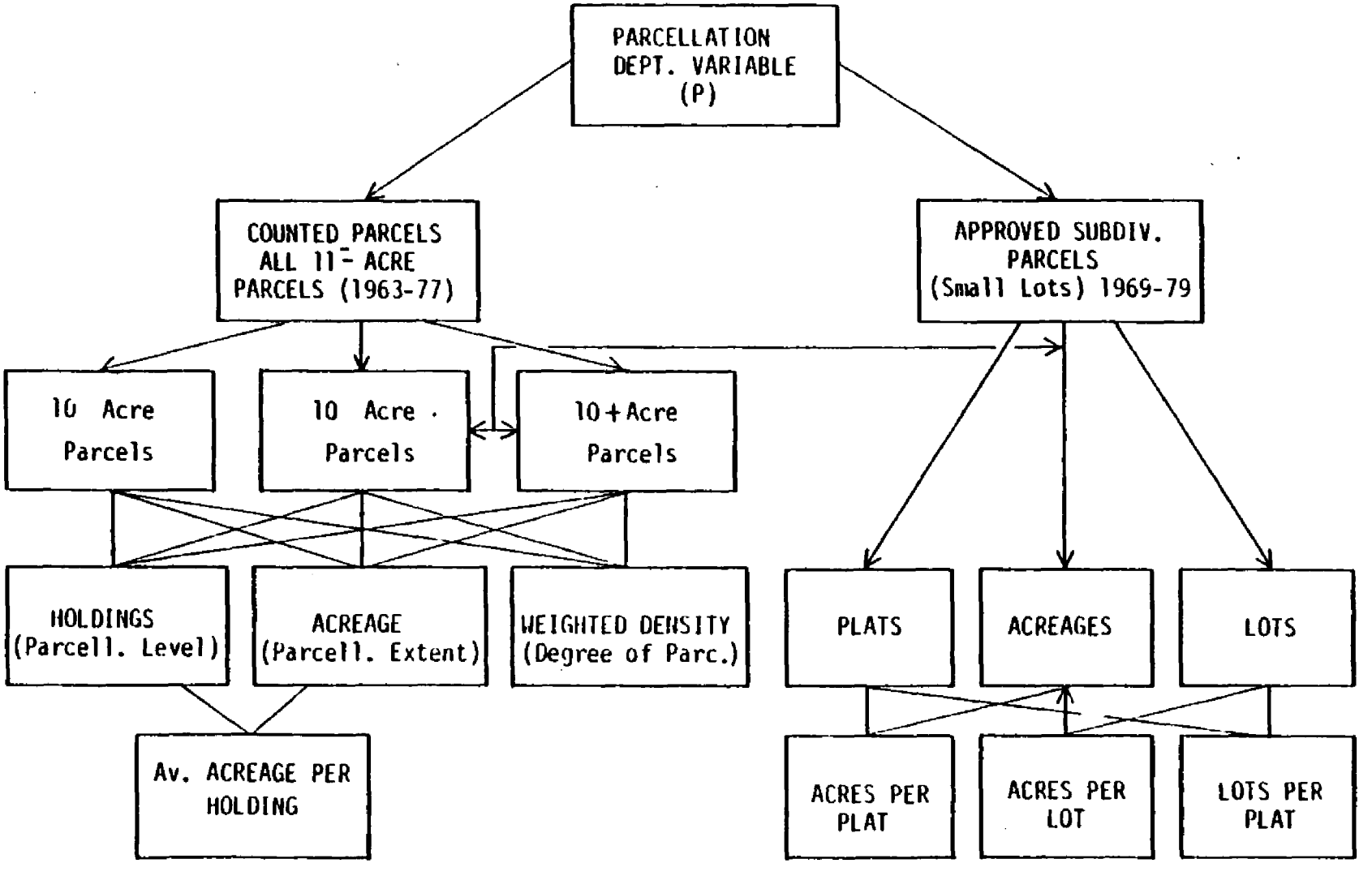

FIGURE 2-2

SUBSAMPLE STRUCTURE OF DEPENDENT VARIABLES

COUNTED PARCELS AND APPROVED SUBDIVISION PARCELS

are excluded).[1] Total acreage parcelled is the principal unit measure for analysis. Acreage is a continuous variable measure which permits parametric statistical treatment of the data.[2]

Another (dimension-less) measure based on acreage figures is parcellation density (WPD). It is parcellation acreage weighted by population and land area of counties.[3] The weighted parcellation density scores are meant to measure degree of parcellation and to provide the basis of comparing level and extent of parcellation among counties, districts and regions.

Data Collection Procedure

The unit of data collection is the township. The 30 counties (36 percent of total counties in the state)

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[1]The cut-off point is arbitrary. The writer recognizes that parcellation involving 11-40 acre parcels is as important as those less than 11 acres. However, time and financial limitations required that the dependent variable be defined narrowly. This opens up a possibility for further research into the much bigger parcels (11-40 acres).

[2]For full discussion of statistical measurement, reader may consult the following authors: (a) Ya-Lun-Chou, Statistical Analysis with Business and Economic Application, 1969, p. 477; (b) Borg, W.R., and Gall, M.D., Educational Research: An Introduction, 2nd Edition, 1971, pp. 312-315; (c) Hucks, S.W., Cormier, W.H., and Bounds, W.G. Jr., Reading Statistics and Research, 1974, pp. 197-198.

[3]Parcellation density is fully discussed in Chapter Four, pages

systematically selected (see list in Table 2-1, pp. 22-23) contain about 465 townships or 37 percent of the total townships in the state. Counties are grouped into districts and districts into regions (Figures 2-3) for comparative study. The three time periods of 1963, 1970 and 1977 provide base year data for trend analysis and projections. Projection takes into consideration current population densities and growth rates in the state.

Sample Districts and Regions

The state was first divided into eight blocks or study districts, (Figure 2-3; Table 2-1); each district contained approximately 10 to 11 counties. About 3 to 4 counties were selected from each district and parcels were counted for all the townships that constituted the selected 30 counties. No further sampling was done at the township level. The eight districts provided the first stage stratification of the 83 counties as well as a spatial frame for comparative analysis.

Figure 2-3 also shows the four study regions. Districts were combined into regions. The regions were designated as R-I (East Southern Lower Peninsula), R-II (West Southern Lower Peninsula), R-III (North Lower Peninsula) and R-IV (The Upper Peninsula). Table 2-1 shows the list of regions and their abbreviated form with the corresponding counties.

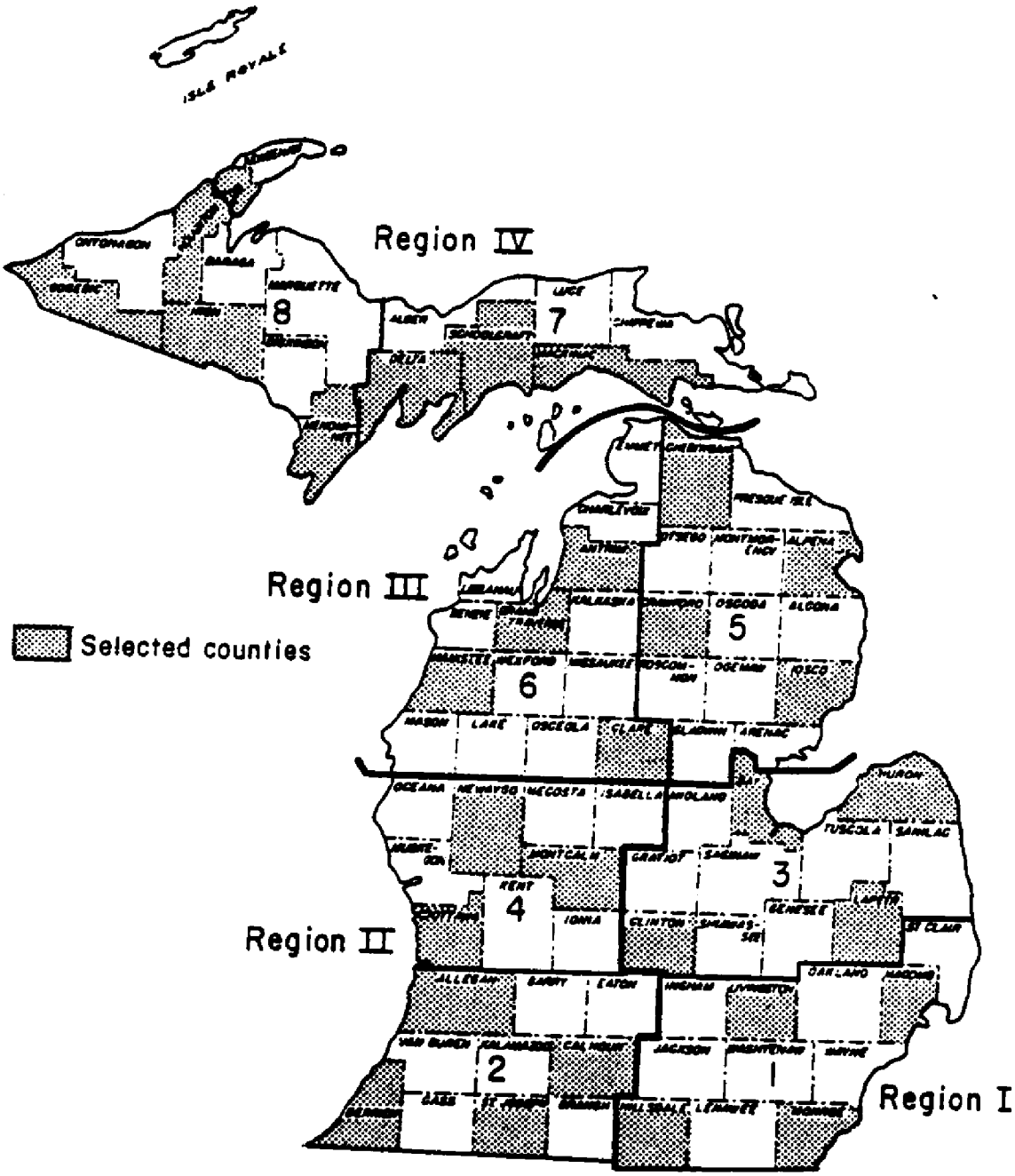

FIGURE 2-3

MICHIGAN: REGIONAL AND DISTRICT DISTRIBUTION OF SELECTED COUNTIES

TABLE 2-1

Location Regions and Districts

For Selected Michigan Counties

Selected County Name	Study District[a]	Study Region[b]
Hillsdale	S.E.S.L.P.	E.S.L.P.
Livingston	S.E.S.L.P.	E.S.L.P.
Macomb	S.E.S.L.P.	E.S.L.P.
Monroe	S.E.S.L.P.	E.S.L.P.
Bay	C.E.S.L.P.	E.S.L.P.
Clinton	C.E.S.L.P.	E.S.L.P.
Huron	C.E.S.L.P.	E.S.L.P.
Lapeer	C.E.S.L.P.	E.S.L.P.
Allegan	S.W.S.L.P.	W.S.L.P.
Berrien	S.W.S.L.P.	W.S.L.P.
Calhoun	S.W.S.L.P.	W.S.L.P.
St. Joseph	S.W.S.L.P.	W.S.L.P.
Montcalm	C.W.S.L.P.	W.S.L.P.
Newaygo	C.W.S.L.P.	W.S.L.P.
Ottawa	C.W.S.L.P.	W.S.L.P.
Alpena	E.N.L.P.	N.L.P.
Cheboygan	E.N.L.P.	N.L.P.
Crawford	E.N.L.P.	N.L.P.
Iosco	E.N.L.P.	N.L.P.
Antrim	W.N.L.P.	N.L.P.
Clare	W.N.L.P.	N.L.P.
Grand Traverse	W.N.L.P.	N.L.P.
Manistee	W.N.L.P.	N.L.P.
Delta	E.U.P.	U.P.
Mackinac	E.U.P.	U.P.
Schoolcraft	E.U.P.	U.P.
Gogebic	W.U.P.	U.P.
Houghton	W.U.P.	U.P.
Menominee	W.U.P.	U.P.
Iron	W.U.P.	U.P.

TABLE 2-1 (Continued)

[a]Districts are designated as:

District 1: South East Southern Lower Peninsula (SESLP)
District 2: South West Southern Lower Peninsula (SWSLP)
District 3: Central East Southern Lower Peninsula (CESLP)
District 4: Central West Southern Lower Peninsula (CWSLP)
District 5: East Northern Lower Peninsula (ENLP)
District 6: West Northern Lower Peninsula (WNLP)
District 7: East Upper Peninsula (EUP)
District 8: West Upper Peninsula (WUP)

(See Figure 2-3)

[b]Regions are designated as follows with county distributions:

Region I: East Southern Lower Peninsula (ESLP), 8 counties
Region II: West Southern Lower Peninsula (WSLP), 7 counties
Region III: Northern Lower Peninsula (NLP), 8 counties
Region IV: Upper Peninsula (UP), 7 counties

Delineations followed county boundary lines closely. The four regions provide a second stage stratification and further spatial frame for broader comparative study than districts.

Broad Comparative Region

Apart from the eight districts and four regions, comparative analysis was occasionally based on three broad regions according to how homogeneous counties were. A line, stretching from the Northern County boundary of Oceana to Bay County usually divided the Lower Peninsula into Southern and Northern halves for broad comparison, with the U.P. remaining a unit most of the time. For multiple regression purpose, the whole state was divided into two regions, the Southern Michigan, embracing the two southern study regions (E.S.L.P. and W.S.L.P.), and the Northern Region which included the Northern Lower Peninsula (N.L.P.) and the Upper Peninsula (U.P.) (see Figure 5-3, pp. 162).

Levels of Analysis

Analysis begins with the whole sample (30 counties) as representing the state (by Statistical Inference Technique); broad generalizations are made about the nature and scope of parcellation in the whole state based on sample evidence. Districts and regions are compared,

providing several stages and levels of analysis. Stages of analysis are vital to the detailed study of parcellation because factors underlying land parcellation (or demand for land parcels) vary considerably from region to region, district to district and even county to county. For example, in the southern Lower Peninsula counties the demand for parcels may be described as "job oriented home site demand", a spillover effect from the industrial urban centers. In the northern counties, the main factor is recreation. Region-by-region and district-by-district analyses permits differential emphasis on relevant spatial factors.

CHAPTER THREE

GENERAL BACKGROUND TO STUDY

Introduction

The concept of land as a "commodity" is based on the fundamental social institution of "property rights". Fee simple ownership rights in land allow individuals to dispose of their lands in any manner that enhances individual's interests and satisfaction. Land parcellation is one mode of real estate transaction through which private citizens transfer their property rights in land to others at any point in time and for any value agreed upon.

Several factors influence land parcellation. The amount of parcellation that exists at any specific time period, and the number of parcels which is created over time and space reflect the underlying determining factors of the parcellation process both on the demand and supply sides of the real estate market.

This chapter briefly examines some of the factors which contribute to the land parcellation process in the State of Michigan. Major factors discussed are population, incomes, demand for various types of residential units, recreational and physical resource amenities, and a few

public policies affecting land use. These factors can be grouped under the broad headings of: (a) ecological, (b) economic, (c) social-institutional determinants. The above classification of factors provide a threefold framework for the analysis of the determinants of land parcellation.[1]

Descriptive Framework

Demand for subdivided property by small-lot parcellation has been one segment of a larger increase in the demand for and supply price of rural lands generally in the nation after the Second World War. Studies have identified, as the main driving force behind rural land demands, the following factors: (1) population dynamics, (2) socio-economic developments and associated increases in per capita personal or family incomes, (3) improved communication systems which have opened up and made accessible remote areas, (4) agricultural technologies leading to capital labor substitution and the freeing of rural labor for urban industries, (5) increased demand for recreational resources and for rural environmental amenities which

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[1]Barlowe, Raleigh. Land Resource Economics (Third Edition), Prentice Hall, Inc., Englewood Cliffs, New Jersey. (Chapter One, p. 5-9, discusses "The threefold framework affecting land use"), 1978.

reflects the changing consumption pattern with emphasis shifting from "quantity of life" to "quality of life," and finally, (6) general societal opulence.[1]

An understanding of the parcellation issue requires a brief examination of some of the major underlying determinants and their interrelationships with land parcellation process. In Chapter Five of this dissertation multiple regression and time series analyses are employed to determine the significance of the relationships. In this chapter, discussion is confined to the explanatory variables.

Social Determinants

Michigan Population and Demand for Homesites

Between 60 percent to 80 percent of all lands parcelled out are required for residential purposes. A study of 10+ acre parcels conducted in 1978 by Frank Mentius in the township of Venice, Shiawassee County, Michigan, reported that about 57 percent of the buyers of small lot parcels

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[1]Heady, E. O., and Whiting, L. R., "Rural Development Problems and Potentials", in Rural Development in a Land Use Perspective, Soil Conservation Society of America, 1974.

surveyed acquired their properties for rural residential purposes.[1] Responses of about 13 County Extension Directors in Michigan to letters sent by the writer of this dissertation, requesting a report on their perceptions about the 10+ acre parcels also revealed that most of the "large" lots were acquired for rural housing estates.[2] Parcellation is, therefore, closely related to real estate residential demand which, in turn, is usually associated with population levels, growth or movements. The direct impact of population is, nevertheless, mixed.[3]

Increasing population requires new housing constructions to accommodate the excess population. Where increasing population is associated with rising incomes, the demand for homesites is accentuated. Housing construction implies demand for housing sites and subdivision lots developments. Even though the effects of population are

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[1]Mentius, F.S. "Venice Township: A Study of Land Fragmentation by 10.1 Acre Parcels, 1968-1978," Preliminary Research Report, Unpublished Research Paper, 1978.

[2]The writer, through Dr. Raleigh Barlowe, sent letters to about 26 County Extension Directors in selected counties for feedback information. Copies of some of the responses are in Appendix 3-B.

[3]Demand for parcels is not always closely related to population. This is especially the case for second and recreational resort homesites where purchasers may actually be living in other counties, regions or even in other states. The Northern Lower Peninsula is a case in point.

mixed, the following aspects of population are discussed to provide a background to the parcellation process: (a) population growth, (b) population distribution and movements, and (c) population concentration or urbanization and its trend spatially and over time.

Trends in Michigan Population (1940-1980)

Michigan population grew at above national average rate during the 1940's and 1950's. Table 3-1 reports total population and decennial percentage change in the population from 1940 to 1980.[1] The rise of the automobile industries in the southeastern portion of Michigan, especially after 1900 and revived after the 1930 slump, provided an impetus for rural population drift towards the industrial region from other parts of the state, and from other states. Factory jobs attracted hundreds of workers from the rural areas, from nearby states and from the rural south.[2] Since 1970, Michigan's population growth has slackened considerably (Table 3-1).

Increasing population and job opportunities during the 1950-1970 period contributed to the increased

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[1]The 1980 data are based on the recently published preliminary report of the census. Figures are liable to change.

[2]"Introduction to Michigan Population," Michigan Statistical Abstract, 1979, p. 3-5.

TABLE 3-1

Trends in Michigan Population

(1940-1980)

Year	Number of Persons	Decennial Percentage Change
1940	5,256,106	8.5[a]
1950	6,371,766	21.0
1960	7,823,194	22.8
1970	8,881,826	13.5
1980	9,228,128	4.0

[a]Percent decennial gain between 1930 and 1940. 1930 population is not reported.

Sources: 1. (1940-1960) Michigan Statistical Abstract, 1979.

2. (1970-1980) Preliminary Report, Census of Population and Housing, 1980.

urbanization and suburbanization, especially in the southern half of the state and particularly the southeastern portion around Detroit, Flint, and Saginaw-Bay City areas where increased personal incomes enabled workers to acquire lands for homes or buy developed subdivision residential units. The 1980 population count suggests that urbanization is still proceeding and spreading to rural counties. The focus is gradually shifting from the old urban centers to new areas, especially counties outlying the old metropolitan centers.[1]

Table 3-1 shows that between 1970 and 1980 Michigan gained only four percent in total population, only one-third as much as the 1960-1970 rate of gain and one-sixth the 1950-1960 rate of gain. This decline is mainly due to net migration loss. A continued decline in population may cause a decline in future land parcellation since vacant homes may increase and absorb any future population increases through natural growth. In this regard, the effects of population on future land parcellation would be negative.

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[1]Michigan Preliminary Population Counts, Report on Population and Housing, 1980. (Also see Ching-Li Wang and Lawrence S. Rosen, Preliminary Population Counts, Office of the Budget, Department of Management and Budget, 1980.

Prior to World War I, Michigan's population was basically rural and growth had been steady. About 60 percent of the total population was classified as rural by the 1900 United States population census.

By 1940, 65.7 percent of the people of Michigan were urban; the rural population was split between rural nonfarm (18 percent) and rural farm population (23 percent). By 1970, 73.8 percent were urban and in 1980, 7,469,991 or 80.9 percent were classified as urban. With these changes, cities grew rapidly and sprawled over rural lands.[1] Rural population declined and continues to decline despite the reversed migration trend noted during the last decade.[2] However, the decline in the rural population of Michigan varies from region to region.

A partial reversal of the post-war urbanization trend was noted in 1970. Michigan population increased only 4.0 percent during the decade, the lowest rate of increase in

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[1]"People and Society," Atlas of Michigan, Michigan State University, 1977, p. 62-89. (Also, Rathge, R.W., and Beegle, J.A., "Urban and Rural Population Change in Michigan Counties, 1960-1975." Rural Sociology Studies No. 7, Michigan State University, July 1978.

[2]Sofranko, A.J., ed., Rebirth of Rural America: Rural Migration in the Midwest. NCRC for Rural Development, Iowa State University Press, Ames, Iowa. 1980.

its history. Large percentage increases were, nevertheless, experienced by most of the northern lower peninsula counties and most particularly by those located in the center of this region. Larger numerical increases and above average percentage increases also occurred in many once rural southern counties and areas located adjacent to metropolitan population centers. The most notable loss of population (-345,671) was in Wayne County while significant percentage losses were also reported for Chippewa, Keweenaw, Ontonagon and Gogebic counties. Altogether, the 42 northern counties showed an 18.5 percent increase in population. Total numbers increased in all but six northern counties and in 39 of the 41 southern counties.

The population reversal trend proceeded between the last intercensal decade of 1970-80. The period saw most of the large cities losing population. Considerable migration to outskirts and areas around major cities occurred. Secondary migration movement to central counties of the northern lower peninsula accelerated with increasing recreational and environmental demands. These internal movements did not affect the general loss of Michigan's population to other states. When allowances are made for the surplus of birth over deaths, Michigan lost about four percent of its population to out-migration between 1970

and 1980.[1] Parcellation distribution closely reflects population distribution in most cases.[2] However, population level and parcellation are not always closely related since second home ownership by absentees can be a major factor in land parcellation. Thus, the distribution of land parcellation in the state is dichotomous. Increasing parcellation in the E.S.L.P. is associated with demand for job-oriented homesites where industrial workers seek large lots in urban fringe counties, far enough out beyond high residential land values, but still close within commuting distances of jobs. This demand for parcel is closely associated with population. Example of heavily parcelled dormitory counties are Livingston, Macomb, Washtenaw and Lapeer.

The increase in population in the northern lower peninsula, associated with recreational and environmental demands, explains some of the increased parcellation in the region. Presently, most of the parcels in the north are

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[1]Preliminary Report on Michigan Population and Housing, 1980 (ibid.).

[2]The relationship between parcellation and population is generally positive on the average but it is not always positive. People from the county or region may purchase lands in another county or region. Absentee land and homesite ownerships are common in the northern lower peninsula.

owned by individuals who live in other counties and in other states, or by speculators and subdividers.[1] Most of the developed parcels are for second and third homes, recreational residences, marinas and tourist condominiums.

According to Fletcher, between 1973 and 1977 a total of 47 recreational land developments were registered in Michigan by outside developers. This involved some 66,589 lots and 18 subdivisions.[2] Fletcher points out that most of the subdivision lots in the nation are vacant and are purchased for speculation or investment purposes or for the purpose of building future leisure homes. Some of the lots are targeted for resort condominiums in anticipation of expected boom in the tourist industry. This observation is relevant to the parcellation situation in the northern lower peninsula of the state. County Extension Directors from the region pointed out that premature parcellation is a common phenomenon in the area.[3] Given current trends in

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[1]This information was obtained through correspondence with County Extension Directors.

[2]Fletcher, J.E. "A Systematic Approach to the Analysis of Land Sales Regulatory Programs: A Case Study of the Michigan Land Sales Act of 1972". (Ph.D. Dissertation, Michigan State University, 1978), p. 157.

[3]County Extension Directors, Antrim and Emmet Counties. Ibid. (Appendix B-3).

Michigan's recreational industry, it is likely that second home ownership by absentees who like to spend vacations in the north will remain as the major reason for parcellation in the region for many years.

It is expected that the wide differences in the distribution of levels and rates of change of population in the state should reflect the variations in the amount and trends of land parcellation in the state. For example, lots already created in metro counties will be left idle, but new parcels would be created in the new center of population gravity. A declining trend in parcellation should be observed in the source regions while an increasing trend should be apparent in the receiving regions.

The impact of migration on land use is closely related to the migrant character. An analysis of migrants by age indicates that the northern lower peninsula is attracting mostly adults and older individuals. These migrants have interest in real estate and tend to stimulate parcellation activities. The southern lower peninsula mostly attracts youth migrating towards job and education centers. Their direct impact on land is a derived one—they create a concentrated market for food and housing. Since they tend to be transient, developers are wary to rely on them. Their purchasing power is also too low to induce brisk housing construction activities. Adult migrants tend to be more

permanent and constitute effective demand for land. Their impact on land has been observed in some of the responses by County Extension Directors in the N.L.P. counties. Reversed migration involving urban to rural movements have several negative consequences on land use pattern and developments.

Urbanization and Urban Exodus in Michigan

Urbanization had its first stage impact on land use when the movement of workers to towns and cities called for the development of land areas for compact urban communities. A more complicated second stage emerged with the swelling of the urbanization and suburbanization movements after World War II. New urban residents brought tremendous demands for additional housing and urban facilities. But at the same time, increased individual mobility, demands for larger lots, the declining attractiveness of central city living, and public policy inducements for suburban development favored an outward movement of city residents to suburban and sometimes rural locations. This stage has been followed in many instances by one of active flight of residents, industries, businesses, and jobs from central cities and the consequent deterioration of once viable downtown areas. It remains to be seen whether this process can be reversed or if there would continue to be

incessant demands for the development of new lands for urban and suburban uses around the fringes of cities while their older sections suffer from underutilization, blight, and decay.

Suburbanization, scatteration of residential developments in the rural-urban fringe areas around cities, and the outward spread of urban-oriented uses has resulted in a luxurious and often wasteful use of lands for these purposes. Southern Michigan had 669,000 acres used for various urban purposes in 1940, 1,058,000 acres in 1955, and 1,722,000 acres in 1961. By 1977, the acreage used for urban and built-up areas both in and around cities had increased to 3,287,000 acres.[1] Both suburbanization and urban exodus to countrysides have several implications for rural communities and rural industries and economy, besides their impacts on cities that serve as source regions.

In the rural areas, developments may occur, but local farming communities are usually unprepared for the increasing tax burden, the high assessed value of their farmlands and the conflicts in land use which eventually arise. Where the exodus is followed by industries job seekers of lower income class follow suit and some of the urban problems are transferred to the rural areas. Parcellation

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[1]Barlowe, R., et. al., Preliminary Report on Michigan Land Resources by the Michigan Task Force; 1981.

proceeds at faster rates and home lots tend to be larger and secluded. Farmlands tend to shift to rural residential and industrial uses as a result of "push" and "pull" forces on the farmers. "Push" forces are associated with increasing assessed values and tax burden on their land as well as court cases involving pollution, nuisance, etc.; "pull" forces are related to capital gains as land values rise. Eventually the agricultural sector quickly gives way to residential and industrial land use.

From the standpoint of land conservation, the process is double-edged. Urban land use, abandoned in cities, have little or no potential for any rural industrial activities. Rural farmers cannot move to urban areas to pursue agricultural activities. However, rural lands are quickly transformed to urban uses. In both instances, good lands are locked up in urban uses irretrievably, especially since most Michigan cities grew and sprawled on good farmlands. Residential developments associated with this type of movement usually consumes large amounts of lands for rural industries. The urban demand for land will be affected by a number of factors such as individual choices concerning residential and building sites, employment patterns, energy developments, and public policies respecting land use. In this regard, the topic of housing demand requires particular attention.

Housing Units

Population trends are only one indicator of growth and development in any community. Another important indicator is new residential developments which have considerable impact on land use pattern. The rapidly declining family size, as has occurred in the state and generally in the nation in recent years, can often mask significant new residential developments.

Approximately 50-65 percent of all small-lot parcellation are utilized for residential purposes. Increasing demands for new homes implies increasing parcellation. Table 3-2 reports the number of occupied housing units in Michigan from 1940 to 1979. Data are decennial. The total number of occupied housing units has been increasing numerically and in absolute terms over the last 40 years. Incremental rate has, however, been declining over the period. The total and annual percentage figures in Table 3-2 reflect a steady declining rate. Seasonal and migratory housing units have been increasing during the last 20 years. Seasonal, second and third homes have become important in the state's recreational and fringe counties. Most of the second and third homes are found in fringe and rural counties as well as in counties with tourist attractions and recreational parks.

The declining rates in housing developments are particularly more evident in S.M.S.A. counties than rural areas of the N.L.P. and counties contiguous to metropolitan

TABLE 3-2

Number of Occupied Housing Units in Michigan: 1940-1979

	Number of Occupied Housing Units and Percent Change		
Year	Number	+ Total % Change	Annual % Change
1940	1,396,014	-	-
1950	1,790,702	28.3	2.8
1960	2,239,079	25.0	2.5
1970	2,653,059	18.5	1.9
1979	3,029,000	14.1	2.0

Source: Michigan Statistical Abstract, 1979, 14th Ed., Research Division, Graduate School of Business Administration, Michigan State University, East Lansing, Michigan.

centers. For most of the rural counties, housing developments are increasing at increasing rates even though the number of housing units remain very low. Increasing rates of development of housing units should be associated with

increasing rates of land parcellation while high existing levels of housing units should be directly associated with high parcellation levels. It should, however, be noted that the demand for homesites is dichotomous—one for industrial worker residential units, the other for recreational activities. Furthermore, in some cases, the relationship between number of developed housing units and demand for parcels for homesites lags.

Information from County Extension Directors confirms that most recreational second home lots remain undeveloped and a developer pointed out that he expected only 20 percent of his recreational second home lots to have houses on them by the year 2000.[1] This points to the fact that lots around cities are usually built upon soon after purchase, while a large number of lots in the recreational areas are bought as investments which owners will build on or sell later. This may account for regional variations in the effects of housing units on parcellation. Table 3-3 reports regional distribution of number of housing units in Michigan, based on most recent census data.

The high percentage change figure for the N.L.P. particularly reflects the impact of reversed migration and the increasing numbers of second and recreational homes in

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[1]This information was obtained second source from Dr. Raleigh Barlowe, May 19, 1981.

the region. The U.P. figure is generally attributed to influx of students and workers into counties such as Marquette, Houghton and Delta. Since demand for housing units

TABLE 3-3

Regional Distribution of Housing Units

(Occupied and Vacant)

1970 and 1980

Region		Number of Housing Units 1970	Number of Housing Units 1980	Percent Change 1970-1980
I	E.S.L.P.	2,042,884	2,319,213	13.5
II	W.S.L.P.	600,599	809,245	34.7
III	N.L.P.	205,676	299,460	45.6
IV	U.P.	108,144	153,305	41.8
		2,957,303	3,625,003	22.6

Source: Preliminary 1980 Population Census Report.

is closely associated to population and its impact on land parcellation is direct (occupied or unoccupied housing unit locks up land) it is preferred over population in the specification of the regression model, though both were retained.

Conclusions

The above population characteristics indicate that if population and parcellation are positively correlated, then:

a) The S.L.P. should show very high level land fragmentation but the creation of new parcels should exhibit declining trend.

b) The N.L.P. should show moderate to low level parcellation but the creation of new parcels should exhibit increasing trends, especially lots of large size categories (10 to 10.9 acre parcels).

c) The U.P. should show low to very low level parcellation with constant to slight increasing rates in the creation of new parcels.

d) Parcels in the S.L.P. should be relatively small in sizes, while the lot sizes in the N.L.P. and the U.P. should be relatively large. Hence the problem of 10 and 10+ acre parcels should be more acute in the very rural areas of the S.L.P. and the N.L.P.

e) Parcellation density should be high in the south, decreasing northwards.

Economic Determinants

Economic Activities

Population concentration and economic activities are almost synonymous. The two factors are extremely related. Economic opportunity in an area tends to attract population; at other times, population concentration creates a market which in turn attracts economic activities. The two factors are both the cause and the effect of their interactions. The strong causal relationships between population and economic activities make it almost impossible to discuss them in isolation.

The supply of land is affected by the market price of land which influences the land owner's willingness to sell or parcel out raw land, or to convert used land to alternative uses. Trends in land values generate speculative behavior among land owners and developers who usually aim at increasing their capital gains. Effective land supply depends not only on the real estate market condition but also on a complex interrelationship between ecological, institutional and personal factors. Several institutional arrangements may facilitate or impede the theoretical frictionless real estate transactions. These are discussed under the other determinants.

Demand for land given biophysical considerations is influenced by land values, information about land and

prices, institutional arrangements and governmental policies, and the preferences of the buyers and sellers. Effective demand is a function of the ability of the individual to pay for the land. This may be facilitated by certain financial arrangements in the system—either private or public, e.g. bank credit facilities, mortgage arrangements, interest rates, and public credit facilities. To examine the relationships between land parcellation and economic factors, assessed valuation of farmlands and incomes were selected for brief discussion. These two factors are included in the multiple regression model specification. Employment is so closely related to population that it is excluded from the models and hence is only briefly discussed. A very brief discussion of Michigan agriculture is also provided as a background to trends in land values and incomes.

Michigan Agriculture

The importance of Michigan's agricultural industry does not rest on its added value or the employment it offers, but on the fact that it has made the state self-sufficient in many products. Several citizens, especially farmers and public officials are, therefore, concerned about losing this industry. The Land Grant University, Michigan State University, is one of the largest in the

world. In terms of employment and added value, the manufacturing sector, led by the automobile and its allied industried and the services sector—commerce, transportation, finance, etc.—are by far the most important. However, agriculture is usually considered the second most important sector of the economy, followed by the growing tourist industry.

Despite its acclaimed importance, Michigan agriculture has and will continue to face many challenges. The question of development of the resource has been a very important issue. There are many competing industries all desiring a substantial quantity of the landscape. Development of housing, upgrading of highways, expansion of airports, industrial and commercial improvements, and land for recreation all compete with agriculture for Michigan's land surface. The development of any one of these industries may have an adverse affect on surrounding farms.

A housing development in a predominantly agricultural area may result in loss of more land because of the non-compatibility of the two uses. Highways likewise directly take substantial acreage for each mile of new construction. Although most of the highways in the interstate system have been completed in Michigan, there are still several significant areas where highway development is contemplated. This development will result in the direct loss of surface

area and also indirectly impact agriculture as development of other types increase. Airport expansion has also utilized substantial agricultural land. Recreational demands are increasing, with more leisure time and apparently more money to invest in recreational vehicles. Citizens of Michigan are demanding more use of the land, and frequently trespass on private land with resultant crop damage.

The concept known as right-to-farm has recently been revived in Michigan. Typically, agriculture has been requested to move out when some other "higher priority" use is considered. The concept of right-to-farm is simply that agriculture is, in its own right, a legitimate use of the land and that other uses must coexist with agriculture.

Michigan's tax policy also does and will continue to have a very significant impact on Michigan agriculture. Property tax, sales tax, inheritance tax and income tax, all directly affect agriculture. Tax policy is a significant force in preserving farmland or promoting the sale of farmland.

As the state's second largest and most stable industry, the decisions made on development, taxes, and the right-to-farm will have a significant impact on the viability of Michigan agriculture.

Based on the various U.S. Censuses of Agriculture[1], the number of farms, the acreages in farms and the acreages of cropland declined steadily throughout the 1940-1978 period. The state has less than a third as many farms in 1978 as in 1940 while the acreage in farms dropped to 61 percent and the acreage of cropland to 70 percent of the earlier levels. Acreage of cropland harvested dropped at a slower rate, reached a low of 5.5 million acres in 1969 at a time when federal programs were still being used to hold down production, and then responded to improved market incentives by increasing to 6.8 million acres in 1978. Average farm size, however, increased during the period. These trends were similar for all regions even though more than 80 percent of the state's farmland is found in the southern 41 counties.

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[1]Prior to 1974, Agricultural Census Reports were based on supposed complete enumeration. The Reports for 1974 and 1979, in contrast, are based on statistical samples. Both approaches do not yield comparable results and, in fact, there has been suspicion of underenumeration. The Bureau of the Census has estimated underenumeration of about 17 percent in 1969, 13 percent in 1974 and 11 percent in 1978. Information based on agricultural statistics in the state must, therefore, be interpreted and used with caution. According to the Report of the State of Michigan Task Force for Natural Resources and Public Policy, the uncorrected totals of 1978, reported by the operators of the sample farms probably provides a much more comparable standard for indicating actual trends in farmland use throughout the state.

Several observations may be made concerning Michigan's farmland use trends. The number of farms has declined at a rapid rate and will probably continue to decline for some time. This trend will be favored by the national trend towards larger farms and the fact that approximately 30 percent of the farm units in the state now involve holdings of less than 50 acres. The 1978 census indicated that only 45.3 percent of the farm operators regarded farming as their principal occupation and that 53.3 percent worked 100 days or more off their farms. More than half of the operators in the southwestern, northeastern and southeastern regions of the state indicated that they were part-time farmers who worked 100 days or more off their farms. The highest rates of off-farm employment were reported for the most part in areas near urban and industrial developments while lower rates were reported in the more strictly agricultural areas.

Michigan has probably gone through its period of major reductions in farmland and cropland acreage. However, the area in farms is still declining and will probably continue to do so as some operators discontinue their farming operations and as farmlands are acquired for various urban-associated uses. Some cropland will be lost to agriculture in this process; but in the case of operators discontinuing operations, much of the better farmland will be taken over by other operators.

Despite the decline in number of operators and farmland acreage, it is interesting to note that the acreage of cropland harvested increased 1.2 million acres between 1969 and 1978. This acreage represented 80.7 percent of the reported cropland area in 1978 as compared with 66.1 percent in 1940, 70.6 percent in 1950, 71.9 percent in 1959 and 64.1 percent in 1969. Ups and downs in this total can be expected with variations in weather conditions and the economic climate for farming. Favorable markets, both domestic and international, for farm products are largely responsible for the higher 1978 acreage. One negative aspect of the trend relates to the fact that a smaller area of cropland was probably planted to soil conservation crops in 1978 than in earlier years.

It must be recognized that those prime lands that lie in the path of urban growth are, generally, in danger of being taken unless a more strict protection policy is adopted. Major hindrance to adopting stricter policies than currently existing is a constitutional and political issue.

Land Values

Average value of farm real estate per acre has been increasing (Table 3-4). Average farmland values for Michigan from 1973-1979 for selected years are compared with other states from selected regions.

All the selected states show an increasing trend in farm real estate value per acre. This is due in part to

TABLE 3-4

Average Values of Farm Real Estate Per Acre

Michigan and Selected States (1973-1979)

Region and State	Value Per Acre in $				
	1973	1975	1977	1978	1979[a]
North East Region	$	$	$	$	$
Maine	253	341	400	441	485
Vermont	346	462	541	597	657
New Jersey	1,337	1,807	2,004	2,057	2,222
Lake States					
Michigan	444	553	767	860	955
Wisconsin	328	434	583	690	807
Minnesota	269	429	652	730	854
Corn Belt					
Ohio	505	706	1,121	1,263	1,516
Missouri	294	396	526	602	674
Illinois	567	846	1,431	1,581	1,786
Northern Plains					
N. Dakota	108	195	258	273	306
S. Dakota	94	142	194	227	257
Kansas	199	296	376	380	437

Source: Michigan Agricultural Statistics, July 1979, MDA.

[a]Preliminary Data

the rising costs of capital investments on the land which reflects inflation, and partly to the increasing expected

value of the farmland itself as urbanization encroaches on them. States such as New Jersey, Ohio, Illinois and Michigan which are highly urbanized tend to have higher land values than rural states such as Maine, North and South Dakota and Kansas. Associated with increasing land values is assessed valuation and tax burden on land owners, a possible push factor in agricultural land transference. Increasing land values should, therefore, reflect increasing parcellation process.

Income

One of the most important factors underlying land parcellation process in Michigan is personal incomes. The per capita personal income in Michigan has often exceeded national average since and as far back as 1921 when the ratio of Michigan average per capita income to that of the nation was about 1.13 or 113 percent (index). However, the percentage has been declining over the years. It reached a peak of 119.8 percent in 1953, began to fluctuate, reached the lowest figure of 102.2 percent in 1975 and since then has began to pick up again. 1978 estimate places the percentage at 108.1.

With declining automobile demand, and competition from Japan and other automobile manufacturing countries, the Michigan average per capita personal income may converge to national average. However, it should be observed that

per capita income in dollars has been increasing nationally; in Michigan it increased from 1950 level of $1,704 to 1977 level of $7,606. National average increased from $1,430 to $7,026 correspondingly. Wide variations exist, however, among counties and regions. In 1977, per capita personal income in Michigan ranged from a low of $3,984 in Oscoda county to a high of $9,776 in Oakland county. The average that year was $7,606 and about 66 counties fell below this average. This indicates a highly positively-skewed income distribution among counties.

The persistently high level personal income in the state, and the increasing purchasing power of families as two persons (husband and wife) begin to earn incomes together, have supported an effective demand for high quality residential units. Michigan real estate construction industry has usually enjoyed large domestic market. Drops in income observed for 1960, 1970 and 1974 coincided with unemployment highs. This close relationship between incomes and employment calls for a brief examination of Michigan's employment situation.

Employment

Employment effect on land parcellation in Michigan is dual in nature. Job opportunities have both concentrated Michigan's population and further increased Michigan's

people's purchasing power through increased per capita income. The housing construction industry is closely linked to the economy of the state. Increasing unemployment tends to slow down the housing industry as couples, uncertain about their future earnings, refrain from taking mortgage loans. Income is, however, used in the regression model in place of employment as a proxy of economic activity.

In general, the unemployment rate in the state has been above national average. In 1975, the unemployment rate reached a peak of 12.5 percent. 1958 had been a high unemployment year (13.7 percent) in the state. National average of unemployment (1977) was 7.0 percent and Michigan reported 8.2 percent that year. 1978 rate showed a slight decline in unemployment nationally (6.0 percent) and for Michigan (6.9 percent). Since then, unemployment has again began to increase. In 1980, Michigan's unemployment level reached 12.5 percent of its labor force. The February 1981 figure for unemployment in the state was a high of 14.2 percent. If such a trend continues, the housing industry will slow down and land parcellation and subdivision developments may slacken. As already noted, increasing unemployment causes out-of-state migration. Most of the migrants have been young college graduates and low income unskilled workers with relatively minimal impact on land parcellation.

Increasing income and employment, nevertheless, increase the purchasing power of the low income earners and enable a proportion of them to afford single family residential units. It could, therefore, be argued that increased employment increases incomes and affluence, which in turn increase demand for rural amenities. However, a stronger urban pull as a result of general economic well-being of the cities is much more likely to weaken the push factor; with proper land use control policies, communities may be able to deal with the pull factors of migration and discourage urbanites from invading rural lands.

Biophysical Determinants

Ecological Factors

Physical factors such as soils, climate, forest, topography, etc., play an important role in human settlements and activities (economic, social and political). It must be recognized that heavily urbanized and industrial areas are often located on productive soils for agriculture and forestry, where the climatic conditions are more favorable for the two industries and other human activities.

Forests

The State of Michigan still possesses considerable forestlands and rural environment, with unique historic resources. About 54 percent of the state is classified as forested. Of the 19.1 million acres of forest in 1965, about 9.0 million acres or 47.2 percent were found in the Upper Peninsula and 7.5 million acres or 39.3 percent in the Northern Lower Peninsula. The public owns about 6.3 million acres or 33.3 percent (state, local and federal). These public lands are in general found in the Upper Peninsula and Northern Lower Peninsula and are mostly in the form of undeveloped forest, parks, wildlife refuges and open spaces, wetlands, and so on; part of the public holdings are managed for multiple uses. To date, the Federal Government, through the Forest Service, USDA, owns about 2.7 million acres of land in the state. Within the boundaries of the federally-owned lands National Park Services and Fish and Wildlife Services have extensive holdings.

The State of Michigan, through the Michigan Department of Natural Resources, administers over 4.3 million acres of forest, parks and wildlife; they are managed on multiple-use basis and provide recreational facilities. Local governments' land holdings and recreational resources are scattered and not very significant.

Areas with public resources attract many tourists from all parts of Michigan and from other states. Demand for natural environmental resources is on the increase in the whole nation and Michigan's richness in forests, lakes, water, historic monuments, wildlife and other scenic attractions have made tourism and recreation a prominent industry in the state. Demand is particularly high for water frontage and counties such as Antrim, Charlevoix, Cheboygan and Newaygo, and almost all the U.P. counties have considerable recreational potential. This potential is associated with the demand for small parcels. It may, therefore, be concluded that parcellation in the North is not directly related with county population, but rather correlated with recreational homesites.

Recreational Amenities

A study of Michigan recreational activities indicate that the north of the L.P. and the U.P. are the focus of most summer recreational activities. From the metropolitan regions of the South and the Chicago-Gary areas, individuals converge on State and national forests for skiing, camping, deer hunting, fishing and boating. Major centers of attraction such as the Sleeping Bear Dunes in Leenanau county, Hartwick Pines in Crawford, Mackinac Island and Bridge, Fort Michilimackinac, Sault St. Marie Locks,

Tahquamenon Falls, Pictured Rocks of Alger and the Porcupine Mountains are all found up north of the state. Subdivisions line up all along the lake shores and counties such as Grand Traverse, Leelanau, Antrim, Keweenaw and Houghton are bustling with real estate activities in second and recreational homes, marinas and resorts. Michigan has over 170,000 seasonal and second homes.[1]

Recreational activities in the south are over utilized. In 1975, about 600 million participant-days were recorded for 20 popular recreational activities—a tremendous pressure on the state's recreational resources. Much of the activity was concentrated on relatively few heavily used areas of private, local government and state lands in the Southern Lower Peninsula.

In general, the major factors attracting individuals to the north of the L.P. and the U.P. are recreation and environmental amenities and clearer air. Buyers interested in the out-of-doors are buying before prices rise further. Some owners may be wealthy, but most represent middle incomes and a surprising number are in low income brackets. Besides, construction and developments of real estates, multi-family housing units and condominiums are likely to

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[1]Michigan Atlas, 1977, (ibid.), pp. 171-202. Also, see Santer, Richard A. (1977) Michigan, Heart of the Great Lakes. Kendall/Hunt Publishing Co., pp. 254-264.

increase land withdrawals in this area. Speculation and premature land sales have already been noted in many of the West Northern Lower Peninsula counties (e.g. Antrim, Charlevoix, etc.) and many subdivided lands sold on a land contract basis are still not on records and hence do not appear on the Plat Atlas maps.

An increasing land parcellation problem is expected in the recreational areas in the future as developers, consumers and subdividers converge on the region. In the regression model, public parks and air quality indexes are included as explanatory variables and proxies for ecological determinants.

Institutional Determinants

Governmental Regulations

Apart from the self-regulation implicit in the land development and sales industry, several governmental regulations in Michigan are designed to direct the pattern of land use. Regulations at local, state and federal levels affect the acquisition of landed property, registration of land titles, leasing arrangements, mortgages and land developments. However, the local governments (municipalities, county and township) have the major responsibility for controlling the location and quality of land developments

through the exercise of the "police power" to protect the health, safety and general welfare of its citizens. Direct and indirect controls such as zoning and subdivision regulations, development rights arrangements under Land Resource Protection Act, Subdivision Control Act, building health and sanitary codes, etc., are a few of such public controls circumscribing the individual fee simple owner's property rights and therefore directly or indirectly infringing on the sales and purchases of land parcels. It should be noted that these public instruments may be used to restrict or facilitate land transactions. They work in both ways, depending upon the objective of the government relative to land resources at any point in time.

Land use policies are treated as shock variables in this study. The Subdivision Control Act of 1976 (PA 288) is selected as the main shock policy variable affecting trends in parcels less than 11 acres. Other Acts and land use controls such as zoning are not examined or included in the model. The impacts of zoning on land parcels for residential purposes have received ample study and extensive discussion in the literature. For example, Nelson has excellent discussion of the impact of zoning on properties in his book, Zoning and Property Rights: An Analysis of the American System of Land Use Regulation

(1977).[1] Jud has also studied the effects of zoning on single-family residential property values, in Charlotte, North Carolina.[2] Jud cites several other empirical works on zoning and its impacts on land use.

The Subdivision Control Act (PA 288 or 1967)

The Subdivision Control Act was adopted as a vehicle to empower local units of government to pass ordinances to regulate planned unit and cluster developments as well as the conventional subdivision.

According to D'Amelio:

> "Properly applied, the provisions can combine zoning and subdivision control into a single administrative process by adopting a subdivision ordinance."[3]

The Subdivision Control Act was revised and enacted during 1967 and became effective in January 1968. The Act has often be referred to as the Plat Act. Although the

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[1]Nelson, Robert H. Zoning and Property Rights: An Analysis of the American System of Land Use Regulation; 1977, The MIT Press.

[2]Jud, G. Donald. "The Effects of Zoning on Single-Family Residential Property Values. Charlotte, North Carolina." Land Economics, Vol. 56, No. 2, May 1980, pp. 142-154.

[3]D'Amelio, R.S., Director, Local Property Services Division, Dept. of Treasury, "The Subdivision Control Act and PUD's" in The Michigan Survey Newsletter, Vol. 10, no. 4, Fall issue, 1975.

majority of the Act is devoted to platting procedures, a key element of the Act is Section 102 (d) which allows only four land subdivision without platting, each of which may be less than 10 acres within a ten-year period. Should a landowner desire a fifth split less than 10 acres, that person must formally plat the land. Even though this can be very financially rewarding, it is also expensive and may require a year or more of time.

The Subdivision Control Act has raised a number of questions relative to the limits to division and sale of land. Section 102 (d) Act 288 of 1967 defines "Subdivide" or "Subdivision" as:

> The partitioning or dividing of a parcel or tract of land by the proprietor thereof or his heirs, executors, adminstrators, legal representatives, successor, or assigned for the purpose of sale, or lease of more than one year, or of building developments where the act of division creates five or more parcels of land each of which is 10 acres or less in area; or five or more parcels of land each of which is 10 acres or less in area are created by successive divisions within a period of 10 years.[1]

The above definition, therefore, exempts any partitioning which creates parcels or lots slightly bigger than the 10 acre minimum. Together with the Michigan Land Sales Act, (PA 286, 1972), developers and subdividers could

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[1]Attorney General's Opinion 4804, April 25, 1974.

create as many as 24 individual parcels, each parcel slightly larger than 10 acres, at any single act of subdividing.[1]

The Act's impact on land parcellation in rural areas is a major concern for rural land use policy. Some policy makers contend that parcels of one or two acres in size are sufficient for residential development in rural areas. Among the reasons, they argue that less land will be removed from agricultural use because the parcels are small. The opposite approach claims that large parcels, e.g. 40 acres minimum for a homesite, is a better method to preserve agricultural land. This would limit the number of buyers who could afford to move into area while maintaining large blocks of land that could easily be leased to full-time farmers. Both sides can present strong cases to substantiate their viewpoints.

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[1]The Michigan Land Sales Act (PA 286 of 1972) is not a subject for discussion in this dissertation. However, it and the Subdivision Control Act (PA 288 of 1967) together constitute the most important land transaction regulations which determine the number and amount of parcels an individual in the state can create during any single act of land partitioning. Paragraph 565. 804, Section 4(b) of PA 286 of 1972 exempts land which is divided into fewer than 25 parcels from the provisions of the Act. The Act requires that a detailed statement of record with property report be filed with the Land Sales Div. of the Michigan Dept. of Licensing and Regulations. Thus, an individual who offers less than 25 lots, parcels, units or interests, including condominium and time share units, if offered as part of a common promotional plan, regardless of the size of the lot, is exempt from the provisions.

For example, an independent study conducted during 1979 examined land use on 10-acre parcels in four townships in Washtenaw county, viz., Freedom, Manchester, Pittsfield, and Salem. Each contains approximately 23,000 acres. Although these were not selected according to the County index of "ruralness" or specifically to examine new housing, the findings are related to land use activity. The investigators determined that 134 10-acre parcels have been created in the four townships between 1964 and 1977. Eighty-three of these were in Pittsfield and Salem, two townships near the urban center, while the remaining 52 were located in the more distant townships of Freedom and Manchester. Only 13 of the 134 parcels remained in large scale agriculture. Twenty-eight of the 10-acre parcels are used for pleasure houses. Each of the 28 contained a relatively new home usually located on the road frontage of the property. Seventy-three parcels appeared to have nine acres of idle land with a new home and a large lawn, while the other parcels may be awaiting new housing in the near future. The remaining land use on the 10-acre parcels was primarily devoted to woods. In these instances, new expensive homes could be observed to occur frequently at the end of the private access roads.

Analysis of the Impacts of Subdivision Control Minimum Lot Regulation on Rural Lands

Empirical studies have shown that the setting of minimum-lot size either by zoning or subdivision control regulations tend to create supply of and to induce demand for lot sizes in excess of the regulated minimum lot size especially for simple family residential developments.[1] The analyses of the effects of minimum lot regulation is very simple.

Generally, minimum lot regulations (by Zoning or Subdivision Control Acts) tend to distort the equilibrium real estate market. Given the supply of and demand for land for competing uses, market forces eventually create minimum lot sizes and parcels for each land use (ignoring the social and ethical implications). Zoning regulations and land use classifications (districting) which seeks to introduce uniformity into community land use have strong positive effects on residential properties. Land purchasers seek much uniformity in land use and would be willing to pay a premium for it. Where public controls are absent, a mechanism would eventually arise to meet the expressed needs of the residential consumer.[2]

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[1]Jud, G. D., 1980 (ibid.), p. 152.

[2]Jud, G. D., 1980 (ibid.), p. 151.

Minimum lot regulations which create larger lots than equilibrium lot size tend to lower the cost of single-family residential housing units constructed on large lots.[1] If the 10-acre minimum lot size provided in the Michigan Subdivision Control Act is greater than what real estate market forces would have eventually determined (0.5-0.6 of an acre) for single-family residential units, it should be expected that more larger lots would be created and demanded for housing construction. Figure illustrates the analytics of the impacts of minimum lot regulation.

The cost per unit lot construction is lowered when minimum lot size is set. This enables developers to reduce the unit price per residential unit to consumers. Setting minimum lot size above market equilibrium lot size, thus, increases the supply and reduces the price of large lot residential land. Figure 3-1 is based on the assumption of a free real estate market and assumes various elasticities of demand and supply.

In Figure 3-1, four panels are constructed to show the linkages between the real estate market sale of land for single-unit residences and minimum lot regulations. Panels should be read clockwise from a...b. In panel (a),

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[1]Ohls, J. C., et. al., "The Effect of Zoning on Land Values." Journal of Urban Economics, October 1974, pp. 428-44.

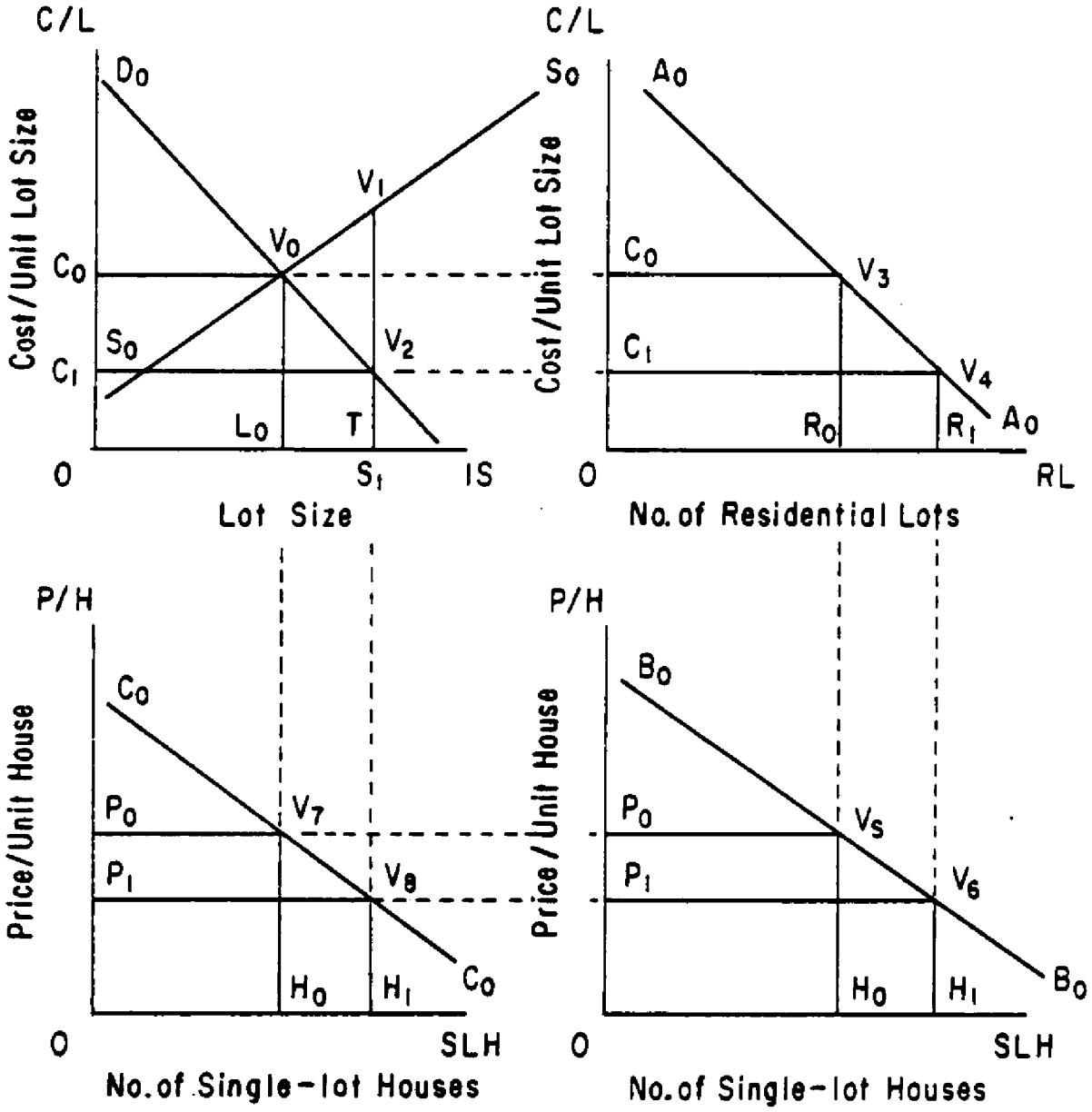

FIGURE 3-1

ANALYSIS OF THE EFFECTS OF MINIMUM LOT CEILING ON PARCELLATION

real estate static equilibrium minimum lot size (lot size is in acres) at C_o. At these equilibrium lot size and cost, developers would purchase R_o units of lot for single unit residential developments (panel b). The curve A_oA_o traces the cost-lot demand relationships. Declining lot cost implies increasing demand for more lots, given lot size. Assuming no speculative demand, all lots purchased are converted into housing units and sold to home consumers (panel c). The curve B_oB_o in panel (c) indicates that as the price per unit of housing lot declines, more single lot houses would be demanded, given infinite elasticity of supply at the point. Thus at P_o, H_od of single lot houses would be purchased and this is consistent with the lot size L_o, (via panel d).

If the legislature adopts a minimum-lot regulation which sets the size at $\bar{L}$, above market equilibrium lot size L_o, (panel a), market equilibrium is distorted, and the relevant supply curve for lot sizes is $S_1V_2V_1S_o$. V_2 becomes the equilibrium point of intersection between dd and S_1S_o and c_o falls to c_1. The response between large lot sizes and unit cost has been ascertained empirically by several studies.[1] With the fall in unit cost of lot size

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[1]Grether, D.M. and Mieszkowski, Peter. 1974. "Determinant of Real Estate Values." Journal of Urban Economics, 1 (April) pp. 127-46. Also see: Maser, S.M., et. al.

for construction purposes, more large lots are demanded for single unit housing developments. R_o increases to R_1 and more such housing units are provided for consumption (H_{od} increases to H_{id}). All things equal, the price per unit of large lot residential units fall correspondingly, from P_o to P_1 and this would be consistent with the regulated lot size $\bar{L}$.

In the case where penalty is incurred by creating lot sizes in the range of 0--$\bar{L}$ ($\bar{L}$ inclusive) e.g. the 10-acre minimum lot size of Michigan, land owners and sellers (subdividers) would usually sell lot sizes slightly in excess of $\bar{L}$ in order to escape the platting expenditures. This further reduces the per unit lot costs to developers, who would then buy the larger lots for the development of single family residential units. Large lot houses tend to be relatively cheaper, by hypothesis, and usually provide extra land for wood lots and other ecological features.

"The Effects of Zoning and Externalities on the Price of Land: An Empirical Analysis of Monroe Co., New York." Journal of Law and Economics, 20 (April) pp. 111-32. Moss, W.G., 1977. "Large Lot Zoning, Property Taxes and Metropolitan Area." Journal of Urban Economics, 4 (October) pp. 408-27. Sagalyn, L.B., and Sternlict, G., 1973. Zoning and Housing Costs, New Brunswick Rutgers University Center for Urban Policy Research.

The demand for large lot is usually induced. The effects of minimum lot regulations on farm lands are therefore obvious. It leads to more farmlands being withdrawn into non-farm residential uses. It is expected that the Michigan Subdivision Control Act which provides for 10-acre minimum lot size should reflect in the rate of change of lot sizes in the range of 10.1 to 10.9 acres in this study.

Conclusion

Chapter Three of this dissertation has revealed that there are several factors contributing, either independently or jointly through their interactions to land parcellation and subdivision developments in the state. Some of the factors such as population may be major determinants, but the impacts of population are mixed, depending on the magnitude of population growth rates and densities at any given place and at any point in time as well as population movements and redistribution over space and over time. Its impacts on the rate of parcellation may be positive for frontier zones or negative for the more mature regions which are serving as source areas for the reversed migration trend.

Agriculture and forestry tend to have negative impacts on parcellation in that areas with high agricultural activities do not normally attract high density residential

concentrations, and concommitant manufacturing and commercial activities. Recent trends, however, indicate that agricultural and forestland are perceived as recreational amenities and are attracting individuals who want to enjoy rural environment.

Gradually, the forest and open spaces in Michigan as well as farm areas are being opened up, becoming more and more accessible and lands are gradually being transferred to non-primary uses. Farmlands are the easy targets for development. Recreational demand is, therefore, becoming a major factor in land use pattern. The trends in land parcellation in Michigan can be appreciated only if trends in these factors are kept in mind.

CHAPTER FOUR

HYPOTHESES AND STATISTICAL MODELS

Chapters One through Three identified the study variable (parcellation) and the possible determinants which may contribute to the problem of land parcellation in Michigan. Contributing factors were examined under the framework of Social, Economic, Biophysical and Institutional Determinants. Based on the background analysis, hypotheses are stated and appropriate general statistical models to test these hypotheses are formulated in this chapter.

Working Hypotheses

This study explores three major hypotheses. The hypotheses are tested statistically at the $\alpha = 0.05$ (significance level). Any amount of parcellation noted in 1963 suggests that land parcellation exists in the state. Based on this assumption (by study definition) three hypotheses are tested. The first hypothesis deals with trends in land parcellation; the second with time and spatial distribution and the third with the impacts of the Subdivision Control Act, (PA 288, 1967).

1. The Time Trend Hypothesis

Based on the assumption that land parcellation does exist in the state (by definition) it is hypothesized that:

> "Land Fragmentation is proceeding at a constant rate in all areas of the State and for all categories."

This hypothesis implies that the difference between the mean parcellation amounts for the three periods of study are not statistically different. The rejection of this hypothesis leads to hypothesis 2:

2. The Incidence and Spatial Trend Hypothesis

If land fragmentation is significant and changing, then the logical questions are:

(a) Where is the process occuring most significantly?

(b) Why the specific spatial distribution or incidence?

(c) At what rate is the process occuring spatially and over time?

(d) How can the rates be explained and what are the implications?

Answers to these questions call for relating parcellation to several explanatory factors. Based on possible relationships, it is hypothesized that:

> "Parcellation is associated with ecological, socio-economic and institutional factors; high level and rapid rate of land parcellation are associated with high level and rapid rates of socio-economic developments."

The test of this hypothesis is expected to demonstrate regional and district differences.

The next question is if land parcellation is increasing and is perceived as a problem to the state, what ought to be done? This provides the basis for the third hypothesis which concerns public action allegedly contributing to the spread of the process:

3. The Impacts of the Subdivision Control Act (PA 288, 1967) Hypothesis

It is hypothesized that:

> "The Subdivision Control Act (PA 288, 1967) has had no impact on the creation of parcels and subdivisions in excess of the 10 acre minimum lot provision and no evidence exists to support the claim that parcels of land 10+ acres are on the increase in the state because of the 10 acre minimum specification."

This last hypothesis is the core of land parcellation problem in the state. It is argued that the minimum lot size of 10 acres specified in the Subdivision Control Act has stimulated the partitioning of land tracts into relatively larger lots, usually too large for residential purposes but too small for viable rural industry. By using trend regression with the Subdivision Control Act as a dummy variable, attempt is made to estimate the impacts of the Act on large lots.

Assumptions Underlying Hypotheses

The three hypotheses are predicated on several assumptions, important among which are:

1. Biophysical (ecological) factors such as climate, topography, soils and living organisms which are recognized to influence the amount of parcellation that occurs in any area directly or indirectly are assumed constant over the period of study and projection. Human factors remain the major motivational force behind the process.
2. Psychological and cultural factors are also recognized to have considerable impacts on most land transactions. These are, however, assumed constant and homogenous over time and over counties.
3. Some institutional factors, especially political and legal factors affecting land transactions are also considered exogenous to the model. However, certain policy measures are regarded as autonomous shock variables (parameters) which generate discrete changes, e.g. revisions in subdivision acts, changes in property taxes, etc. These variables tend to be stable over longer time periods than the other endogeneous variables such as per capita incomes, number of housing units, population and so on. To project figures to the year 2000 A.D., the following assumptions are further made:

(a) There would be no major catastrophes such as war, earthquakes, global climatic changes, etc.

(b) The land area of Michigan would remain fixed at current level of 56,817 square miles or 36,362,880 acres. Land area cannot increase significantly.

(c) County boundaries remain fixed at current delineations.

(d) Michigan population growth rates will continue at the current trend over the projection period; the population will continue to increase at a very low and declining rate of about 1.0 percent or less. Zero population growth (ZPG) will not be attained by the state during the period of study.[1]

(e) Current state-of-arts remains constant.

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[1]Michigan population increased by 13.5 percent during 1960-1970 intercensal period; this represented an annual compound growth rate of about 1.275 percent. Between 1970 and 1980 intercensal period, the population grew by only 4.02 percent or at a rate of 0.4 percent per annum. (Variations exist among counties and regions—see Preliminary Population Report - 1980, Chi-Li Wang and Lawrence S. Rosen, Office of the Budget, Dept. of Management and Budget). Projected figures between 1970-2000 indicate that the population of the state will grow at an average yearly growth rate of about 0.6 percent (Michigan Statistical Abstract, 1979).

Assumptions Underlying Statistical Tests

Specification of valid statistical models require several assumptions about the sample data. To determine the type of statistical analysis and techniques, parametric or non-parametric, that would be appropriate to analyze the collected data, the data were subjected to two test runs, viz: skewness and goodness-of-fit tests. Smoothed frequency polygons revealed a slight skewness to right (positive skewness).[1] This observed skewness created a problem as to whether the mean or the median was the appropriate statistic of central tendency. The use of the median would rule out some of the most powerful classical statistical tests, associated with parametric method of tests. A test of skewness was conducted on the various size unit categories and for three time periods. Results are reported in Table 4-1.

The Pearsonian coefficients of skewness ranged between 0.8 to 1.9, ($0.8 \leq S_{kp} \leq 1.9$) for all distributions of the study variables. $S_{kp} = 0$ implies perfect symmetrical frequency distribution and the mean and median would coincide.[2]

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[1]The distribution graphs are provided in Appendix 4-C with a summary of the various discriptive statistics.

[2]Any introductory statistical analysis textbook discusses skewness and other descriptive statistics. For example, see: (a) Chou, 1969, ibid., p. 109; (b) Neter, Wasserman and Whitmore, 1966, ibid., p. 63.

Chou points out that theoretically, S_{kp} varies within the limits of ±3, but in practice, S_{kp} values seldom exceed the limits of ±1. However, he further argues that for most social-behavioral non-laboratory research, S_{kp} lying within the limits of ±1 for all practical purposes reflect mild assymetry and the mean can be considered as a good approximation of the population parameter.[1] It should, however,

TABLE 4-1

Pearsonian Coefficient of Skewness for Sample Acreage Distribution by Year and by Size Unit

Size Unit	1963	1970	1977
11- Acre Parcels	1.5	1.2	1.0
10+ Acre Parcels	1.9	1.2	1.3
10 Acre Parcels	1.8	1.2	1.4
10- Acre Parcels	1.2	1.1	0.8
Large Parcels (10-10.9)	1.9	1.2	1.4

be recognized that positively skewed distributions are most common and reflects multiplicative forces operating on the variable. For most of the data collected on parcellation, both the mean and median values are reported. Also, for most of the statistical models, 1977 terminal data are used to reflect the most current relationships and situations of

[1]Ya-Lun-Chou, (ibid.), pp. 108-109.

land parcellation in the state. An examination of Table 4-1 and figures in Appendix 4-C reveal that most of the category distributions tend to be only moderately skewed, ranging between 0.8 to 1.4. The test for skewness provided only a partial and not entirely conclusive support for the use of parametric test in this study.

An interview with Dr. D. E. Chappelle[1] on the issue of normality assumption, and also with Mr. Essama Nssah,[2] revealed that the skewness test above is not a sufficient condition to establish normality or non-normality. Some distributions reveal skewed frequency distribution, but may be normal; the converse is also true. A test for goodness-of-fit was suggested and run at $\alpha = 0.05$ and $\alpha = 0.01$. Distribution was fairly normal at 0.05, but not at 0.01. Since all tests in the study are run at $\alpha = 0.05$ the normality assumption is accepted.

There are three sets of distribution for each parcellation size unit—1963, 1970 and 1977. A relative variance test [CV (X)] revealed that the variances (or standard

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[1]Dr. Chappelle is a professor in the Department of Resource Development, Michigan State University, and a member of the author's Guidance and Dissertation Committee. The author acknowledges his invaluable assistance to this chapter.

[2]Mr. Essama Nssah is a Ph.D. candidate in Theoretical Econometrics at the University of Michigan, Ann Arbor, Michigan.

deviations) of the period distributions were not significantly different at $\alpha = 0.05$.

The coefficients of variation for 1963, 1970 and 1977 distributions of large-lot parcellation are 89.4 percent, 77.2 percent and 86 percent, respectively, and these were not statistically different. However, some serial correlation between period data sets is suspected since the amount of parcellation that occurs in a period is likely to impact the amount of parcellation that can occur in another period. For example, one of the respondents to the letters sent out for second stage survey, aptly pointed out:

> "A major portion of the land area (in Oakland County) has already been divided and sold in 10, 11, 12 or 15 acre parcels. It is no longer in process, for the most part is has happened."[1]

Mr. Nierman is suggesting that, as far as those size categories (10, 11, 12 or 15) are concerned, Oakland is near saturation. However, clearly, 15, 12 or 11 acre parcels can again be subdivided into 10 and still smaller acre lots, if they are not totally developed. In this regard, lot size units less than 10 acres are correlated with large size units, especially over time.

Nevertheless, where parcels are subdivided for residential purposes, partitioning occurs once and forever. No

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[1]Nierman, Wayne. Oakland County Extension Director. Response to letters. (Appendix 3-B).

consolidation or repartitioning would be possible unless the property developed on it is destroyed, or unless the whole parcel was not developed. In that case the portion of the parcel remaining idle can be resold or resubdivided.

A simple chi-square test was run between parcellation density and large lot parcellation based on the hypothesis that large lot parcellation is independent of parcellation density (i.e. no ceiling effect). Counties were classified into two groups by density and amount of large lots as high and low and a 2-by-2 contingency table test at $\alpha = 0.05$ rejected the hypothesis of no dependence. Critical region of chi-statistic of 1d.f. at 5 percent confidence level was $3.84 \leq X^2 \leq \infty$ and computed chi-squared (X^2) was 11.230. However, dependent relation between large lot parcellation and parcellation density need not necessarily imply ceiling effect. If high density is associated with low amounts of large parcels the ceiling effect exists; but if high density is associated with high level large lot parcellation, no ceiling effect can be assumed, though relationship still exists. Based on the skewness and goodness-of-fit tests, the assumption of normality is maintained. Variance homogenity is also assumed based on relative variance test and chi-squared test of dependence. The sample mean is considered as the appropriate least square estimator of the population parameter.

Hypotheses Testing

Based on the assumption that parcellation is the major mode of land transference in the state, but its nature, extent, scope and trends are posing problems to the state, by threatening certain "critical" land uses, the hypothesis about trends over time is tested.[1]

To test trends over the 15-year period of study, parcellation means are paired and tested as:

a) $H_{1963} = H_{1970}$ and $H_{1963} < H_{1970}$ (1-1)

b) $H_{1970} = H_{1977}$ and $H_{1970} < H_{1977}$ (1-2)

and

c) $H_{1963} = H_{1977}$ and $H_{1963} < H_{1977}$ (1-3)

All tests are done for one-tail at $\alpha = 0.05$. Pairwise tests of equality among mean parcellation are based on

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[1]Several independent studies have shown that parcellation exists in several localities of the state. Barlowe and Hostetler did a study covering six counties in the southwest corner of the SLP. Their result was positive. Mentius researched into land parcellation in Venice Township (1978) and the result was positive. The Michigan Public Opinion Survey conducted by Kimball and others revealed that parcellation causing agricultural land withdrawals into nonfarm uses is a problem in the state. Research conducted in Washtenaw County on subdivisions turned out positive results—parcellation and subdivision were occuring and idle lots and inefficient use of land (for its highest and best use) were a growing problem. County Extension Directors of 13 counties reported increasing or mature process of parcellation (Appendix 3-B). Farmland Retention studies by Allen K. Montgomery Jr., Master's Technical Paper (1980), conducted in Canton Township, Wayne County, revealed advanced form of land parcellation in the area due to urban sprawl.

t-test analysis of the difference between means.[1] If the difference between the period means are statistically significant, and the null hypotheses are rejected, it is concluded that parcellation process is increasing over time.

The second hypothesis requires tests for relationships. The county, as the most common organizational subdivision, was chosen as the unit of interest. This approach permits a cross-sectional comparative analysis.

Correlation and multiple regression techniques were used to study the relationships between parcellation (measured in acreage units) as the dependent variable and the selected socio-economic and biophysical determinants, discussed in Chapter Two. Correlation analysis measures the degree of association that exists between two independent variables; regression analysis quantifies the parameters of such an association, and provides estimates of the value of dependent variable from known values of one or more independent variables. These methods also permit statistical inference and testing hypotheses concerning population parameters.

To test the significance of the relationships analysis of variance (AOV) subprogram is used. Hypothesis about the period means and variances are tested to establish any significant variations among district and regional observations.

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[1]Ya-Lun Chou, Statistical Analysis with Business and Economic Application, 1969, pp. 385-429.

Partial Correlation Metrix

The partial correlation matrix (SUBPROGRAM PARCOR) reveals the strengths and directions of the various relationships among the explanatory variables and between the dependent and explanatory variables. The cells of the PARCOR MATRIX are filled with Pearson 'r' coefficients which, besides establishing relationships, strengths and directions, also help identify spurious correlations, and confounding or masked variables. Such variables are then discarded before the multiple regression model is specified, in terms of variables showing strong, direct and clear relationships.

Multiple Regression Analysis

The rationale for the use of multiple regression subprogram was to develop predictive models of land parcellation. Such models will allow trend comparisons among counties and regions.

Least square (LS) multiple regression was run using data for the 30 selected counties.[1] This technique permitted analysis of land parcellation for the whole state.

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[1]The LS Multiple Regression was adopted as a final technique of analysis after several multiple regression techniques have been tried, e.g. L STEP where the computer is asked to delete or include certain variables. The L STEP helped in rejecting and retaining certain variables.

Differences in demand for land parcels exist between northern and southern Michigan. Separate equations were, therefore, developed for the two broad regions split along Oceana to Bay County line (see Figure 5-3, page 162) and designated as Southern Michigan (SM) and Northern Michigan (NM).[1]

The parcellation index consisted of five subcategories; multiple regression equations were specified for each subcategory for the three time periods of 1963, 1970 and 1977. For each category two separate equations were developed based on the broad regional aggregative data for the 1977 period only. This method permitted the isolation and discussion of the different influences on parcellation relevant to the two broad regions.

The model for any period of study tests only the relationships between the variables at that particular point in time based on the hypothesis that:

> "Parcellation (extent or level) is associated with and is explained or caused by socio-economic, physical determinants and certain other factors."

The General Model

The General Statistical Model is a functional relationship between parcellation amount (PAS) and those determinants identified in the threefold framework of Chapter Three,

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[1] c.f. Figure 2-3, page 21, for subregion classification.

viz.: Biophysical (P), Economic (E), Institutional (I), Social (S). The model is closed by adding Z for "other factors". The General Parcellation Function (GPF) may be formulated in this form:

Parcellation = F (Biophysical, Economic, Institutional, Social, Personal, Other factors).....(2-1)

Symbolically, function (1) may be written as

PAS = F (P, E, I, S, Q, Z).....(2-2)

where Z, other factors, takes care of all those other forces which may not be accounted for by the specified elements of the model.

PAS, P, E, I, S, Q and Z are all vectors which can be broken down into several components. The model can be simplified by the following transformations. Let:

PAS = Y ... (A vector of Parcellation)

P = X_1 ... (A vector of Biophysical Factor)

E = X_2 ... (A vector of Economic Factor)

I = X_3 ... (A vector of Institutional Factor)

S = X_4 ... (A vector of Social Factors)

Q = X_5 ... (A vector of Personal Factor)

and Z = X_6 ... (A vector of Other Things)

Then, Equation (2-2) becomes

$Y = G (X_1, X_2, X_3, X_4, X_5, X_6)$.....(2-3)

and is the general "closed" parcellation model. The formulation is "closed" because it includes any other possible

factors in Z or X_6. To make the function operational, additivity is assumed along with all other classical assumptions underlying a multiple regression model.[1] The general regression equation based on the general functional equation in (2-3) may be set up as:

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5U_5 + e_6 \ldots (2\text{-}4)$$

where 'b' (0...6) are the multiple regression coefficients, (b_o = constant), and e_6 is the stochastic element; Y and X_s are already explained. Each vector can then be broken into its component parts so that the expanded version of equation (2-4) may be presented as:

$$(Y_i \ldots Y_n) = b_o + b_i (X_i + \ldots + X_{in}) + b_{2i}(X_{2i} + \ldots + X_{2n}) + b_{3i}(X_{3i} + \ldots + X_{3n}) + b_{4i}(X_{4i} + \ldots + X_{4n}) + b_5U_5 + e_6 \ldots (2\text{-}5)$$

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[1] Many basic statistical texts discuss the assumptions underlying the classical linear multiple regression; extensive discussion on assumptions underlying multiple regression procedure can be found in: (a) Kmenta, J. Elements of Econometrics, 1971, The MacMillan, N.Y., Chapter 10; (b) Steel, R.G. and Torrie, J.H., Principles and Procedures of Statistics: A Biometric Approach, 2nd Ed., 1980, McGraw-Hill Inc., Chapter 14; (c) Ackoff, R.L. and others, Scientific Method: Optimizing Applied Research Decisions, 1962, also discusses the topic on pages 329-341. The assumption of linear multiple regression is made for expediency. Methods are available for non-linear regression analysis.

where the subscripts i..n refer to the individual component, the n's need not be equal and 0, 1, 2, 3 .. 6 are the major functional vectors in equation (2-4). Thus X_{2i} is a factor or variable i in vector X_2 or an economic factor.

Each of the Yi's is isolated and run on all the dependent variables. The list below indicates that there are five different types of dependent variables,

$$Y = Y_i, Y_2 \ldots Y_6 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2\text{-}6)$$

where:

Y_1 = AAPAS ...(Acreage All Counted Parcels, 11- Acres)

Y_2 = ASPAS ...(Acreage Small Parcels, 10- Acres)

Y_3 = AMPAS ...(Acreage Mean Parcels, 10 Acres)

Y_4 = ALPAS ...(Acreage Large-Lot Parcels, 10+ Acres)

Y_5 = LAGPAS ...(Acreage Large Parcels, 10-10.9 Acres)

Each of these is run on the explanatory variables and for each year. The final operative equation is:

$$Y_i = b_o + b_{ii}X_{ii} + b_{2i}X_{2i} + b_{3i}X_{3i} + b_{4i}X_{4i} + b_5U_5 + e_6 \ldots \quad (2\text{-}7)$$

where

X_{11} = Biophysical Factor Land Area per County in square miles (LACO).

X_{12} = Biophysical Factor Public Recreational and Forestlands as percent of county land area (1974), (PUBREC).

X_{13} = Biophysical Factor, Air Quality, (1974), measured by micrograms of particulates per cubic meter (AQUA).

X_{21} = Institutional-Economic Factor, Property Value Assessment, for tax purposes, in current million dollars (PAV).

X_{22} = Economic Factor, Average per Capita Income, of a county in current dollars (PHPI).

X_{31} = Social Factor, total population, per county in number of persons (TOTPOP).

X_{32} = Social Factor, Standardized Percent net migration for 1950-1960, 1960-1970 and 1970-1980 (SPNM*).

X_{33} = Percent urban population (PURB).

X_{34} = Number of housing units (NOHU).

Equation (2-7) can now be put in the parcellation acronym form as:[1]

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*The percent Net Migration (NM) figures were standardized to remove negative signs. The formula used is SPNM = 1 ± NM/100, depending upon the sign. For example, if the percent NM of a county is 32 percent, the standardized value, SPNM = 1 + 32/100 = 1.32; if the percent NM is -10 percent, then SPNM = 1 - 10/100 = 0.90, and so on.

[1]All subsequent equations use variable labels (acronyms) from the computer programs. See Appendix 4-D for complete list and definitions.

$$PAS = bo + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(Intercept)}$$

$$b_{11}LACO_{11}+b_{12}PUBREC_{12}+ \quad b_{13}AQUA_{14}+\ldots\ldots\text{(P-Factors)}$$

$$b_{24}PAV_{24}+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(I-Factors)}$$

$$b_{36}PHPI_{36}+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(E-Factor)}$$

$$b_{47}TOTPOP+b_{48}SPNM+\ldots\ldots\ldots\ldots\ldots\text{(S-Factor)}$$

$$b_{49}PURB_{49}+b_{410}\ NOHU_{410}+\ldots\ldots\ldots\text{(S-Factor)}$$

$$b_{511}U_{511}+\ldots\ldots\ldots\ldots\ldots\ldots\text{(U-Factor)}$$

$$e_{6}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(Stochastic)}\ldots$$

(2-8)

All variables and subscripts are defined in Appendix 4-D.

Selection of independent variables in the absence of previous state-wide research was based on a priori assumptions about the probable factors contributing to both the demand and supply of lots for urban uses. This meant a considerable background information on the real estate market as discussed in Chapter Three.

Quasi-Experimental Design Model

In order to isolate the impact of the Subdivision Control Act for detailed analysis, a trend model is also used. The time model is specified as:

$$PAS_{1963},\ SCA_{1967},\ PAS_{1970},\ PAS_{1977}\ldots\ldots\ldots\ldots\text{(3-1)}$$

where $PAS_{1963,\ 1970\ \text{and}\ 1977}$ is mean parcellation for the study periods and SCA_{1967} is the Subdivision Control Act of

1967 entered as the shock variable. The limited number of observations impose a constraint on the usefulness and precision of the method. Campbell and Stanley discuss the shortcomings of this formulation.[1] This model 1 is mainly used to provide indications about trends in large lot parcellation over time relative to the land use regulation.

Method of Estimating State Acreages From Sample

The previous section of this chapter provided a rational for using the sample mean as the least square estimator of the population mean. However, it was realized that a weighted mean would reflect closely the true population given the distribution of some of the socio-economic determinants influencing the studied variable. Population and land area were selected as appropriate weights. The amount of parcellation (total acres of land under any category of parcellation) is directly related to total population and land area. The ratios of the mean sample population and land area to mean state population and land area are used as weights on the sample mean amount of parcellation. The mean amount of parcellation for the State is obtained by the formula:

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[1]For detailed discussion of time series experimental design, see Campbell, D.T. and Stanley, J.C. Experimental and Quasi-Experimental Designs for Research, 1966, pp. 37-43.

$$\bar{P}AS_{mt} = \left(\frac{\bar{P}OP_m \times \bar{A}_m}{\bar{P}OP_s \times \bar{A}_s}\right) \bar{P}AS_{st} \quad \text{.....(4-1)}$$

where the subscripts

m = Michigan

s = Sample of 30 Counties

t = Time Period,

and

$\bar{P}AS$ = mean amount of parcellation in acres,

$\bar{P}OP$ = mean population

$\bar{A}$ = mean land area in acres,

and the (bar) over these variables imply "mean" or "average".

Since land area remains constant and mean population is a known parameter for any period of study, the term in parenthesis in equation (4-1) may be considered as a parameter symbolized as ψ_t. Equation (4-1) is, therefore, reduced to:

$$\bar{P}AS_{mt} = \psi_t(\bar{P}AS_{st}) \quad \text{.....(4-2)}$$

and the values of ψ_t are calculated and presented in Table 4-2. ψ is virtually constant over time with a slight decline. This decline is reflected in the population ratios and implies that the sample counties are gradually gaining in total populations relative to the whole state. Once the weighted mean parcellation amount is obtained, the total parcellation for the state is easily estimated by multiplying the weighted mean parcellation by the number of counties

in the state. Thus,

$$TOTPAS_m = 83(\psi\bar{P}AS_s) \quad \text{.....(4-3)}$$

or

$$TOTPAS_m = 83\ \bar{P}AS_m \quad \text{.....(4-4)}$$

is the total amount of parcels in the state for any specified time period of study. Table 4-3 reports the weighted

TABLE 4-2

Values of ψ_t for 1963, 1970 and 1977

Parameter	1963	1970	1977
$\bar{P}OP_m/\bar{P}OP_s$	94,255/54,344	107,010/67,483	110,154/73,587
$\bar{A}_m/\bar{A}_s$	685/730	685/730	685/730
ψ	1.6	1.5	1.4

and unweighted mean amounts of parcellation for the three study periods. These weighted averages better reflect the underlying population distribution of the state than the unweighted averages. The weighted means provide the basic data for calculating the amount of parcellation in the state and thereby for projection to 2000 A.D.

The rationale for using a weighted estimate lies in the fact that parcellation is closely linked to population distribution and Michigan population distribution was found

to be extremely skewed; skewness ranged between 3.8 to 4.4. The use of unweighted sample mean would not reflect accurately the underlying population distribution since the proportion of sample population to state population is not

TABLE 4-3

Estimated Mean Parcellation Amount
for The State of Michigan and the Sample Means
for Periods 1963, 1970 and 1977

Year	Weighted Mean	Unweighted Mean
1963	8,104	5,065
1970	9,877	6,585
1977	16,093	11,495

exactly equal to (30/83) or 0.36, but ranged between 0.20 to 0.24 for the three study periods. This implies that the systematic sampling technique selected, relatively, less populated counties. It should be noted that metropolitan counties such as Wayne, Washtenaw, Genesee, Oakland, Saginaw, Ingham, Kalamazoo and Kent were not selected by sampling. These counties alone contain nearly 60 percent of the total population of the state. None of these SMSA counties were selected by the systematic sampling procedure. The only counties of significant population concentration included in the sample were Bay and Macomb. Parcellation figures

would, therefore, be subjected to a slight downward estimation (under-estimation) of the true population parameter. This would be true even if the mode or median is used.

Weighted Parcellation Density (WPD)

Unweighted parcellation density (PD) simply measures the number of holdings or amount of parcellation in acreage per square mile or per township section (P_{Ai}/A_i). Thus by dividing the amount of parcellation for any county by the total land area, the unweighted density is obtained. However, this simple density is trivial because it does not permit county-by-county comparisons and groupings.

By weighting raw density index with population densities and land area, the weighted densities (WPD) obtained for the study counties become more meaningful and facilitate county-by-county comparative study. It also permits district and regional comparisons. The weighted density may be multiplied by 100 to standardize the scores. Weighted density figures are derived for all parcellation categories for the periods 1963, 1970 and 1977. The standardized weighted density values of 1977 reflects recent degree of parcellation in the state. A table is constructed to report the values for each county and for each period of time. Based on the values of WPD counties are grouped into High, Average or Moderate and Low parcellation pressure areas.

Appendix 5-C reports a summary of the density figures for all counties. High density figures imply high pressure on land or high degree or intensity of land use and vice versa.

Derivation of WPD Scores

County population density (Di) and land area (Ai) are compared to the mean sample population density ($\bar{D}$) and average per county land area ($\bar{A}$), as weights of county parcellation acreages (P_{Ai}), which are also compared to the mean sample acreage ($\bar{P}_A$). The density estimator is:

Weighted Parcellation density of a county =

$$\frac{\text{County Pop. Density} \times \text{Mean Sample Area} \times \text{County Parcellation Acreage}}{\text{Mean Sample Pop. Density} \times \text{County Area} \times \text{Mean Sample Parcellation Acreage}}$$

or

$$WPD_t = \frac{D_{it} \times \bar{A} \times P_{Ait}}{\bar{D}_t \times A_{it} \times \bar{P}_{At}} \quad \text{.....(5-1)}$$

where WPD_t = weighted density

Di = population density of selected county (i = 1, 2, ..., 30)

$\bar{D}$ = mean sample population density

$\bar{A}$ = mean per county land area of sample

A_i = actual land area of a county

P_{Ai} = actual parcellation acreage of a county

$\bar{P}_A$ = average parcellation acreage of the sample

t = 1963, 1970, 1977.

For any specified time period, D_i, $\bar{D}$, $\bar{A}$, A_i and $\bar{P}_A$ are known parameters. Since the weighted parcellation density is based on the aggregate parcellation category—all parcels less than 11 acres, the values of $\bar{P}_A$ are fixed for 1963, 1970 and 1977. The formula for parcellation density is provided below as:

$$WPD_t = \left(\frac{D_i}{\bar{D}}\right)_t \times \left(\frac{\bar{A}}{A_i}\right) \times \left(\frac{\bar{P}_{Ai}}{\bar{P}_A}\right)_t \quad \text{.....(5-2)}$$

or

$$WPD_t = \left(\frac{\bar{A}}{\bar{D}\,\bar{P}_A}\right)_t \left(\frac{D_i P_{Ai}}{A_i}\right)_t \quad \text{.....(5-3)}$$

letting

$$\phi_t = \left(\frac{\bar{A}}{\bar{D}\,\bar{P}_A}\right) \quad \text{.....(5-4)}$$

Then expression in (5-3) reduces to

$$WPD_t = \phi_t \left(\frac{D_i\ P_{Ai}}{A_i}\right)_t \quad \text{.....(5-5)}$$

The Standardized Weighted Parcellation is[1]

$$SWPD_t = \phi \left(\frac{D_i\ P_{Ai}}{A_i}\right) 100 \quad \text{.....(5-6)}$$

Implicit in the derivation process are certain assumptions and hypotheses. Assumptions are made about the underlying distribution of the sample or population. Earlier sections of this chapter examined the statistical assumptions

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[1]Weighted Parcellation Densities are standardized by 100 to remove decimal fractions.

in connection with the derivation of state parcellation estimates and the underlying distribution.

The main hypotheses implicit in the density index estimator are:

a) Parcellation pressure on a county is directly related to the population density of the area;

b) It is directly related to the total acreage under parcellation;

c) It is inversely related to the land area of the county.

The higher the population density and the amount of parcellation, the higher the pressure or degree of parcellation; however, the larger the land area, the less the pressure. Thus, as pointed out in the early part of this section, 1,000 acres of parcellation in a county such as Iron need not exert the same pressure on the land as 1,000 acres in Wayne or Macomb county even though the extent of parcellation in both counties may be the same.

From equation (2) it is clear that if $D_i = \bar{D}$, $\bar{A} = A_i$ and $P_{Ai} = \bar{P}_A$, then $WPD_i = 1$. That is, a county with population density equals to the mean state density, the land area equals the mean per county land area of the state and the amount of parcellation equals the sample mean amount of parcellation, will have weighted density exactly equals a unity or 100. WPD = 1 or SWPD = 100 is generally assumed to be the delineation between high pressure and low pressure

densities. A unity or 100 may also be obtained by other combinations of the factors involved in the computation of WPD. Parcellation density index is a non-negative score where WPD $\geq$ 0; it cannot be less than zero. It can theoretically take any value between zero and infinity.

TABLE 4-4

The ϕ_t Value for 1963, 1970 and 1977

For Calculating Parcellation Density

Parameters	ϕ_t Values = $\bar{A}/\bar{D}\cdot\bar{P}_A$		
	1963	1970	1977
Mean Sample Area (Acres)	704(x640)	704(x640)	704(x640)
Mean Sample Population Density	82	94	107
Average Sample Parcell., ($\bar{P}_A$)	5,065	6,586	11,495
ϕ_t	1.0848	0.7278	0.3663

Population density data were obtained from 1960, 1970 and 1980 censuses. Table 4-4 reports values for the coefficient parameter for parcellation density (ϕ_t) for 1963, 1970 and 1977. The value of $\bar{P}_A$ are based on the mean amount of parcellation for each study time period.

The land area is given in acres instead of square miles to increase the ϕ values for computational purposes. (The use of square miles gave a ϕ_t value of 0.00165 for 1963.) The effect of the 640 acre multiplier is cancelled out eventually since county land areas (as denominator) are also multiplied by 640.[1]

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[1]The estimate for each county is:

$$WPD_t = \frac{D_{it} \times 640 \times P_{Ait}}{\overline{D}_t \times 640\ A_{it} \times \overline{P}_{At}}$$

and the 640 acre factor is eliminated.

CHAPTER FIVE

RESEARCH FINDINGS

Non-Platted Parcels

Holdings of Non-Platted Land Parcels

Number of holdings and acres of non-platted land parcels for each of the 30 selected counties and for the three time periods of 1963, 1970 and 1977 are provided in Appendix 5-E for the size units, 11-, 10-, 10, 10+ and 10-11 acre parcels.

A total of about 28,316 parcels, ranging from as small as 0.1 of an acre to 10.9 acres were counted for the 30 counties in 1963.

Table 5-1 summarizes the county data into totals by categories.

TABLE 5-1

Number of Holdings by Size Unit and By Period of Study for 30 Selected Counties in Michigan

	Holdings by Period		
	1963	1970	1977
10- Ac. Parcels (ASPAP)[1]	22,186	29,183	49,871
10 Ac. Parcels (AMPAS)	5,275	6,645	13,317
10+ Ac. Parcels (ALPAS)	855	1,190	2,204
10 and 10+ Ac. Parcels (LAGPAS)	6,130	7,835	15,521
11- Ac. Parcels (AAPAS)	28,316	37,067	65,392

Number of holdings increased to 37,067 parcels in 1970 and then to 65,392 parcels in 1977. Thus, between 1963 and 1970, about 8,751 new non-platted parcels were created in the study counties. The total new parcels represented an increase of 30.9 percent over the 1963 base year figure. An additional 28,325 new non-platted parcels less than 11 acres were created during the second 7-year period between 1970 and 1977. This increment represented about 76.4 percent of the 1970 figure or slightly over 100 percent of the 1963 base year figure. Thus, more than twice the number of new parcels created between 1963-1970 was created between 1970-1977 period.

[1]Meanings of Acronyms were provided in Appendix 4-D.

Acreages of Non-Platted Land Parcels

The amount of land that is being parcelled into small lots is best measured in acreages. Individual holdings are, therefore, converted into acres. Citizens are more interested in knowing the total acres of land that are affected by land parcellation rather than the number of holdings under the parcellation.

The rest of this study analyzes parcellation by using an acreage index. County by county data on both holdings and acreages, by size unit and period are all provided in Appendix 5-E, Tables E-1 to E-8.[1]

There were about 151,952 acres of land under 11- acre parcellation in the 30 counties in 1963. However, amount of parcellation varied greatly among the counties studied, ranging from a maximum of 19,344 acres in Berrien county to a minimum of 1,178 acres in Huron County that year (Appendix 5-E).

Table 5-2 reports the total amount of parcels counted for each period of study by parcellation categories.

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[1]Conversion technique was explained in Chapter Two, pp. 17-19.

TABLE 5-2

Amount of Parcellation by Size Units and By Periods of Study for 30 Counties in Michigan

Size Unit	Parcels in Acres by Period		
	1963	1970	1977
ASPAS (10-)	90,237	118,622	189,143
AMPAS (10)	53,110	66,450	133,170
ALPAS (10+)	8,605	12,496	23,146
LAGPAS (10-11)	61,715	78,946	155,716
AAPAS (11-)	151,952	197,568	344,859

The amount of parcellation increased from 151,952 level of 1963 to 197,568 acres in 1970 and then to 344,859 acres in 1977 for the 30 sample counties.

Trends in Amount of Parcellation

An examination of Table 5-2 reveals that significant amounts of new non-platted parcels were created during the 1970-1977 period of study.

The hypothesis that there was no significant difference between the mean parcellation amounts (for all parcellation categories) of 1963 and 1970 could not be rejected on the basis of available evidence at the 5 percent level of significance. However, the hypothesis was rejected for the means of 1970 and 1977. The computed

t-values of all categories for the difference between 1970 and 1977 were all greater than the critical value of 2.00 (Table 5-3).

Table 5-3 reports the mean amounts of parcellation by size unit for each study period, the standard deviations (SD) and the t-statistics of the two interval periods t_1(1970-1965) and t_2(1977-1970).

TABLE 5-3

t-Test, for Difference Between Means of Parcellation Amounts for Time Period 1963-1970 and 1970-1977

Parcellation Category	1963		1970		1977			
	Mean	SD	Mean	SD	Mean	SD	t_1	t_2
AAPAS (11-)	5,065	4,324	6,585	4,696	11,495	7,729	1.28	2.92*
ASPAS (10-)	3,008	2,641	3,954	2,848	6,305	4,372	1.31	2.43*
AMPAS (10)	1,770	1,472	2,215	1,581	4,439	3,490	1.10	3.13*
ALPAS (10+)	.287	422	417	530	772	770	1.03	2.04*
LAGPAS (10-11)	2,057	1,841	2,632	2,034	5,211	4,009	1.10	3.09*

The increase in parcellation between 1970 and 1977 for 10 acre parcels (AMPAS) and 10-10.9) acre parcels (LAGPAS) had larger t-values, (t=3.13 and 3.09 respectively, Table 5-3) than the other size categories. This indicates that the impacts of the Subdivision Control Act on parcellation trends between 1963-1970 was negligible owing to the short time lag between its execution and the period

*$\alpha \leq 0.05$; Critical Value = $\pm$ 2.00; N = 30; df = 58.

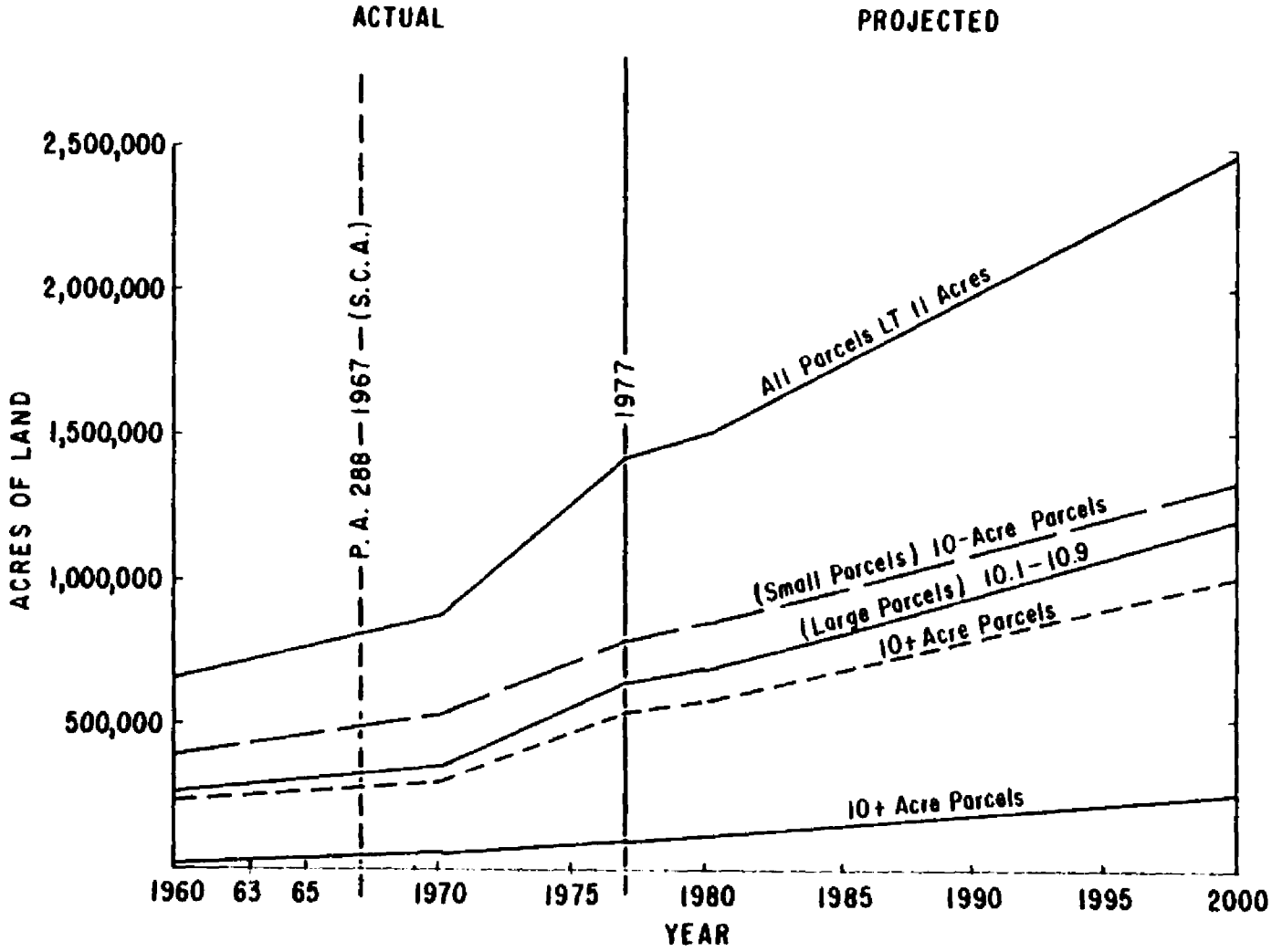

FIGURE 5-1

TRENDS IN NONAPPROVED PARCELS, 1963, 1970, 1977
AND PROJECTED TO 2000 BY SAMPLE

parcellation data were collected. The effect of the Subdivision Control Act lagged but after 1970 the Act began to effectively change parcellation trends in the state; particularly, the 10 and 10.9 acre parcels were more affected than the others.

Figure 5-1, showing trends in all categories of parcellation is based on the quasi-experimental design model discussed in Chapter Four. The Subdivision Control Act, introduced in 1967 and effective in 1968, is observed to have affected all categories of parcellations between 1970 and 1977. This is reflected in the abrupt change in the slope of the trend graphs. A simple linear extrapolation projection is adopted to project trends to the year 2000.

The test of hypothesis of no trend support the graphical depiction of trends in Figure 5-1. The Subdivision Control Act had induced effect on demand and supply of parcels. It could,however, be argued that in general parcellation was increasing during the period of study but the increase accelerated as a result of the policy variable introduced in 1967, thus explaining variations in parcellation over the period of study.

Table 5-4 reports the numerical and percentage changes in the amount of parcellation, which occurred during the 14 year period and among parcellation categories. Total all categories increased by 45,616 acres or 30 percent between

1963 and 1970. Between 1970 and 1977, about 147,291 acres of new parcels or 74.5 percent of the total amount of parcels in 1970 were added.

TABLE 5-4

Increases in Parcellation Acreages by Size Unit for 30 Counties in Michigan

Size Unit	1963-70		1970-77		1963-77	
	Numerical Acres	Percent	Numerical Acres	Percent	Numerical Acres	Percent
ASPAS (10-)	28,385	31.5	70,521	59.5	98,906	109.6
AMPAS (10)	11,340	21.4	66,720	100.4	80,060	150.7
ALPAS (10+)	3,891	45.2	10,650	85.2	14,541	168.9
LAGPAS (10-11)	17,231	27.9	76,770	97.2	94,001	152.3
AASPAS (11-)	45,616	30.0	147,291	74.5	192,907	127.0

New parcellation acreages more than doubled during this second period. Such a significant increase in the amount of new non-platted parcels synchronized with the period of the Subdivision Control Act of 1967. Thus, the rate of increment in parcellation rose significantly higher after the Act, (Figure 5-1). Trend analysis indicated that the SCA of 1967 explains about 62 percent or 18,000 acres of total 11- parcels and about 80 percent of the 10-11 acre parcels between 1970-77. The remaining 38 percent and 20 percent may be attributed to normal increasing demand

associated with several socio-economic factors such as increased income, desire for larger secluded homesites with rural environment, increasing demand for small part-time farms (sometimes as hobbies) and non-platted subdivisions, especially in the northern Lower Peninsula in anticipation of future boom in recreational and tourist activities. Between 1963-1977 a total of 192,907 new unplatted parcels less than 11 acres were created in the 30 counties. This represented an average yearly parcellation of 13,850 acres or 462 acres per county per year.

Trends in Parcellation Categories

Table 5-4 reports trends in categories. "Small" parcels increased by about 28,385 acres or 31.5 percent between 1963 and 1970. A relatively moderate increase (compared with other size units) of 59.5 percent (70,521 acres) occurred during the second 7-year period. A total of 98,906 acres of land were withdrawn into "small" parcels of under 10 acres in the 30 counties. This represented an average yearly small parcel developments of 7,065 acres or 235 acres per county per year.

Large parcels between 10 and 11 acres increase by 17,231 acres or 27.9 percent during the first interval period. Spectacular increases occurred in this size unit during the second interval period. Acreage figures rose by 76,770 acres or 97.2 percent over the 1970 totals. Thus

"large" parcels more than tripled in amounts. The 10 acre parcels component of this size unit increased by 21.4 percent in 1963-70 period and 100.4 percent during 1970-77 period, and the 10+ acre component increased by 45.2 percent during 1963-70 period and almost doubled to 85.2 percent. These remarkable gains in large parcels, are partly associated with the Subdivision Control minimum acreage provisions. Between 1963-77, a total of 94,001 acres of new unplatted large parcels (10 and 10+ acres ranges) were developed in the 30 counties. This figure represented an annual large parcellation of 6,714 acres or 244 acres per county per year, just as much as small parcels, despite the fact that the latter category contained over 80 percent of all parcellation holdings.

Based on data presented in Table 5-4, and trend analysis of Figure 5-1, as well as the results of t-tests of no difference in mean parcellation, it is concluded that no significant increase in parcellation (all size units) occurred between 1963 and 1970, but increases were highly significant for the period between 1970 and 1977 after the effective date of the Subdivision Control Act.

Of major interest to the study is the relative proportions of total parcellation acreages and relative trends in the proportions for various size units. Table 5-5 reports the proportionate shares of the total amounts of parcels for each period by parcel categories.

In 1963, parcels under 10 acres constituted about 59 percent of total acreage of all parcels under 11 acres. It increased its share very slightly (by about 0.6 percent point) in 1970 and its shares declined to 54.8 percent. Projected estimates (page 108 of this chapter) indicates that by the year 2000, "small" parcels would constitute about 50 percent of total acres of land under 11- acre parcellation; this size unit would make up about 75 percent of all holdings.

TABLE 5-5

Percentage Shares of Parcellation Categories of Total Amount of Parcels Per Period

	Share Percent of Period Total		
Size Unit	1963	1970	1977
ASPAS (10-)	59.4%	60%	54.8%
AMPAS (10)	35.0	33.6	38.6
ALPAS (10+)	5.7	6.3	6.7
LAGPAS (10-11)	40.6	40.0	45.2

Large parcels of 10 acres or more (but less than 11 acres) constituted a little over 40 percent of the total acreages in 1963 and 1970; but its share increased to a little over 45 percent in 1977. Projection indicates an increasing trend to about 50 percent by year 2000. Of the "large" parcel category, 10 acre units made up 35 percent in 1963, dropped slightly in 1970, and again increased its

share to about 38 percent. Since 10+ acre parcels also gained steadily (in share) during the study period, any gains in proportionate share observed in "large" lot parcels must have been at the expense of small parcels. This implies that between 1970 and 1977, the rate of large parcel developments exceeded the rate of small parcellation.

TABLE 5-6

Percent Share Distribution of Total Increments in Parcellation Acreages Between "Small" and "Large" Parcels

	Percent Shares		
Size Unit	1963-70	1970-77	1963-77
Small Parcels (10-)	67.9%	47.9%	51.3%
Large Parcels (10-11)	32.1%	52.1%	48.7%

Of probable significant interest is the amount of parcels each category of parcellation contributed to total increments during the period of study. Table 5-6 reports size unit shares to incremental changes in amount of parcellation. Small parcels accounted for about 68 percent of the total increment in the amount of parcels created between 1963-1970. This share dropped to 48 percent during 1970-1977 period. On the average, during the 14-year period of study from 1963 to 1977, small parcels contributed about 51.3 percent to the total of all new parcels measured in acres. Large parcels increased in share from 32 percent

in the first 7-year period to 52.1 percent during the second period, thus outstripping small parcels in its contribution to the total. On the average, about 49 percent of the total acres of new unplatted parcels created between 1963 to 1977 was made up of 10-11 acre units. This is clearly reflected in the t-value of the two parcellation categories. The t-scores for "small" parcels (ASPAS), between 1970 and 1977 was 2.43 and that of "large" parcels (LAGPAS) was 3.09, all significant at less than a 5 percent level of probability.

Summary on Time Trend Analysis of Parcellation

1. 1970-1977 was a period of significantly higher parcellation activity in Michigan. The period coincided with the Subdivision Control Act of 1967 (about 3 years-lag). Time series analysis indicate that the Act contributed to the spectacular increase in the amount of parcellation which occurred after 1970 and t-tests of near differences revealed that increases in parcellation (all categories) were not statistically significant for the interval period between 1963 and 1970, but were highly significant for the period between 1970 and 1977. The Subdivision

Control Act explained about 40 percent of the total variation which occurred in the amount of parcellation over the 14 year period. The rest was due largely to increasing demand for larger homesites, associated with increasing affluence, demand for environmental resources and quality of life and demand for second and third recreational homes.

2. After 1970, 10 and 10+ acre parcels rose in importance as taker of land. The acceleration can be associated with the impact of the minimum lot provisions in the Subdivision Control Act of 1967.
3. The proportion of large parcels (10-11) rose faster than that of small parcels and by 1977 the two broad categories of small lot parcellation, (ASPAS and LAGPAS) were accounting almost 50-50 to the total acreage under parcellation, despite the facts that LAGPAS constituted only 30 percent of all holdings.
4. Between 1970 and 1977 alone, about 150,000 acres of new parcels under 11 acres were created in the 30 counties and over half of these were 10-11 acres. There is a tendency for this category to increase in relative importance.

5. These findings confirm the hypotheses that (1) large parcels are increasing in amount and in holdings in the state and (2) that the Subdivision Control Act has contributed to the upward trend.

Estimated Acreages of Parcellation in Michigan

In Chapter Four estimation procedure was explained and weighted mean parcellation acreages were derived. Statistical tests about the means indicated that the weighted mean parcellation figures obtained fell within the significant confident intervals at $\alpha = 0.05$.

The weighted mean parcellation figures for acreage values were 8,104 acres in 1963, 9,877 in 1970 and 16,093 acres in 1977. Based on these mean values, state total acreage figures for each time period are obtained and projected to year 2000. Table 5-7 reports the resultant estimates.

TABLE 5-7

Estimated Total Nonapproved Parcels in Michigan by Period of Study (1963, 1970, 1977)

	Estimates of Acreage and Holdings		
	1963	1970	1977
Number of Holdings	125,330	153,882	253,316
Acreages of Parcels	672,632	819,791	1,170,348

Figures in Table 5-7 indicate that corresponding estimates of holdings and acreages in 1963 for the whole state were 125,330 and 672,632, respectively. About 28,552 holdings or 147,159 acres of land under 11 acres were developed between 1963 and 1970. Between 1970 and 1977, an additional 99,434 holdings or 515,928 acres were affected by 11- acre parcellation. About 50 percent of the total new nonplatted parcels was made up of large parcels in the size range of 10-11 acre units in 1977.

Table 5-8 reports the straight line projection estimates for acreages from 1980 to 2000, based on the estimated figures for 1963, 1970 and 1977.

TABLE 5-8

Quinquannial Projection Estimates of Amount of Parcellation Under 11 Acres in Michigan (1980-2000)

Year	Amount of 11- Acre Parcels	
	Holdings	In Acres
1980	268,928	1,335,719
1985	314,637	1,407,864
1990	360,346	1,643,981
1995	406,056	1,880,798
2000	451,765	2,117,615

A straight line projection will result in total holdings and acreages of 451,765 and 2,117,615 in another 20 years,

an addition of around 200,000 holdings and about 800,000 acres. It must be emphasized that the parcellation categories analyzed here, constitute only a part of the total parcellation which is occurring in the state. Parcels of 11 acres and more and approved subdivisions which require platting by law of the state are excluded in these estimates. Projected estimates for each size unit is provided in Appendix 5-F for 1980 to 2000. The average rate of increment during the 20 years would be about 2.6 percent per annum. A total of about 781,896 acres of land would be added to the 1977 figures during the 23 years of projection. This implies that about 34,000 acres of land would be affected annually. Of the annual increment in parcellation amount, about 16,000 acres or almost 48-50 percent would be accounted for by parcels in the range of 10-11 acres.

Spatial Distribution of Land Parcellation in Michigan

Concerned citizens are not only interested in knowing the amount of parcellation that is occurring in the state, or about the level and trends over time but also in where parcellation is taking place and why. It is important also to know how much land is being swallowed up by large lot parcellation and where the specific category of parcellation is occurring. In this section, an attempt is

made to show where parcellation is occurring in the state, generally, and where large-lot parcellation specifically is most severe. Also trends in the pattern of distribution are examined.

To make acreage values comparable among counties and regions, counties are grouped into three categories according to their weighted parcellation density scores.[1] Counties in each density classification are arranged by density ranking, and their corresponding acreage figures for the two parcellation categories being analyzed are also provided. Acreage figures cover 1977 counts. The acreage data of 1963 and 1970 are used mainly for spatial trend analysis. The main objective of this section is to determine current distribution of parcellation, over the state and trends in such distribution over time (trend in spatial distribution).

Table 5-9 provides a summary of the 11- acre weighted parcellation density scores for 1963, 1970, 1977 and for projected values of 2000 AD. Corresponding acreage figures for 1977 are also provided county by county. Nineteen sixty-three is considered the base year and the Weighted Density scores are calculated over 1963's density coefficient. In this way, the scores are standardized like any index number and can be compared over counties and over time. Thus, 1963

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[1] In Chapter Four, the derivation of the W.P.D. scores was explained and discussed and tables of the scores are provided in Appendix 5-G for each time period; 1963 is the base year.

TABLE 5-9

Weighted Parcellation Density Index for
1963, 1970, 1977 and Projected Estimate for Year 2000

County		Acreage of 11-Parcels 1977	Year			
			1963	1970	1977	2000
1	Allegan	16,314	1.47	1.91	3.20	4.98
2	Alpena	6,194	.30	.44	1.03	2.10
3	Antrim	8,913	.13	.26	1.05	2.35
4	Bay	11,568	5.47	6.50	11.48	19.57
5	Barrien	24,499	14.24	16.73	20.62	27.41
6	Calhoun	13,659	4.36	5.88	6.34	9.30
7	Cheboygan	9,005	.14	.28	.60	1.24
8	Claire	8,214	.10	.46	1.00	.70
9	Clinton	12,770	.80	2.06	3.21	7.57
10	Crawford	11,593	.15	.19	.58	1.01
11	Delta	8,543	.20	.25	.22	.67
12	Gogebic	3,813	.07	.07	.10	.17
13	Grand Traverse	7,418	.38	.88	3.13	7.05
14	Hillsdale	6,610	.47	.70	1.27	2.39
15	Houghton	4,935	.07	.13	.30	.64
16	Huron	4,754	.10	.15	.42	.91
17	Iosco	5,422	.21	.43	.86	1.63
18	Iron	3,482	.05	.07	.06	.07
19	Lapeer	27,501	.45	.96	7.33	17.24
20	Livingston	31,785	1.98	3.73	16.09	35.88
21	Mackinac	3,021	.02	.03	.05	.09
22	Macomb	17,792	32.57	59.39	88.75	148.07
23	Manistee	10,295	.42	.70	1.29	2.53
24	Menominee	4,969	.06	.13	.20	.48
25	Monroe	17,658	5.60	8.33	12.59	19.75
26	Montcalm	11,029	.45	.70	1.72	3.43
27	Newaygo	20,610	.54	.79	1.65	2.98
28	Ottawa	22,995	5.57	8.65	11.86	34.14
29	St. Joseph	7,598	1.18	1.55	2.76	4.60
30	Schoolcraft	1,900	.02	.02	.02	.03
Sample Average		11,495	1.00*	1.46*	2.89*	5.32*

*The W.P.D. scores for the whole sample for each time period were derived by using mean parcellation amounts and the formula in Chapter Four.

density score is 1.00 or 100 percent. All other indexes are compared with the base year score.

County scores for 1963 ranged from as low as 0.02 (Schoolcraft) to as high as 32.5 (Macomb). Most of the low density scores are reported for Upper Peninsula counties. In 1970, density scores ranged from 0.02 (Schoolcraft) to a maximum of 59.4 (Macomb). Compared with 1963 base year, all counties showed increases in parcellation density.

Using the 1977 scores, counties are grouped into high, moderate and low degree of parcellation. Table 5-10 summarizes the density classification of counties.

The first group of counties are generally found in the southern half of the Lower Peninsula. They have very high to high Weighted Parcellation Densities and they are designated in this report as High Weighted Parcellation Density (HWPD) group. Their WPD scores are above 10.0.

Group 2 counties include almost all counties from the southern LP except those in group 1. Both group 1 and group 2 contain all the sample counties south of the Oceana-Bay line of counties. They are characterized by moderate parcellation density scores. WPD ranges between 1.0 to 10.0. They are designated as MWPD (Table 5-10).

TABLE 5-10

Description of Each of the Groups of Counties Categorized by WPD

County Group Number		Description
Group-1	Very High to high Density WPD > 10.0 (HWPD)	Counties that have estimated parcellation density of 10.0 and over. Some have very high density over 50.0
Group-2	Moderate Density 1.0 < WPD < 10.0 (MWPD)	Counties with estimated WPD ranging between 1.0 to 10.0 (excl.) The threshold figure is WPD = 1.0 for 1963
Group-3	Very low to low Density; WPD < 1.0	Counties with estimated WPD less than or equal to 1.0. This group includes counties with WPD as low as 0.02. Parcellation pressure on land in such counties is insignificant.

The third group of counties constitute the majority of the 30 counties studied; they are described as very low to low WPD areas and are designated as LWPD. All the UP counties and most of the NLP counties are included.

Parcellation density scores were calculated from 1977 county acreage figures. Areas of high amounts of parcellation need not necessarily coincide with areas of high parcellation density and vice versa, because of the population and land area factors in the estimation of the density scores.

TABLE 5-11

Acres of Land Under Parcels Less Than 11 Acres and Large Parcels (10-109) with Corresponding Parcellation Density for Each Group of Counties Based on 1977 Data

County Group	N=30	Total Group Density	Amount of Parcellation	
		WPD Score	11- Acre Parcels	10-10.9 Acre Parcels
1-High Density	6	168.4	126,297	50,316
2-Moderate Density	10	31.70	133,805	61,926
3-Low Density	14	6.21	84,757	43,474
Total	30	206.31	344,859	155,716

Table 5-11 reports the total acres of land in the two size categories for each group of counties with their corresponding aggregate parcellation densities.

Figures in the Table 5-11 reveal interesting facts about the nature of the distribution of land parcellation among the study counties and in the state generally. Six out of the 30 counties fell within the group category of

high parcellation density, 10 in the category of moderate parcellation density and the remaining 14 were designated as low parcellation density. The skewed distribution of density scores over counties closely reflect the population distribution of the state.

The implications of the above figures are revealing. Despite the extremely skewed distribution of density scores, the amount of parcellation is fairly spread among the three groups. The first group contained about 36.6 percent of the 11- acre parcels and 32 percent of the large-lot parcels. The second group contained larger proportions of the two categories of parcellation (39 percent and 40 percent respectively). Even the low density group together contained about 25 percent and 28 percent of the total acreages of the two categories. This implies that the high density areas are not necessarily those with large tracts of land in parcellation as defined by this study. A corollary implication is that areas with high parcellation density scores are characterized by high level parcellation and intensive land use so that only a few large parcels can be added each year; they are gradually approaching saturation point. Conversely, areas with low parcellation density tend to have fewer population and/or large land areas so that larger parcels could be created.

Six counties are classified as High Density areas, most of these counties are found in the southern Lower Peninsula where urbanization is advanced and land use is highly intensive. For most urban counties, there would be few raw lands left for large lot parcellation; competition among various uses would limit extensive withdrawal. The NLP and UP still remain relatively moderate to low pressure regions. This is apparent from tables which report the parcellation density values by county and by group.

TABLE 5-12

Density and Acreage
by Group and County, 1977

Group-1 HWPD

Counties in Group-1 HWPD	1980 Density: Population Persons Per Square Mile	1980 Density: 11- Acre Parcels WPD	1977 Parcellation Acreage: 11- Acre Parcels	1977 Parcellation Acreage: 10-10.9 Acre Parcels
1 Macomb	1447.3	88.8	17,792	5,697
2 Berrien	295.1	20.6	24,499	10,858
3 Ottawa	277.8	18.8	22,995	7,775
4 Livingston	175.0	16.1	31,785	17,667
5 Bay	268.0	11.5	11,568	2,484
6 Monroe	240.0	12.7	17,658	5,835
Total	------	----	126,297 (136.6%)	50,316 (29.8%)

Table 5-12 reveals that, even though, Macomb recorded the highest WPD among all the counties studied, it did not account for the greatest proportion of acreage totals for

both categories. Livingston, which ranked fourth in density contained the largest amount of large-lot parcels as well as of total acreage of all categories studied in 1977.

Parcellation densities in counties such as Monroe, Bay, Ottawa and Livingston are relatively lower than that of Macomb and possibly other continguous counties such as Wayne and Oakland, despite the fact that all these counties may be classified as High Parcellation Density. This suggests that relative land use pressure in the former group-1 counties must be lower than that of the latter; a continued parcellation activities in the former counties and a slowing down to negligible large-lot parcellation activities in the latter group-1 counties should be expected. Large-lot parcellation in counties such as Wayne, Genesee, Washtenaw, Oakland and Ingham, which may be included in group-1 density classification, may not be practicable in the future if it is not so now. These counties as the main hub of intense land use with Livingston and Lapeer forming the center of current large-lot parcellation activities. However, most of the very high to high density counties are moderate to low large-lot parcellation areas. These findings confirm the hypothesis that:

> Large-lot parcellation is more likely to occur in areas of relatively low socio-economic activities-rural and fringe counties. Conversely, counties

> with intense land use and socio-economic activities are likely to experience least large-lot parcellation.[1]

A simple correlation analysis of the various parcellation categories and selected independent variables fails to reject this hypothesis.[2]

All the six counties classified as High Parcellation Density are found in the Southern Lower Peninsula (SLP); four of them in the eastern section and the remaining two in the western section. In general, the south eastern section of the state is under greater parcellation pressure than the west, and the whole South together is much more pressured by parcellation activities than the North.

Table 5-13 reports figures for group-2 counties. There were 10 counties in this group described as moderate parcellation density. Most of the counties in the group are again found in the Southern Lower Peninsula.

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[1] A later section of this Chapter attempts at providing statistical test results of the relationships between parcellation categories and selected independent variables.

[2] See page 139 for correlation analysis.

TABLE 5-13

Parcellation Density and Acreages

Group-2 MWPD

Counties in Group-1 HWPD	1980 Density: Population Persons Per Square Mile	1980 Density: 11- Acre Parcels WPD	1977 Parcellation Acreage: 11- Acre Parcels	1977 Parcellation Acreage: 10-10.9 Acre Parcels
7 Lapeer	106.0	7.3	27,501	12,763
8 Calhoun	198.1	6.4	13,659	4,354
9 Clinton	94.1	3.2	12,770	4,354
10 Allegan	98.1	3.2	16,314	7,794
11 Grand Traverse	118.1	3.1	7,498	3,577
12 St. Joseph	111.1	2.7	7,598	3,230
13 Montcalm	7.1	1.7	11,029	4,506
14 Newaygo	41.2	1.6	20,610	13,039
15 Hillsdale	70.1	1.3	6,610	3,000
16 Manistee	42.0	1.3	10,295	5,337
Total	-----	---	133,805 (38.8%)	65,926 (42.3%)

Among the 10 counties in this group, Lapeer recorded the highest Parcellation Density score (7.3) and the largest amount of 11- acre parcellation. It was second in large-lot parcellation. Newaygo, Hillsdale and Manistee recorded the least Parcellation Densities in the group (1.6-1.3). Newaygo, however, recorded the highest amount of large-lot parcellation (13,039) and ranked second after Lapeer in 11-acre parcellation. This negative relation between parcellation density and amounts is due to the fact that population density in these counties is low compared to a county such as Calhoun, which ranked second on the density scale with a total parcellation amount of 13,659 acres. It should

further be recognized that counties such as Newaygo and Hillsdale are outliers with several lakes that are an attraction for second home developments. Demand for parcels in these outlying counties is predominantly recreationally motivated rather than employment related. The 10 counties contained about 39 percent and 40 percent of the amounts of parcellation in the two parcellation categories reported. The following conclusion can, therefore, be drawn.

The extent of parcellation, both large-lot and 11-acre parcels, is relatively higher in the Moderate Parcellation Density areas, especially for those counties in the Southern Lower Peninsula than either the High Parcellation Density areas or other Moderate Parcellation Density areas. Most of the counties in the group are described as 'fringe' in most population studies of the state. The moderate density region includes southern counties such as St. Joseph, Branch and Hillsdale and other counties of the Southern Lower Peninsula between the east and west High Parcellation Density areas. The moderate region then branches east and westwards to include counties such as Arenac, Tuscola and Sanilac to the east and (Newaygo, Oceana, Mason)[1] and Grand Traverse with all other adjacent counties. Most of the group-2 counties are, therefore, found west of the

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[1]These counties are not necessarily contiguous. They belong to Muskegon--Norton Shores--Oceana S.M.S.A. Area.

Michigan Meridian, south of the Oceana-Bay county line. With the exception of some counties of the Thumb, most counties of the Southern Lower Peninsula may be described as high to moderate parcellation density and high to moderate amount and total parcellation area. It may, therefore, be concluded that large-lot parcellation is still taking place in the south, specifically, at a moderate rate in counties of Moderate Parcellation Density and at relatively low rate in the High Parcellation Density counties. Projected estimates of the parcellation density acres indicate that the western portion of the state, from the southern boundaries to the northern tip of the Lower Peninsula would be most affected by large lot parcellation. In general, the whole Lower Peninsula would be affected by very high to high large-lot parcellation if the process continues at current rate.

Fourteen counties fell within the group-3 Low Parcellation Density category. Table 5-14 reports figures for these counties. Five counties in the group were scored almost zero parcellation density. This may imply that, either population densities are low, or amounts of parcellation small or both.

TABLE 5-14

Parcellation Density and Acreages

Group-3 LWPD

Counties in Group-2 LWPD	1980 Density		1977 Parcellation Acreage	
	Population Persons Per Square Mile	11- Acre Parcels WPD	11- Acre Parcels	10-10.9 Acre Parcels
17 Alpena	57.0	1.0	6,194	2,394
18 Antrim	34.0	1.0	8,913	5,942
19 Cheboygan	29.0	0.6	9,005	5,459
20 Clare	42.0	1.0	8,214	6,169
21 Iosco	52.1	0.9	5,422	3,124
22 Crawford	17.2	0.6	11,593	2,468
23 Delta	33.0	0.2	8,543	2,468
24 Houghton	37.0	0.3	4,935	2,554
25 Huron	44.0	0.4	4,754	1,343
26 Gogebic	18.8	0.1	3,813	1,323
27 Iron	12.5	0.1	3,482	1,362
28 Mackinac	10.7	0.1	3,021	1,480
29 Menominee	24.6	0.2	4,969	1,571
30 Schoolcraft	7.0	0.0	1,900	805
Total	----	---	84,757 (24.6%)	43,474 (27.9%)

An examination of both the parcellation density and acreage figures reveal that all the five counties that scored near zero parcellation density are characterized by both low population densities and small amounts of parcellation. In 1980, the mean population density of Michigan was 162. The maximum density among the bottom group-3 counties was 24.6 reported by Menominee. Also, the mean amount of parcellation (11-) for 1977 was 11,495 and the maximum amount obtained in the group is 4,969, again by Menominee. All five counties are in the Upper Peninsula.

Alpena topped the list of the group by density ranking though Crawford contained larger amount of parcellaction. The group contained about 28 percent of total large-lot parcel in the sample, and 25 percent of all parcels. In general, the whole Upper Peninsula Region is characterized by low parcellation-low density. The most important controlling factors are ecological and remoteness. All the 7 counties from districts 5 and 6 in the extreme north of the Northern Lower Peninsula are also found in the third density group. This implies that the extreme north of the Lower Peninsula and the Upper Peninsula are still relatively least pressured by parcellation. If other conditions are favorable, more increasing large-lot parcellation in these areas should be expected than any other part of the state in the future. It should be noted that, counties such as Crawford, Clare, Cheboygan and Antrim have quite a bit of 11- acre parcels and Antrim, Cheboygan and Clare have already experienced some degree of large-lot parcellation; this may indicate that other conditions in that locality favor future large-lot parcellation. This will become apparent in later sections when spatial variation in parcellation is analyzed using multiple regression.

Summary on Generalized Parcellation Distribution in Michigan

Distribution of amount of parcellation extent in the state in 1977 suggests a division of the state into three

regions, the southern half, below Oceana-Bay county line, the northern half of the Lower Peninsula above the line and the UP. Generally, parcellation is far advanced in the south, decreasing northwards in amount and spatial coverage. The UP is, as yet, unaffected significantly by any type of parcellation. The parcellation density analysis confirms the following findings:

1. Small parcel fragmentation (partitioning of tracts of land into parcels less than 11 acres) exist in Michigan and is on the increase.
2. Parcels in the size category 10 to 11- acres are increasing in number and in amount faster than those in the range less than 10 acres.
3. The proportions of 10- acre parcels have been declining over the years, while that of 10 to 11- have been increasing; projections reveal that the two categories are converging to a 50-50 ratio.
4. Despite the scant time series data, it is apparent that relationship exists between the SCA and large-lot parcellations as well as all category parcellation; the SCA has obviously contributed to the accelerated creation of larger parcels and observation and information from other sources indicate that the creation of some of these large-lot parcels were speculative. In some NLP counties,

such parcels are becoming more and more tax delinquent. (Responses from County Extension Directors.)

5. Even though the proportion of 10- parcels in on the decline (acreage measure), total amount of 11- acre parcels is still increasing and pulling all categories along. It is expected that some 2.5 million acres would be in this kind of parcellation in 2000, this would constitute about 7 percent of the state land. Current estimates of farm land conversion indicate that over 50 percent of this amount of parcellation would be carried on farm lands. This implies that in year 2000, this particular parcellation would have contributed a cumulative total acreage of 1.2 million acres to agricultural land withdrawal; the remaining 1.3 million would have come from other land uses.
6. Parcellation is most advanced in the southeastern Lower Peninsula than any other region, followed by the western LP. The NLP is only moderately affected and the process is still insignificant in the UP except isolated areas.
7. Parcellation density is very high in the ESLP than any other area in the state. Its

distribution follows closely the population distribution of the state. Parcellation density declines northwards.

8. "Large" lot parcellation is more extensive in areas of low parcellation densities, especially the western half of the LP.
9. The UP is unique in the following sense:
   a. parcellation density is very low but
   b. parcellation amount and level are also low and
   c. the rate of parcellation is also low
   d. there is little indication to suggest that the region would significantly be affected by any kind of parcellation on an extensive scale. Parcellation activities that would occur in the region would be localized.
10. Large-lot parcellation activities would not be practicable any more in the ESLP. Most of the parcellation that would occur in that area would involve re-partitioning of lot sizes in the range of 10-20 acres or more into still smaller lots.
11. The western SLP still has room for large lot parcellation however, total amount of parcellation would increase only slowly and a great proportion of the new parcellation activities would involve re-subdivisions of relatively larger lots.

12. The NLP would be the region to watch closely. Overall parcellation would increase at relatively fast rates and more and more large lots could be created if other conditions become favorable.

Statistical Analysis of Variations in Parcellation

Several factors were selected a priori and discussed in Chapters Three and Four as contributing to the spatial variations in parcellation. In Chapter Four, an attempt was made to provide a general statistical formulation showing the relationships between the dependent variable (parcellation) and the independent variables.

Both correlation and multiple regression analyses confirm that parcellation of land is closely related to socio-economic and bio-physical factors as well as institutional or policy parameters. Simple correlation matrix was used to identify highly intercorrelated variables prior to the multiple regression analysis. It also provided a measure of the degree of association between several pairs of key variables.

Three sets of correlation matrices were obtained; one set showed relationships between pairs of dependent variables (not reported), a second set showed correlation between dependent and independent variables (Table 5-15) and the third set reported relationships between pairs of

TABLE 5-15

Correlation Coefficient Matrix of the Dependent Variables and Independent Variables for the years 1963, 1970, and 1977; df = 28. Middle and Last values are the coefficients for 1970 and 1977 respectively.

	Dependent Variables				
Independent Variable	AAPAS (11-)	ASPAS (10-)	LAGPAS (10-10.9)	AMPAS (10)	ALPAS (10+)
PAV	.591*	.643*	.466*	.414*	.587*
	.778*	.827*	.638*	.587*	.699*
	.383*	.521*	.195	.138	.390*
TOTPOP	.591*	.641*	.468*	.419*	.584*
	.526*	.571*	.416*	.363*	.514*
	.393*	.535*	.199	.140	.405*
NOHU	.636*	.679*	.519*	.467*	.635*
	.543*	.589*	.429*	.374*	.533*
	.345	.491*	.156	.096	.373*
PHPI	.643*	.675*	.542*	.499*	.625*
	.658*	.694*	.548*	.484*	.658*
	.506*	.694*	.232	.178	.402*
LACO	-.286	-.287	-.260	-.253	-.255
	-.353	-.345	-.331	-.329	-.291
	-.423*	-.406*	-.378*	-.381*	-.240
PURB	-.254	.327	.128	.007	.219
	.158	.260	.002	-.035	.109
	-.051	.193	-.294	-.350	.053
SPNM	-.481*	.489*	.415*	.377*	.495*
	.330	.296	.346	.353*	.275
	.337*	.095	.621*	.662*	.230
PUBREC	-.415*	-.408*	-.389*	-.365*	-.426*
	-.493*	-.510*	-.424*	-.376*	-.502*
	-.518*	-.616*	-.330	-.279	-.453*
AQUA	.544*	.551*	.487*	.455*	.539*
	.537*	.560*	.454*	.407*	.530*
	.448*	.539*	.281	.228	.431*

* $\leq .05$

$r^* = .36$

independent variables (Table 5-16). Critical 'r' values were set at .36 and .70.

Even though all categories of parcellation were highly correlated (critial 'r' for pairs was greater than .90 in most cases), all categories were used in regression equations. Further, all categories were significantly related to most of the independent variables for the three study periods. Weakest relationships were noted for only 1963.

Correlation Analysis

Almost all the size units of the dependent variables were significantly correlated with most of the socio-economic factors such as TOTPOP, NOHU, PHPI and PAV, especially for 1970 and 1977 (Table 5-13), and at 5 percent level of significance. (Significant 'r' between dependent and independent variable is .36, while 'r' for inter-correlation between independent variables is .70.[1]) Table 5-15 includes correlation coefficients, for the three study periods and all parcellation categories with the 9 selected independent variables.

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[1]To determind the critical 'r', the following formula was used:

$$t.05,df = r/\sqrt{(1-r^2)/(n-2)}\ .$$

For a full discussion of the above formula, see R.G.D. Steel and J.H. Torrie, Principles and Procedures of Statistics: A Biometric Approach; 2nd ed. McGraw-Hill Book Co. 1980.

On broad regional basis, however, considerable variations exist among the South and North with regard to significant correlations, (Table 5-23, page 164). Whereas socio-economic factors such as percent net migration (SPNM), PHPI and PAV continued to show strong association with some of the parcellation categories in the South, in the North, physical factors such as LACO and PUBREC increased in importance in addition to the socio-economic factors.

In general, however, all the factors selected were significantly related to the study variables for each study period most of the time. The strength of relationship either increased or weakened with time and sometimes, the sign changed with time. For example, the correlation between NOHU (Number of Housing Units) and AAPAS (Parcels Less than 11 Acres) declined from r = .636 in 1963 to r = .345 in 1977, whereas, the correlation between PHPI (Per Head Personal Income) and ASPAS (Parcels Less than 10 Acres) hardly showed any change (r = .675 in 1963 to r = .649 in 1977). Thus while some factors gained in importance in their relationships with the dependent variables others lost their importance over time. Such variability in relationship is also observed with respect to spatial distribution of the parcellation phenomenon.

These relationships have no connotations for causality. Increasing or decreasing relationship does

not correspond to increasing or decreasing contribution to total variations in the dependent variable. The correlation coefficients reflect trends in association over time.

Of interest are the signs of association. Almost all factors selected were positively correlated to all the categories of parcellation. The only explanatory variables that had negative correlation coefficients consistently over time, and with all parcellation categories were LACO and PUBREC. This was expected. Counties with Large Land Area (especially in the UP) are generally associated with few parcellation amounts; also, most of the counties with public recreational lands are associated with few amounts of parcellation of all categories. Land Area, however, had insignificant relationship with most of the parcellation categories and for most of the time PURB is not significantly correlated with any of the parcellation categories. In general, PURB had been positively correlated with all categories of parcellation (however insignificant) during the early periods.

Highly urbanized counties had been associated with high amounts of parcellation. However, during the later periods of study, the sign changed to negative for some parcellation categories (albeit insignificant amount). For example, the correlation between PURB and AAPAS, LAGPAS and

AMPAS, changed from positive to negative implying that, with time, counties with highly urbanized population became associated with fewer parcellation amounts. This phenomenon has been described in Chapter Four as the ceiling effect. As county population becomes more and more urbanized, there is considerable amount of parcellation initially, but with intensive land use parcels become small and the process of parcellation declines, since only a few new parcels can be created without excessive costs. Counties as Oakland, Wayne, Genesee and Kent exhibit such ceiling effects.

Parcellation in highly developed areas may have peaked and reached a limit where only re-subdividing of existing parcels may be feasible. It is therefore expected that some amount of smaller-lot parcellation activities are still going on in the very High Parcellation Density areas as the correlation coefficients suggest.

Table 5-16 reports the correlation coefficients for pairs of all the selected independent variables. Coefficients of correlation between PHPI and PAV, TOTPOP, and NOHU exceeded .70, the chosen critical 'r' value of intercorrelation. It was generally noted that the relationship between pairs of socio-economic factors tended to be stronger than among pairs of physical factors, or between pairs of

TABLE 5-16

Correlation Coefficient Matrix for the Eight Independent Variables for the Years 1963, 1970 and 1977; df = 29. Middle and Last Values are the Coefficients for 1970 and 1977 Respectively. Starred Items are Significant at 5% Confidence Level or Less

	2 TOTPOP	3 NOHU	4 PHPI	5 LACO	6 PURB	7 SPNM	8 PUBREC	9 AQUA
1. PAV	.968*	.990*	.601	-.285	.578	.739*	-.401	.408
	.433	.456	.766*	-.458	.288	.118	-.622	.623
	.995*	.993*	.712*	-.347	.579	-.150	-.367	.426
2. TOTPOP		.973*	.563	-.251	.577	.715*	-.292	.415
		1.000*	.704*	-.305	.585	.274	-.366	.401
		.998*	.714*	-.320	.683	-.159	-.375	.397
3. NOHU			.647	-.305	.576	.732*	-.431	.449
			.716*	-.306	.592	.261	-.376	.409
			.714*	-.299	.603	-.159	-.348	.383
4. PHPI				-.494	.415	.686	-.608	.551
				-.584	.422	.291	-.619	.606
				-.532	.504	-.149	-.659	.536
5. LACO					.130	-.560	.560	-.566
					.091	-.647	.560	-.566
					.107	-.297	.560	-.566
6. PURB						.161	-.023	.098
						-.248	.025	.260
						-.515	-.048	.103
7. SPNM							-.345	.551
							-.264	.208
							.050	-.189
8. PUBREC								-.475
								-.475
								-.474

*≤ 0.05

r* = .70

physical and socio-economic factors. All 9 variables were, nevertheless, retained in the multiple regression equations because of the possibility of spatial and time variations in their impacts, as well as the fact that no specific variable was a priori identified as the major explanatory factors. All variables were selected by hypothesis.

Table 5-17 summarizes results of the multiple regression programs for all categories of parcellation. The explanatory variables eventually retained were grouped under physical, economic and social determinants. In general, the final regression results were obtained after several computer subprogram runs involving L.S. and Stepwise regression subprograms.

Results of Multiple Regression Analysis

All Parcels Less Than Eleven Acres (AAPAS or 11- Acre Parcels)

Regression equations for all the study periods were significant. In 1963, the nine selected explanatory variables explained about 60 percent of the total variations in the amount of 11- acre parcellation in the state (Table 5-17) at $\alpha = .01$ significance. Since variables are expressed in different units so that coefficients of regression are non-comparable, beta weights or standardized

TABLE 5-17

(LS) Multiple Regression Statistics for AAPAS (11-) as Dependent Variable for the Years 1963, 1970, and 1977; df = 20

Independent Explanatory Variable		1963			1970			1977		
		Beta Weights	Partial Corr. Coeff.	R^2 Deletes	Beta Weights	Partial Corr. Coeff.	R^2 Deletes	Beta Weights	Partial Corr. Coeff.	R^2 Deletes
PHYSICAL	LACO	.134	-.140	.600	.397	.414	.732	.130	.148	.760
	PUBREC	.176	.147	.600	.057	.079	.776	-.051	.069	.761
	AQUA	.290	.310	.565	.141	.201	.768	.292	.356	.731
ECONOMIC	PAV	-.440	-.081	.605	.674	.568	.672	-1.652	-.291	.743
	PHPI	.467	.365	.547	.037	.033	.777	.055	.050	.765
SOCIAL	TOTPOP	-.190	-.053	.606	-3.257	-.212	.767	10.148	.594	.637
	SPNM	-.294	-.203	.590	.376	.440	.724	.155	.158	.759
	PURB	-.353	-.316	.563	-.242	-.307	.754	-.236	-.255	.749
	NOHU	1.359	.206	.590	3.594	.230	.765	-8.097	-.540	.669
	R^2		.6073			.7777			.7652	
	Significance Level		.01			<0.0005			<0.0005	

coefficients of regression are reported for all cases with partial correlation coefficients and R^2 deletes (i.e. the contribution of each selected explanatory variable to the total variation in the dependent variable as represented by R^2 values).

In 1970, the selected variables explained almost 80 percent of the total variation around the mean in AAPAS ($R^2 = .7777$). This was significant at $\alpha \leq 0.0005$. Similar values were obtained for 1977. Number of housing units was the most important factor in 1963 with the highest positive beta weight value of 1.359. Per head personal income was next in importance in explaining the variations in parcels less than 11 acres, with beta weight of .467. Land value and percent urban population had negative beta weights. Increase in land values and population concentrations led to a reduction in parcellation process. In other words, counties with high land values and population concentrations were characterized by fewer amounts of 11-acre parcels in 1963. Total Population played less important role in explaining variations in AAPAS in 1963 but by 1970 and 1977 it had gained in importance. Total Population had negative beta weight in 1963 but in 1977, it showed positive coefficient. This implies that while in 1963 counties with large population were associated with fewer new parcellation, population increases in 1977 led

to increases in parcellation. The main reason for this paradoxical relationship is that population growth during the second period of study (1970-1977) occurred mostly in suburban and frontier areas where land was still available for new parcellation.

The beta weights for NOHU remained positive for 1963 and 1970, but became negative in 1977, though it still remained a very important explanatory factor. Thus in 1963 and 1970, increasing number of housing units called for increasing number of parcellation. However, in 1977 increasing number of housing units did not necessarily increase the number of land parcellation. The best predictive variables in 1977 were PAV, TOTPOP and NOHU. PHPI declined in importance as a predictor variable over time. Income played no major predictive role in 1970 and 1977 parcellation. This confirms the hypothesis that most of the recreational demand for parcels is made up of both middle and lower income groups and counties with low average per capita incomes still experienced significant land parcellation.

Coefficients in the multiple regression tables can be compared column-wise among predictors as a result of the use of beta weights instead of regression coefficients. In general, physical factors such as Land Area (LACO), Public Lands (PUBREC) and Air Quality (AQUA) do not appear

to play an important predictive role. Economic and social factors seem to be the main contributing factors in explaining spatial variations in parcellation. Nevertheless, the physical factors were still retained in the specification because other types of multiple regression sub-programs (LSSTEP Analysis) where the effects of individual factors are isolated from others identified them as important predictors. Furthermore, when these factors were dropped from one of the L.S. Multiple regression runs, the Coefficient of Multiple Determination (R^2) and the significant levels reduced drastically. Thus, their inclusion is based on several multiple regression runs (not reported).

In the next sections, AAPAS is broken into subcategories ASPAS (10- acre parcels) and LAGPAS (10-10.9 acre parcels) so that the differential effects of the predictors can be discussed. LAGPAS is subsequently broken into AMPAS (10 acre parcels) and ALPAS (10+ acre parcels) for further discussion.

Analysis of ASPAS and LAGPAS

Tables 5-18 and 5-19 summarize the Multiple Regression Statistics for ASPAS and LAGPAS, category subdivisions of AAPAS. In 1963, more than 60 percent of the spatial variations in ASPAS and exactly 50 percent of the variations in

TABLE 5-18

(LS) Multiple Regression Statistics for ASPAS (10-) as Dependent Variables and LACO, PUBREC, AQUA, PHPI, TOTPOP, SPNM, PURB, and NOHU as Independent Variables for the Years 1963, 1970, and 1977; df = 20

(Independent) Explanatory Variables		1963			1970			1977		
		Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weight	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	.108	.117	.642	.396	.466	.790	.086	.115	.826
	PUBREC	.200	.176	.636	.019	.030	.835	-.042	-.059	.827
	AQUA	.308	.343	.600	.144	.237	.826	.216	.313	.809
ECONOMIC	PAV	.217	.042	.646	.725	.653	.713	-1.412	-.291	.812
	PHPI	.542	.432	.566	-.029	.031	.835	.155	.161	.823
SOCIAL	TOTPOP	-.035	-.010	.647	-3.069	-.230	.826	11.492	.699	.663
	SPNM	-.369	-.265	.620	.382	.502	.780	-.164	-.193	.821
	PURB	-.319	-.302	.611	-.107	-.164	.831	-.169	-.216	.819
	NOHU	.583	.095	.644	3.378	.250	.824	-9.682	-.667	.684
	R^2		.6468			.8354			.8278	
	Significance Level		.004			<0.0005			<0.0005	

TABLE 5-19

(LS) Multiple Regression Statistics for LAGPAS (10 & 10+) as Dependent Variables and LACO, PUBREC, AQUA, PAV, PHPI, TOTPOP, SPNM, PURB and NOHU as Independent Variables for the Years 1963, 1970 and 1977; df = 20

(Independent) Explanatory Variables		1963			1979			1977		
		Beta Weights	Partial Corr. Coefs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	.158	.143	.487	.362	.299	.572	.157	.162	.706
	PUBREC	.126	.094	.493	.106	.110	.605	-.063.	-.068	.712
	AQUA	.290	.232	.469	.123	.134	.603	.323	.358	.671
ECONOMIC	PAV	-1.345	-.214	.473	.541	.387	.541	-1.631	-.263	.692
	PHPI	.320	.231	.469	.125	.087	.607	-.065	-.053	.713
SOCIAL	TOTPOP	-.396	-.097	.492	-3.223	-.160	.600	6.965	.417	.653
	SPNM	-.160	-.099	.492	.332	.311	.568	.481	.410	.656
	PURB	-.374	-.297	.449	-.409	-.380	.544	-.271	-.264	.692
	NOHU	2.357	.307	.445	3.568	.175	.598	-4.970	-.336	.677
	R^2		.5000			.6103			.7136	
	Significance Level		.068			.101			.001	

LAGPAS were explained by the variations in the selected predictors. This implies that about 40 and 50 percent of the variations around the means in the two dependent variables were left unexplained. The remaining percentage in variations may be attributable to other factors (specified in the general model as U) such as cultural, personal, etc. which could not easily be quantified. However, over time the selected factors increased their predictive power and in 1977, over 80 percent and 70 percent of the variations in ASPAS and LAGPAS respectively were explainable in terms of the variations in the selected variables. The level of significance also improved in all cases.

Physical factors such as air quality (index of Environmental Amenities) and public lands (index of Recreational Amenities) played only minor roles in predicting variation. However, as their predictive power declined with time, relative to ASPAS (small parcels) their importance increased with time with regards to LAGPAS. For example, the beta weight of AQUA in the ASPAS equations declined from .308 in 1963 to .216 in 1977, while for LAGPAS, it increased from .240 in 1963 to .323 in 1977. Thus, even though the impacts of ecological factors on statewide land parcellation is still weak, these factors contributed positively to land parcellation and in the case of large-lot parcels, their impacts were increasing. Buyers of parcels were increasingly taking into consideration

environmental amenity factors such as air quality, water quality, forest resources, recreational facilities and the like.

Economic factors, in general, have played an important role in land parcellation. However, for both ASPAS and LAGPAS the predictive power of PHPI declined over time whereas the contribution of PAV increased correspondingly, especially in the case of LAGPAS. The variations in LAGPAS was closely associated with assessed land values. In general, the higher the assessed value of land, the fewer the large-lot parcels created. In 1970, the relationship between PAV and LAGPAS was positive (Table 5-19), but was not as important as that of 1963 and 1977. The 1970 positive beta weight suggest a reversed impact. Parcellation must have increased in areas of low assessed valuation as indicated by the sign of the beta weight in 1963. But with increasing parcellation, land values must have gradually increased so that in 1970, one finds that parcellation was increasing in areas with increasing land values. Nevertheless, in 1977, PAV contribution to R^2 was still too small to be operationally important. However, after 1970, the trend reversed again.

Social factors such as population, and number of housing units still remained the strongest predictors of variations in both ASPAS and LAGPAS, and their importance increased with time.

It, however, appears that migration and percent urban population have remained weak predictors. But the significance of these two factors to the study lies in their signs. PURB has consistently maintained negative coefficients. This confirms the hypothesis that highly urbanized areas would generally exhibit declining parcellation process since parcellation would have reached advanced stage and ceiling effect would affect future parcellation. In fact, the impact of ceiling effect is borne out by the fact that the beta weight becomes smaller and smaller with time. The contribution of the predictor declines over time.

In 1963, SPNM had negative contribution and, in fact, was a stronger contributor than TOTPOP. It ranked third in predicting ASPAS, though it was not very important for LAGPAS. Its sign changed to positive in 1970 for both ASPAS and LAGPAS and, improved over the 1963 values. This implies that while in 1963, areas that had large influx of migrants experienced less amounts of parcellation than those with few influx, the trend reversed in 1970; areas with high influx of migrants experienced large amounts of parcellation. This clearly is explainable in terms of state migration trends.

Between 1960 and 1965, migration was towards urban centers where new parcellation was very limited. Between 1965 and 1975, movement of population was towards contiguous

counties and this was associated with increasing parcellation since most of these counties had not already experienced heavy parcellation. The positive sign for 1970 changed to negative again by 1977 in the case of ASPAS as small lot parcellation in contiguous counties declined, and again, since most such counties (such as Oakland, Washtenaw and Macomb) began to reach parcellation saturation. However, for LAGPAS, the sign remained positive because such parcels were created in rural areas (e.g. NLP) which were experiencing in-migration from urban areas of the SLP.

Analysis of AMPAS (10 Acre Parcels) and ALPAS (10+ Acre Parcels)

A comparison of the beta weights in Tables 5-20 and 5-21 for AMPAS and ALPAS with those in Table 5-19, page 150, for LAGPAS reveal a very close similarities in the signs and magnitudes of the coefficients. Factors which contributed most to the variations in R^2 for LAGPAS remained the most important predictive variables for AMPAS and ALPAS. Thus, PAV, TOTPOP and NOHU remained the most important predictive variables for the three periods of study. This implies that the analysis for LAGPAS is applicable to that of AMPAS and ALPAS. They, therefore, do not require further discussion.

TABLE 5-20

(LS) Multiple Regression Statistics for AMPAS (10) as Dependent Variables and LACO, PUBREC, AQUA, PAC, PHPI, TOTPOP, SPNM, PURB, and NOHU as Independent Variables for the Years 1963, 1970, and 1977; df = 20

Explanatory Variables		1961			1970			1977		
		Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	.131	.112	.428	.279	.215	.505	.078	.079	.699
	PUBREC	.123	.087	.431	.143	.135	.520	.002	.003	.701
	AQUA	.220	.202	.411	.075	.075	.526	.251	.279	.676
ECONOMIC	PAV	-1.432	-.215	.408	.605	.392	.443	-1.501	-.238	.683
	PHPI	.288	.197	.412	.055	.035	.528	-.055	-.044	.701
SOCIAL	TOTPOP	-.401	-.093	.430	-1.747	-.079	.523	7.095	.416	.639
	SPNM	-.152	-.089	.430	.307	.266	.492	.449	.380	.151
	PURB	-.360	-.272	.390	-.410	-.344	.465	-.311	-.295	.673
	NOHU	2.403	.296	.380	2.069	.093	.524	-5.248	-.346	.661
	R^2		.4349			.5283			.7014	
	Significance Level		.152			.043			.001	

TABLE 5-21

(LS) Multiple Regression Statistics for ALPAS (10+) as Dependent Variables and LACO, PUBREC, AQUA, PAV, PHPI, TOTPOP, SPNM, PURB, and NOHU as Independent Variables for the Years 1963, 1970 and 1977; df = 20

Explanatory Variable		1963			1970			1977		
		Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	.233	.238	.601	.555	.523	.672	.462	.370	.512
	PUBREC	.121	.104	.620	-.020	-.027	.761	-.388	-.290	.540
	AQUA	.279	.306	.585	.248	.329	.733	.554	.475	.456
ECONOMIC	PAV	-.876	-.163	.614	.273	-.261	-.744	-1.687	-.226	.556
	PHPI	.393	.319	.581	.318	.270	.743	-.087	-.059	.577
SOCIAL	TOTPOP	-.327	-.093	.621	7.258	-.418	.712	4.108	.218	.558
	SPNM	.169	-.120	.613	.358	.411	.713	.470	.341	.523
	PURB	-.375	-.340	.575	.371	-.431	.707	-.001	.000	.578
	NOHU	1.905	.289	.589	7.520	.431	.707	-2.091	-.123	.572
	R^2		.6240			.7618			.5787	
	Significance Level		.007			<0.0005			.018	

Spatial Variations in Parcellation Trends

This section examines variations in parcellation rates and trends by districts and regions. Three modes of land partitioning are examined, viz: (1) 11- acre parcels, (2) 10-10.9 acre parcels (large parcels) and (3) approved subdivisions. Acreage totals are used in preference of holdings.

In general, isolated parcellation has been increasing in the state. However, the rate of increase varies from county to county, district to district and region to region. Tables in Appendix 5-H summarize acreage parcellation figures for the districts and regions and for 11- acre and 10-10.9 acre parcels. The trend figures indicate that total parcellation increased in all districts. Sharper increases occurred after 1970, after the Subdivision Control Act (P.A. 288, 1967) and the trend continued monotonically upward. Districts 3, 4, 5 and 6 experienced sharper shocks; D-7 and D-8 in the Upper Peninsula were hardly affected.

Large-lot parcellation exhibited similar trends. Table 5-22 reports the average annual rates of large-lot parcellation for the 30 counties, by districts. Again, the second 7-year period experienced the greatest rates but there is a general tendency of declining rates in the future. However, Districts 3, 4, 5 and 6 showed higher

TABLE 5-22

Trends in Average Annual Rates of Change in (10-11) Acre Parcellation, Actual and Projected by District

District	1963-1970	1970-1977	1963-1977	1980-2000
	%(r)	%(r)	%(r)	%(r)
1 S.E.S.L.P.	4.5	9.8	7.1	3.0
2 S.W.S.L.P.	1.2	4.4	2.8	2.6
3 C.E.S.L.P.	5.9	15.0	10.4	3.5
4 C.W.S.L.P.	3.2	11.0	7.0	3.1
5 E.N.L.P.	5.7	16.0	10.8	3.6
6 W.N.L.P.	7.1	11.9	9.5	3.4
7 E.U.P.	1.3	8.2	4.7	2.5
8 W.U.P.	2.3	8.6	5.6	2.6
Total	3.6	10.2	6.8	3.1

*Annual Rates (r) is calculated by the formula:

$$\log(1+r) = \frac{\log Xn - \log Xo}{n}$$

from the equation: $(1+r)^n = \frac{Xn}{Xo}$

rates than all the others. These four districts constitute a contiguous region which lies north of the Ottawa-Macomb County boundary line. This implies that large-lot parcellation should occur more rapidly in the northern two-thirds of the Lower Peninsula than in the southern one-third or in the U.P. With the exception of SWSLP district in the Lower Peninsula, the U.P. districts recorded the lowest rates of change both actual and projected. Table 5-22 reveals these variations. It appears that between 1980 and 2000, the mean annual rate of parcellation in the state would be around 3 percent.

Variations in Parcellation Among Study Regions

Figure 5-2 displays a cuboid locational graph, intented to show trends in regional parcellation totals (11- and 10-10.9). Projected amount of parcellation for 2000 AD is also shown. The map clearly demonstrates both spatial distribution of amount of parcellation and of relative parcellation trends among regions. More parcellation would still occur in Region I by the year 2000, followed by Region II and then Region III. However, in terms of rates of increase, Region III clearly would experience the highest rate, followed by Region I. The rates of increase in amount of parcellation in Region II and IV are upwardly steady but relatively low compared with the

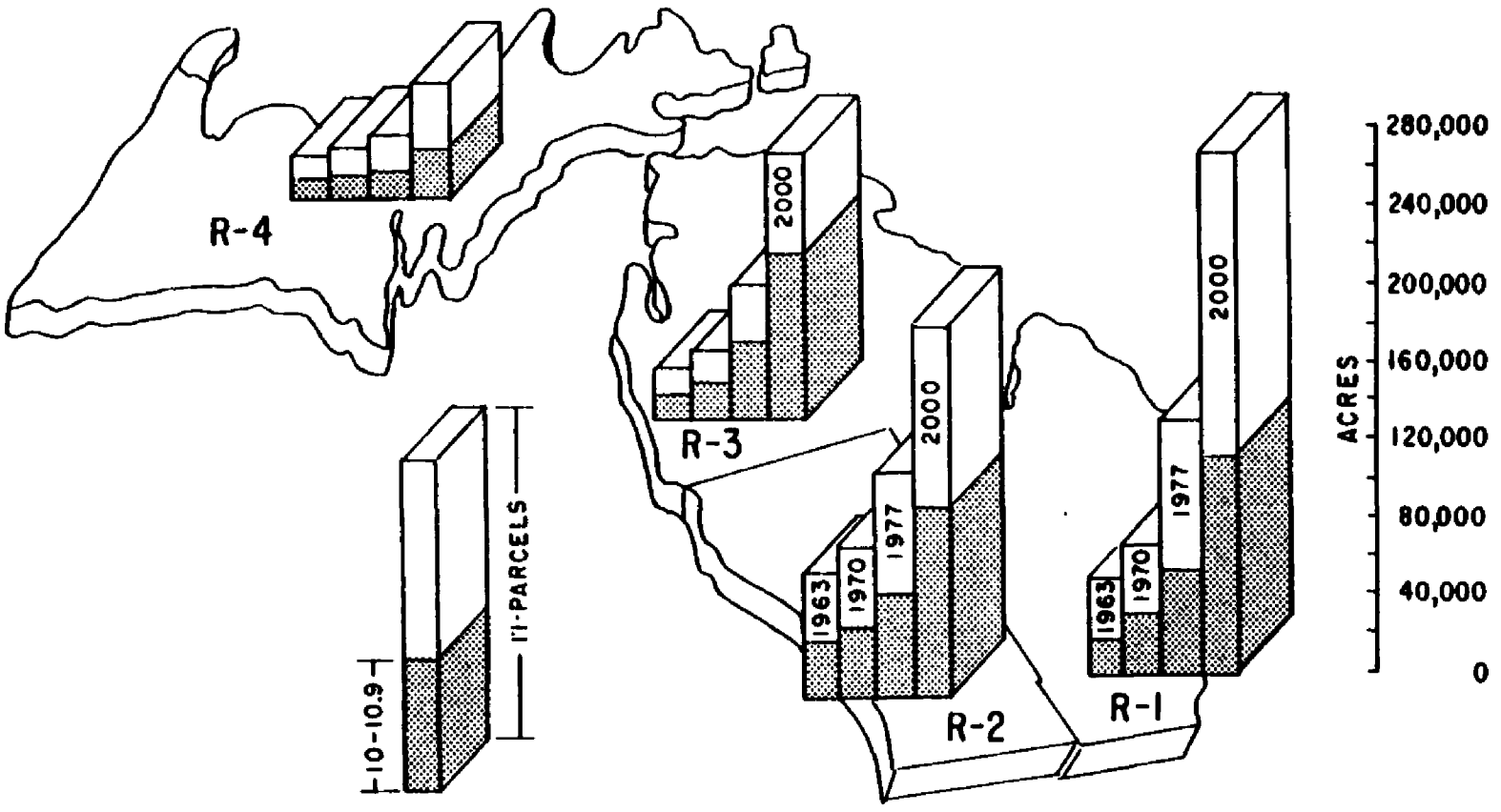


FIGURE 5-2

TRENDS IN NONAPPROVED PARCELS 1963-1977 AND PROJECTED TO 2000 BY STUDY REGION

other two. Two regions to be watched by policy makers are the E.S.L.P. and the N.L.P. The underlying causal factors are, however, different. It was hypothesized that the main causal factor in the E.S.L.P. is population concentration associated with socio-economic activities and hence demand for employment oriented homesites while in the N.L.P. the obvious factors are ecological, recreational homesite demand and land availability at relatively cheap value. Multiple Regression Analysis based on two broad regions of Southern and Northern Michigan, attempted to reveal the regional differences in the impacts of factors that contributed to parcellation in the state.

Broad Regional Analysis of Non-Platted Parcels

Previous analysis of the spatial variations in parcellation based on the whole state indicated that Michigan can be divided into two broad regions for comparative study (Figure 5-3, page 162). In general, statewide analysis of variations in the early sections tended to be too generalized and to gloss over regional differences. It was pointed out that two types of demands for parcels existed in the real estate market of small lot parcellation. Job oriented demand for homesites was particularly important in the southern half of the state where most of the socio-economic activities are occurring; recreational and amenity

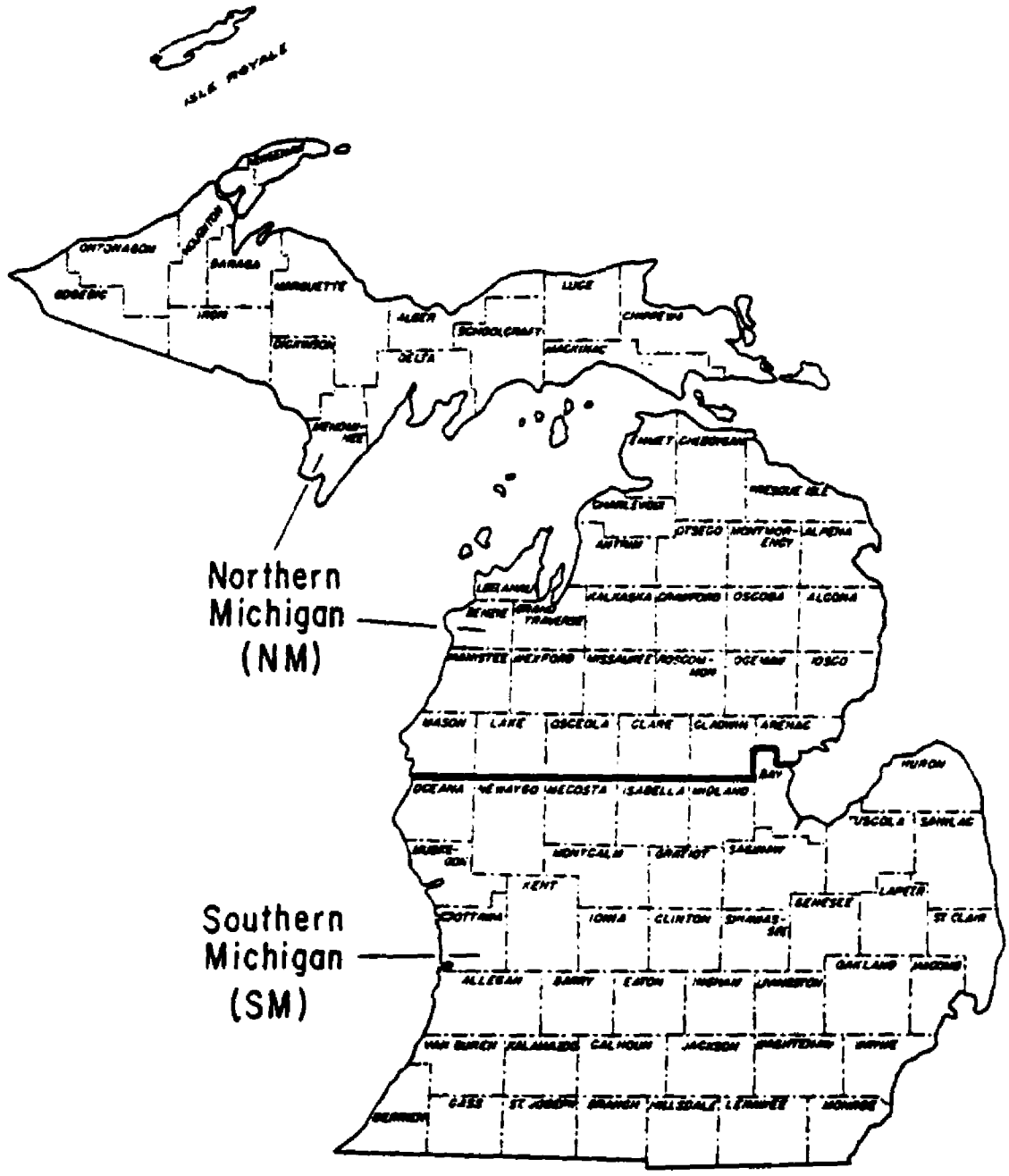


FIGURE 5-3

MAP SHOWING BROAD STUDY REGIONS
FOR STATISTICAL ANALYSIS

related demands for parcels are particularly noted in the northern half of the state where tourism is becoming an important industry.

The dichotomy in the demand for small parcels less than 11- acres associated with the predominant activities in the different regions called for the specification of multiple regression equations for each region.

Two sets of regression equations for all parcellation categories and for 1977 were developed for the two broad regions-Southern and Northern Michigan. Each equation contained all the selected independent variables. Tables 5-23 and 5-24 report the regression statistics.

Regression equations for all categories (except ASPAS, which was excluded) of parcellation for 1977 for the broad regions revealed that in the Southern counties TOTPOP (17.58), NOHU (-14.76) and PAV (-2.73) were the most important predictive factors which contributed the most to explain variations in parcellation (AAPAS) as well as to all other categories. The same factors played major roles in the Northern counties with beta weights of (-5.65, 5.53, and .91) respectively but with corresponding signs reversed. Further, in the North, physical factors contributed significantly to the variations more than they did in the South. For example, LACO (-.66) and PUBREC (.71) were quite important in the North; in the South their corresponding

TABLE 5-23

(LS) Multiple Regression Statistics for AAPAS (11-), LAGPAS (10-11), AMPAS (10) and ALPAS (10+) as Dependent Variables and LACO, PUBREC, AQUA, PAV, PHPI, TOTPOP, SPNM, PURB, and NOHU as Independent Variables for the Year 1977, for SOUTHERN MICHIGAN

Explanatory		Dependent Variable (1977) AAPAS (11-) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	LAGPAS (10-11) Beta Weight	Partial Corr. Coeffs.	R^2 Deletes	AMPAS (10) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	ALPAS (10+) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	.059	.078	.791	.091	-.129	.583	.097	.135	.812	.036	.033	.583
	PUBREC	.685	.608	.671	.693	.643	.475	.659	.615	.702	.648	.454	.475
	AQUA	.245	.315	.770	.289	.390	.471	.219	.301	.797	.543	.461	.471
ECONOMIC	PAV	-2.730	-.435	.744	-2.348	-.410	.563	-2.316	-.398	.780	-1.788	-.218	.563
	PHPI	.833	.466	.735	.659	.412	.561	.609	.398	.780	.520	.226	.561
SOCIAL	TOTPOP	17.576	.707	.586	9.805	.517	.578	10.609	.538	.740	2.841	.113	.578
	SPNM	-.317	-.225	.782	.187	.146	.565	.132	.101	.813	.402	.203	.565
	PURB	-.713	-.361	.762	-.549	-.307	.582	-.603	-.327	.793	-.116	-.044	.582
	NOHU	-14.757	-.683	.611	-7.426	-.454	.582	-8.248	-.484	.758	-1.098	-.049	.582
	R^2		.7927			.8232			.8150			.5832	
	Significance Level		.211			.154			.168			.651	

TABLE 5-24

(LS) Multiple Regression Statistics for AAPAS (11-), LAGPAS (10-11), AMPAS (10) and ALPAS (10+) as Dependent Variables and LACO, PUBREC, AQUA, PAV, TOTPOP, SPNM, PURB, and NONU as Independent Variables for the Year 1977, NORTHERN MICHIGAN

Explanatory Variable		Dependent Variable (1977) AAPAS (11-) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	LAGPAS (10-11) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	AMPAS (10) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes	ALPAS (10+) Beta Weights	Partial Corr. Coeffs.	R^2 Deletes
PHYSICAL	LACO	-.661	-.497	.758	-.729	-.788	.883	-.714	-.739	.872	-.129	-.107	.801
	PUBREC	.714	.637	.693	.455	.730	.905	.457	.685	.891	.023	.-26	.802
	AQUA	.166	.224	.808	.031	.088	.955	-.018	-.046	.942	.271	.341	.777
ECONOMIC	PAV	.907	.430	.776	.551	.506	.940	.834	.614	.907	-1.493	-.602	.691
	PHPI	-.188	-.120	.815	-.605	-.620	.928	-.569	-.545	.917	-.237	-.145	.799
SOCIAL	TOTPOP	-5.673	-.654	.680	-3.630	-.748	.899	-3.890	-.726	.878	1.158	.168	.797
	SPNM	.948	.617	.705	1.175	.892	.783	1.065	.843	.800	.670	.471	.747
	PURB	-.478	-.444	.773	-.267	-.490	.942	-.186	-.324	.935	-.459	-.416	.762
	NONU	5.527	.689	.653	3.390	.764	.894	3.303	.710	.883	.695	.114	.800
	R^2		.8175			.9557			.9422			.8029	
	Significance Level		.164			.007			.013			.191	

beta weights were LACO (.06) and PUBREC (.69) for AAPAS. Similar differences were noted for other parcellation categories.

In general, all the selected variables explained over 80 percent of the total variation around the mean in all parcellation categories in the North (Coefficients of Multiple Determination, R^2, were: AAPAS (.818), LAGPAS (.956), AMPAS (.942) and ALPAS (.803)). In the South, the variables explained over 70 percent of total variations in AAPAS (R^2=.793), LAGPAS (=.823) and AMPAS (=.815) and less than 60 percent of variations in ALPAS (R^2=.583). In both North and South, selected variables showed their weakest predictive power in relation to ALPAS (10 acre parcels).

Reversal of the beta weight signs is noteworthy. The negative beta weight for LACO in the Northern equation (but positive for the South) implies that counties with bigger land areas are still experiencing relatively few parcellations. However, the beta weight for PUBREC is positive which suggests that recreational and natural amenities do positively contribute to variations in parcellation in that region. Since correlation between LACO and PUBREC is positive (.438), it can be inferred that eventually, large counties with low intensity of land use will eventually attract more parcellation if other factors are

favorable in the statewide analysis where LACO had positive beta weights for all categories of parcellation. This assumption was borne out in the South, the two physical factors had positive beta weights (.059 and .685) but the predictive power of LACO was extremely weak. This may be attributed to the fact that the southern counties are relatively homogeneous with respect to land area more than the northern counties.

Similar explanation can be provided for the signs of TOTPOP, and NOHU. The positive beta weight of TOTPOP for the South suggests that increasing population pressure in this region calls for increasing parcellation, especially since demand for parcels here is associated with employment. On the other hand, the negative sign for the North confirms earlier analysis that the demand for parcels in that region is closely linked to second and third homes for recreational purposes so that absentee ownership is common.

A closer examination of the regional regression tables reveal further that PHPI had positive and relatively significant beta weight (.833) for the Southern equation but negative and very small beta weight for the North (-.188). Thus while incomes seemed to play a role in parcellation in the South (especially since land for parcellation is relatively scarce and land values are high), personal incomes did not significantly influence parcellation in the North

failing to reject the hypothesis that recreational demand for homesites in the North is not necessarily income generated. Both lower and upper income classes are equally involved.

Another variable of interest is percent net migration (SPNM). The beta weights of SPNM for AAPAS were -.317 (South) and .948 (North). Migration was therefore, an important contributor to parcellation in the North but was not a significant for large lot parcellation (LAGPAS). Analysis of migration in Chapter Three indicated that the North is experiencing considerable influx of migrants lately while the South is losing population. The negative sign for the South probably reflects the fact that outmigration releases pressure on land and hence permits additional parcellation. It should be observed that even in the South, positive beta weights were obtained for the large parcel categories. This is because outmigration in the region may be intra-regional so that those southern counties acting as destinations are experiencing large-lot parcellation. Parcellation in counties such as Lapeer and Livingston and Clinton are the result of population spill over from the adjacent cities (Detroit, Flint and Lansing). However, this hypothesis could not be tested by the analysis provided in this study. It should also be pointed out that the use of R^2 as a sole

measure of goodness-of-fit presents a problem in that confidence regions may still be large.

Nevertheless, regional analysis has conclusively confirmed that:

1. the demand for parcels less than 11 acres is dichotomous according to the two broad regions in the state;
2. variables operating on parcellation differ in importance regionally;
3. the signs of variables vary with region, time and with parcellation categories, and
4. amenity factors are becoming more and more important in land parcellation.

The next section examines, briefly, trends in platted and approved parcels.

Approved Subdivisions

Trends in Approved Subdivisions

Table 5-25 reveals virtually no trend except a slight downtrend over time. Subdivision developments appear to have been irregular over the years, following hardly any strict pattern. However, a critical study of the various components reveal intriguing cyclical pattern of development.

TABLE 5-25

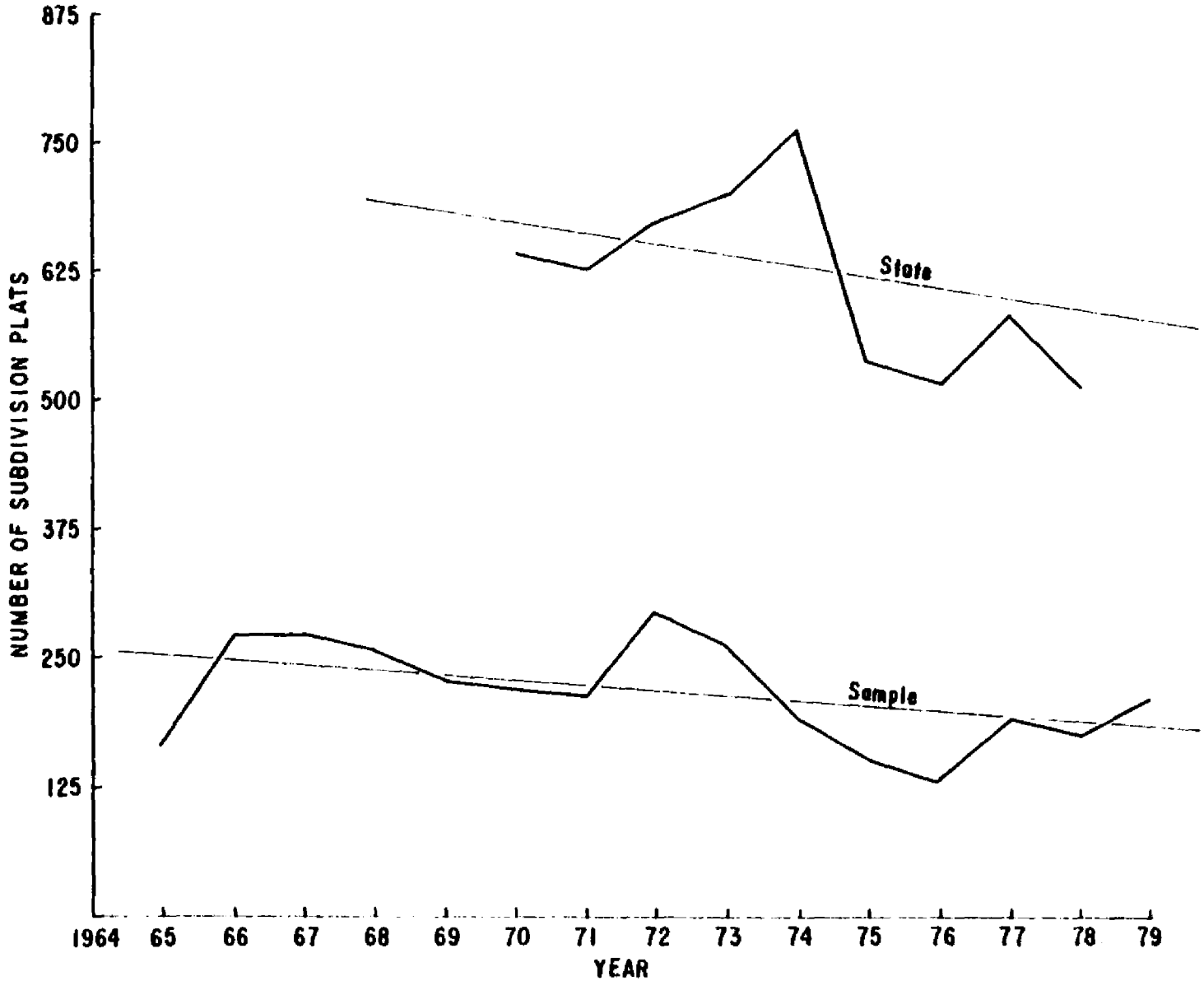
Subdivision Statistics for 30 Selected Counties and the State of Michigan 1969-1979

Year	Number of Subdivisions		Acres of Subdivisions		Number of Subdivisions	
	Sample	State	Sample	State	Sample	State
1969	226	640	6,644	-	10,074	-
1970	219	639	7,349	15,300	10,599	34,600
1971	213	624	7,267	21,760	11,035	33,940
1972	294	670	7,523	17,000	10,444	24,100
1973	263	695	6,686	16,840	8,738	26,229
1974	187	756	4,448	19,070	6,108	28,340
1975	151	536	3,511	13,115	4,842	19,638
1976	131	515	2,890	11,525	4,980	15,850
1977	190	579	4,132	10,425	7,910	17,145
1978	176	636	4,199	13,118	5,991	21,951
1979	211		4,971	-	7,588	-
1980						
Cumulative Total	2,261	5,651	59,619	138,153	88,309	221,793
Mean Annual	206	628	5,419	15,350	8,028	24,644

Source: (a) Michigan Department of Treasury, Plat Office, Plat Files, Collected May 1980; (b) State of Michigan: Annual Report of the State Treasurer, Research Section, Oct. 1977 to Sept. 1978. Table 33, page 65.

FIGURE 5-4

TRENDS IN APPROVED SUBDIVISION PLATS
WITH FITTED CURVE, SAMPLE AND STATE,
(1969-1979)


875
750
625
500
375
250
125
NUMBER OF SUBDIVISION PLATS
State
Sample
1964
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
YEAR

Between 1970 and 1978, a total of 5,651 new subdivisions were platted and approved in the state. This represents an annual mean subdivision development of 628 plats. Corresponding acreage and lot figures were 138,153 acres, and 221,793 lots or mean annual figures of 15,350 acres and 24,644 lots.

During that same period, the 30 sample counties created 2,261 plats or 59,619 acres and 88,309 lots correspondingly. These figures constituted about 32.3 percent, 34 percent and 31.9 percent of the totals, respectively. The mean annual figures for the sample were 206 plats, 5,419 acres and 8,028 lots per year.

The almost non-apparent declining trend is also evident in the sample figures. Figure 5-4 shows the line graphs portraying trends in subdivisions for both state and sample counties, based on plat figures. The graph also shows the Least Square Linear trend lines. The actual figures hardly reveal any trend; however, the fitted trend lines reveal very slowly declining trend in the number of new subdivisions platted and approved. The slopes of the two trend lines are negative, (about -10.23 for the state and -4.89 for sample).

Acreages Under Subdivision

Of more importance and greater interest than the subdivision plats are the acreage figures, since acreage

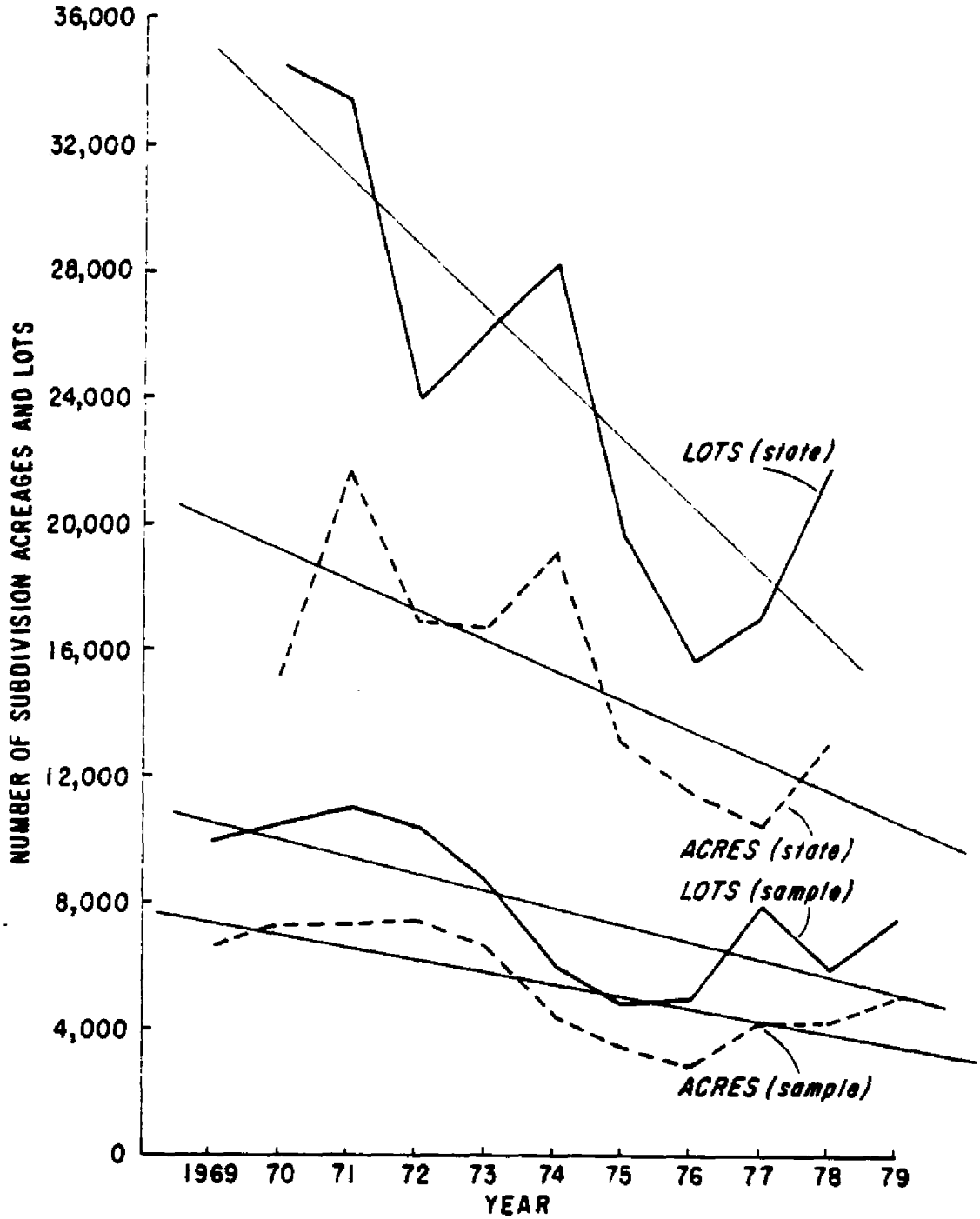


FIGURE 5-5

TRENDS IN SUBDIVISION ACREAGES AND LOTS, SAMPLE, STATE, (1969-1979)

measure is more revealing than number of plats (compare with holdings and parcellation acreages). Figure 5-5 portrays trends in both acreage and lots of subdivision developments in the state of Michigan from 1969 to 1979 (Sample and State). Declining trends in acreages are much steeper than the number of plats reflected. This simply implies that individual subdivisions are getting smaller and smaller in area, and are containing fewer and fewer lots. Acres per plat declined from about 25 to 210 and may stabilize around 24-20 acres per plat. Correspondingly, the number of lots per subdivisions had been declining from over 50 to about 30 and may stabilize between 35-30. The downward trend cannot continue indefinitely. Logarithmic projection indicated a stabilization level around 20 acres and 35 lots per subdivision after 1985 or about 0.6 of an acre per lot.

Trends in Approved Subdivisions by District and Region

Since subdivision data covered a continuous period of 10 years trend equations based on district subdivision acreage figures are provided along with regional trend graphs in Appendix 5-I and 5-J. Statistical equations for Districts 2, 3, 7 and 8 were not significant at 5 percent and hence would not be used for predictive purposes. However, their coefficients reveal the direction of trend.

Three districts, S.E.S.L.P., E.U.P. and W.U.P. showed positive coefficients, implying possible increasing trend. The correlation coefficient of the first district, S.E.S.L.P, was quite high (r=0.8) and significant at 99 percent level. However, the latter two U.P. districts had very low r-coefficients (r=0.1 and 0.3) and were not significant at α = 5 percent. This implies that generally, the rate of subdivision developments in the U.P. has remained constant over time. The rest of the 5 districts had negative coefficients with their r's ranging between -0.5 to -0.8, and significant at over 90 percent.

With the exception of W.S.W.L.P. District, all the other districts which showed declining trends in approved subdivision developments, on the contrary, showed highly increasing trends in unplatted parcellation. It may be concluded that: (1) some districts which were experiencing decline in approved subdivisions were, on the other hand, experiencing positive and increasing isolated parcellation. There appears to be a substitution between approved and non-approved subdivisions. These districts are C.E.S.L.P., C.W.S.L.P., W.N.L.P. and E.N.L.P. They are all in the northern two-thirds of the L.P.

(2) The U.P. districts are experiencing virtually no trend in approved subdivisions and very little increasing trend in isolated parcellation.

(3) The S.E.S.L.P. and S.W.S.L.P. districts are experiencing very minimal upward and downward trends. They constitute the southern third of the L.P. and parcellation activities are reaching a constant rate.

It may be generalized that the most important mode of land fragmentation, currently, is not approved subdivision but isolated land parcellation and the main area in the state mostly affected is the north of Ottawa-Macomb boundary lines, i.e. mid and northern Lower Peninsula regions.

Figures in Appendix 5-J show trend graphs of subdivision acreage for the four regions. In general, subdivision declined steeply in Region III (N.L.P.) where isolated parcellation was noted to be increasing at increasing rate. Region II (W.S.L.P.) showed a gradual declining trend while Regions I (ESLP) and IV (UP) again revealed slight increasing trend. However, trends were not very clear owing to the periodic fluctuations.

Conclusion

The Multiple Regression analysis have clearly shown that the most important determining factors in parcellation are economic and social. Economic factors such as personal income and land values played a major role in explaining variations in parcellation categories. The effects of

income, declined towards the terminal period of the study. Social factors such as population, number of housing units and percent net migration remained as highly important factors and their effects increased with time. Physical factors did not appear to contribute significantly to the variations in any of the parcellation categories, for the overall state-wide analysis. However, when the state was divided into two broad regions of North and South, the impacts of physical factors became apparent in the North. Further, it is still premature to judge the impacts of physical factors since they more or less increased in importance as contributors towards the terminal year of study. Such a trend suggests that in the future, physical factors are going to play considerable role in influencing land parcellation in Michigan.

Since most of the regressions were significant, it can be concluded that the selected predictors do have considerable influence on land parcellation and they do help explain variations in the spatial distribution of all categories of parcellation.

For the most part, approved subdivisions showed declining trends for the whole state. Regional analysis revealed, however, that the decline is not universal. The East Southern Peninsula and the UP still exhibited increasing subdivision trends. The declining trend in subdivision

noted for the NLP was, nevertheless, associated with increasing non-platted parcellation, especially for parcels in the size range of 10-11 acres. This presupposes some kind of substitution between platted and non-platted parcellation in the region.

The concluding chapter of this study attempts to relate these findings to selected land use policies and then based on these findings, certain policy recommendations are made.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Increasing awareness about both physical and economic scarcity of land resources relative to population growth and multiplying demands and doubts about the effectiveness of the "free market" to optimally allocate and distribute land to meet broad social welfare goals, have generated public concerns over the utilization of its basic resource--land. Gone are the frontier days when Michigan land resources were considered as inexhaustible.

Governments are increasingly being requested by the general public to monitor and regulate future uses and distribution of private lands, not only for the benefit of current users, but also for the security and survival of future generations. Land is one of the most important possessions of mankind which Adam Smith's "Invisible Hand" has visibly failed to allocate optimally among competing ruses and to distribute efficiently intra- and inter-generations.

Parcellation (non-platted subdivisions) has been one major unregulated method of land allocation and distribution

in the state and in many parts of the nation that is based on "free market" operations. Platted subdivisions have remained the other side of the coin where governmental intervention in the "free market" has been channelled to direct and control private land use and development.

As the government is called upon more and more to control land use and its allocation, there is going to be a need for more and more information and data about who owns land and for what; about how much land is owned and how land is being partitioned and transferred into other uses and to different users so that appropriate and effective land use policies can be initiated and executed.

This study has attempted to provide information about how much of Michigan land has undergone small tract parcellation over the 15-year period and what probable future trends in this method of land distribution are to be expected. Attempt has been made to provide explanation for both the spatial and time trends in non-platted parcels less than 11 acres.

It was hypothesized that land parcellation is increasing in the state and that several socio-economic and institutional factors have been contributing to this increase. Institutional factors such as the Subdivision Control Act and its 10 acre minimum lot provision have diverted developers from smaller lots less than 10-acres to lot sizes in excess of 10 acres.

The general framework of the study has been to collect data on parcels less than 11 acres and subject the information to statistical analysis, using multiple regression and time series. This enabled the research to locate areas most affected currently by the process of parcellation as well as areas that would experience increasing parcellation process in the future.

Spatial Distribution

The process of non-platted parcellation was found to be most advanced and intense in the southern half of the state, especially in the Lower Peninsula, which has been the hub of the state's socio-economic activities. Approved subdivision activities have been much more intensive in the south, too, than in the north. However, spatial trend analysis indicated that the Northern Lower Peninsula remained the frontier region for intensive parcellation activities in the future. Parcels in excess of 10 acres were becoming the most popular non-approved subdivisions in the region.

Unlike the south where the demand for parcels had been associated closely with employment, the demand for land parcels in the north has been motivated by environmental amenities and recreational activities. Little parcellation activities were noted in the Upper Peninsula.

Time Trend

Parcellation leading to land fragmentation is a continuing process in the State of Michigan. There is a tendency towards increasing trend over time. Between 1963 and 1977, about 700,000 acres of land were parcelled out into lots less than 11 acres. This represented a doubling of the total acreages of parcels that existed in the state in 1963. Trend analysis indicated that more new non-platted parcels were created between 1970 and 1977 than between 1963 and 1970. Projected estimates indicated that another 800,000 acres of land would be parcelled out in the next 20 years, or some 1,000,000 acres of new parcels would be created between 1977 and 2000.

While the extent of 10 and 10+ acre units may not at the moment be as large as the fears of some individuals, groups and public agencies suggest, it still remains a growing phenomenon, involving problems that merit policy considerations.

Multiple regression analysis revealed that scattered homesites have been one of the major factors contributing to land parcellation in the state. This calls for policies that related to demand for homesites. It is to be recognized that subdivisions once created lock up land which cannot be retrieved for non-urban uses without considerable economic and social costs.

Conclusions

Parcellation definitely involves "important" rural lands and "critical" physical resources that Michigan would like to preserve in or for uses other than residential or other urban land use. The proportion of relatively large parcels (10-11) is increasing over time and spreading to several frontier regions.

Time series and multiple regression analyses indicate that two non-policy factors have been contributing to the spatial and time trends of (10-11 acre) parcellation and one policy factor accounts for a greater proportion of the sudden accelerated increase in the relatively larger parcels between 1970 and 1977.

The first non-policy factor relates to demand which involves job-oriented homesites. This is occuring in rural and semi-rural counties contiguous to urban centers. Increased personal incomes and quick transportation systems that permit commuting to work have contributed to reinforce this demand. Differences in land values between urbanized and non-urbanized counties appear to have contributed to such demand too. The second demand occurs mostly in the hinterland of Michigan in the Northern Lower Peninsula where physical environment and recreational resources such as landscape, water bodies, forests and so on, have attracted extra regional demand for second and recreational

homesites. Again land values and tax burden in these frontier regions tend to be lower than the southern heavily-urbanized regions. Neither of these demands is necessarily closely related or associated with local demand.

Parcellation of land, in the range of 10-11 acre size units are already advanced in most counties in the southern third of the Lower Peninsula. Zoning and other land use regulatory policies can hardly have any further effect on the fragmentation process and trends in these counties (e.g., Oakland, Wayne, etc.). It is probably inappropriate to talk of "process" in such counties. In the north, the term "process" is still applicable and appropriate. Land is available for large lot parcellation, all other factors equal. Projection indicates that the north of the Lower Peninsula is the main hub of future large-lot development activities. The rush by real estate agents, developers and subdividers, to the north in response to expected boom in the recreational industry is likely to generate irresponsible land transaction activities—speculation, premature developments, leap-frogging, narrow strip developments and eventual idle lots.

Independent studies have shown that residential uses will continue to be the predominant taker of land in urban areas and of the new parcels that are being created in the rural contiguous and fringe areas, as well as in remote

up-country. Single-family housing still consumes most of the residential land though in high-density urban areas, multi-family housing has exceeded single-family in the number of dwelling units. Mobile and modular homes are also increasing in number each year and contributing to the rapid consumption of prime lands and the increasing number of small-tract parcellation.

The trend continues to increase over time and to spread spatially from the south toward the north. As the process proceeds, and land use conflicts increases (between urban and rural land uses), public concern increases and anxiety about Michigan's future rural industry resource base mounts.

The third factor is a policy variable. The Subdivision Control Act which exempts lots greater than 10 acres did significantly contribute to the acceleration of the creation of 10+ acre parcels.

Subdivision Regulation: Subdivision Control Act of 1967

This study found that the Subdivision Control Act has contributed significantly to the increasing trend in large lot parcellation in the state. The exemption of land over 10 acres from platting provided by the Plat Act has increased the demand for and supply of small tract holdings slightly in excess of 10 acres. The side effects of the

Plat Act on rural land resource base may not have been anticipated. The Plat Act has tended to create the problem of haphazard developments more than before with 5-split limitation within 10-year period, in many counties where zoning regulations are not strictly enforced. In their responses to letters sent them about the issue, several County Extension Directors reported that the 10-acre limitation in the Plat Act is positively related with the increasing trends in the creation of larger tracts for residential purposes.

Donald Jud's study (1980)[1] on the effects of Zoning on Single-Family Residential Property Values in the City of Charlotte, N. Carolina, concluded that:

1. Buyers of residential housing seek uniformity in neighborhood (communities) land use. Where such uniformity is provided by a residential zoning classification, consumers are willing to pay a premium for it.
2. A decrease in per acre cost of homesites reduces the fixed cost component of residential construction and hence the total average cost of subdivision development. The tendency is to increase the supply and reduce the price of large-lot residential homesites.

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[1]Jud, G. D., 1980, (ibid.), p. 152.

3. Increased supply of large-lot tracts tend to lower prices for large-lot housing relative to small-lot housing units on per unit basis, and hence demand for such housing units increases.

The 10-acre limit which has encouraged the creation of lots slightly in excess of 10 acres has actually generated demand for and supply of large-lot residential lands in the state. As one extension director pointed out, "Real estate people have made costs of acquiring land fairly attractive with requirements of low down payments and low monthly payments."[1] Subdividers reduce acquisition cost by avoiding platting requirements and costs. They are, therefore, able to sell residential sites at a lower cost per acre. This has encouraged younger and middle-aged individuals to seek more secluded areas.

The impact of the Subdivision Control Act of 1967 on publicly approved subdivisions, however, was not conclusive. The declining trends in the number of plats and acreages of subdivided land is a reflection of increasing platting costs, uncertainties in the real estate market in the mid-1970's when many developers lost money and the natural tendency of the market to move towards equilibrium.

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[1]Responses of County Extension Directors confirm this argument. See Appendix 3-B, especially Lapeer and Antrim.

The impact of the Subdivision Control Act is best reflected in isolated non-platted parcels. Loopholes in both Michigan Land Sales Act and the Subdivision Control Act allowed developers to partition land into more than five, but less than 25 parcels, each parcel over 10 acres in size without meeting any legal or policy requirements.

It is here concluded that zoning and subdivision regulations in Michigan have contributed to large lot parcellation, but not to publicly approved subdivisions and the process of creating these large lots is still increasing over time and spreading spatially to most rural lands where land values are relatively low and recreational and environmental amenities tend to attract homesite consumers. Withdrawal of prime rural lands into such secluded large lot residential units will continue if no further action other than current land use control mechanisms is taken.

The process of large-lot fragmentation favors developers who reap economies of size. Certain zoning regulations also favor farm owners whose lands are protected and preserved at the expense of society, but who have the option to eventually sell land for capital gains, the protection and preservation having contributed to the appreciation of the value of the land. Cost is imposed on all taxpayers who must pay for the provision of public services and utilities to these scattered and secluded residential units or for the protection program.

Recommendations

A. Recommendations Stemming from the Study Findings

In view of the above analysis, the following recommendations are made:

1. The minimum lot size provision in the Subdivision Control Act should be removed from the definition. The state may still retain the 5 split limitation within the 10-year period. States such as Alaska do not have any acreage limitations, but maintain split minimum. Alaska does not allow any divisions of property before platting. Illinois, Massachusetts and Ohio also do not have any minimum splits before platting. Michigan, California, Idaho, Wisconsin and a few other states allow 4 splits. So far the number of allowable splits before platting range from 0-4.

   Michigan appears to be the only state that has the 10-acre minimum specified in the Act. Most states have 5-acre minimum (Alaska, Idaho, Illinois, Ohio, Oregon). Rhode Island, for example, has only 1-acre minimum and Wisconsin has 1½-acres minimum. It is suggested that a comparative study about the impacts of these different minimum lot size provisions be made so that Michigan

can draw from them. On the other hand, the subdivision definition may be made more flexible by requiring platting of any kind of small lot splitting, irrespective of the number of splits and size. In this case, market forces will eventually establish these threshold limits. It is to be recognized that partitioning of land into splits less than 25 parcels each of which is larger than 10 acres is virtually uncontrolled.

The plat act should require the official platting of all subdivisions of under 40 acres when the intent is to use the subdivided parcels for residential purposes. Some easing of platting restrictions may be with plats of 4 or less units. In this respect, more detailed research is needed to ascertain the effects of such easing off and which types of the provisions to be relaxed.

2. A state level land use policy coordinating agency should be established to coordinate the actions of local land use agencies, to organize a detailed study of tax laws, zoning regulations and all other public policies that independently and in their various jointness combine to infringe on private land use and resources. Conflicting and counter balancing effects that tend to neutralize

the possible positive impacts on these regulations should be sorted out and corrected, if any exists. This has implications for the next recommendation.

3. Public policies which contribute to urban sprawl—ranging in single or in combinations—must be studied and screened or reshaped to meet with the increasing public demands for limit to urban expansion and growth.
4. This study has revelaed that for certain counties large-lot parcellation is already extremely advanced and the process has reached its limits. Such counties as portrayed by density index in Appendix 5-C may require different types of policies which will promote land consolidation and recombination.

B. Recommendation for Future Research

This study has raised more questions than it answered. This result was expected and indeed had been an implicit objective of the study.

Land parcellation is a social, economic, political, personal and psychological issue which takes its root in the fundamental institution of land ownership and natural resource allocation. Research topics are never exhaustive in this area of human activity especially as society develops and human problems multiply in complexity and in dimensions.

An area of great interest for future research may have to deal with the nature and scope of land transactions in the state—who sells and who buys, why, for what, what are the impacts on the economy—social set up, power structures, and so on. How many times does a single tract change hands (study of turnover rate in land parcellation). Another parcellation category worth studying is the 11-20 acre parcels. As farmlands increase in size, will 11-20 acre plots be economically feasible? What kind of farming and forestry can efficiently be practiced on such limited tracts?

Another area of research might be a study of the impacts of local interest pressures on the administration of land use control regulations. What are the benefits and costs of such local impediments? Who gains and who bears the costs? Why are land use regulations not adopted and/or enforced in all localities, counties, and municipalities?

Land parcellation, as pointed out, is a process by which land is allocated among persons and among uses. It cannot be checked under a normal process of market forces. Sellers and buyers alike derive private satisfactions—either economic, social or psychological, from land transactions. However, the process can be directed and efforts channelled to meet current as well as future goals and aspirations of the people in the state.

Final Comments

Planning for the Future

The future is for the one who plans ahead; planning does not necessarily imply governmental interference in private rights or socialization of private ownership. It is simply looking ahead into the future and letting the past and present provide guidance into the unknown future. It involves careful and reflected anticipation and calculated choices among competing alternatives; therefore, there is always a cost. Planning contributes to weighing and balancing competing ends within the constraint of available resources; making appropriate choices that would maximize current and future welfare of society at little cost to individuals in the society. Such an optimization process requires the input of all citizens as they provide the needed mandate to their political representatives and further cooperate with the various institutional set ups for the successful and effective implementation and working of planned policies. In this respect, the citizens of Michigan have a major responsibility and role to play in determining the proper use, administration and development of their base resource—land.

An African wise saying about land ownership has it that:

"Land belongs to the numerous dead,
It is the trust of the living few
and is the property of uncountable
millions yet unborn."

This philosophy sums up all traditional land use policies in indigenous Africa. In this respect, probably, the advanced nations have something to learn. The notion of land as a "commodity" may eventually have to give way to land as "common trust".

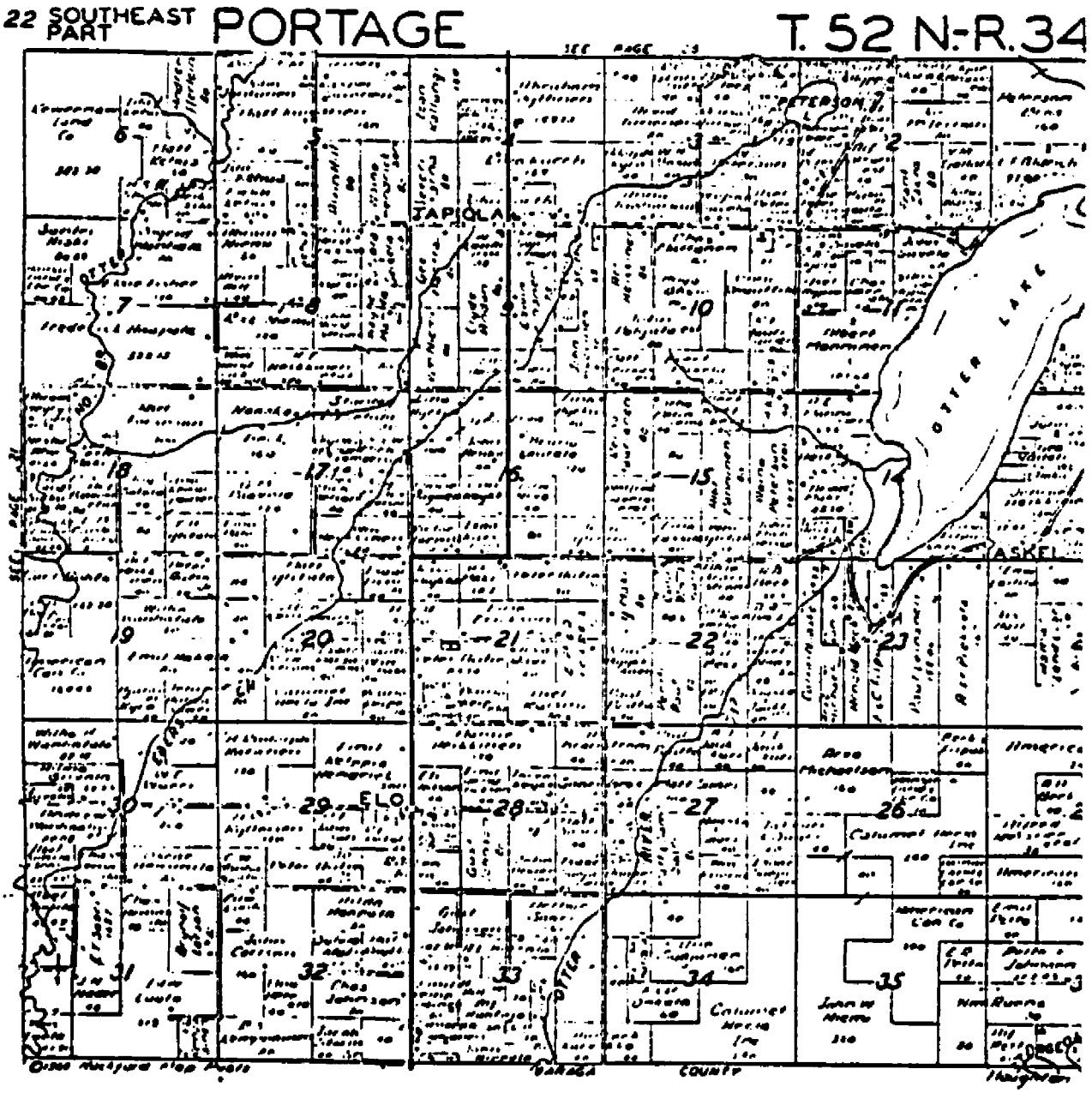
APPENDICES

APPENDIX 2-A

Sample of Land Atlas and Plat Book
Map of Portage Township, Houghton
County, Upper Peninsula

APPENDIX FIGURE 2-A

Sample of Land Atlas and Plat Book Map of Portage Township, Houghton County, Upper Peninsula



APPENDIX 3-B

Sample Correspondences with County Extension Directors for Feedback Information of Land Parcellation

APPENDIX 3-B-1

Letters Written to County Extension Directors (CEDs)

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY • EAST LANSING • MICHIGAN 48823
AND U.S. DEPARTMENT OF AGRICULTURE COOPERATING

Department of
Resource Development
Natural Resources Building

February 10, 1981

Mr. Lawrence W. Stebbins
Ottawa County Extension Director
County Building
Grand Haven, MI 49417

Dear Larry:

The Department of Resource Development at Michigan State University is currently studying the problems associated with the parcellation of land tracts of 11 acres and less. Your county is one of a sample of 30 Michigan counties that has been selected for study. Our analysis to date indicates that your county has experienced an above average amount of parcellation when degree of parcellation is measured in terms of area parcelled weighted by county population density and area.

We realize that factors of which we are not aware may explain the parcellation trends in your county. To help us better understand what has been going on during the last 15 years, we would greatly appreciate it if you would take a few moments to give us your perceptions about trends in the creation of small tract holdings - most particularly lots in the 10 to 11 acre size category, the forces that are favoring small lot parcellation, and the problems (if any) that this may be causing for local government.

Please send your comments to either Dr. Raleigh Barlowe or Mr. Francis Arthur of the Department of Resource Development. Your cooperation in responding to this request will be greatly appreciated as it will provide needed perspective to our overall study. Thank you.

Yours sincerely,

Raleigh Barlowe

Raleigh Barlowe
Extension Specialist
Land and Natural Resources Policy

RB/js

APPENDIX 3-B-2

Selected Responses of CEDs

CES
COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY · U.S. DEPARTMENT OF AGRICULTURE & GENESEE COUNTY COOPERATING
G-4215 W. Pasadena Ave. Flint, Michigan 48504

General Phone
Agriculture
4-H & Youth
Ag. & Energy
Family Living Education
Administration

February 23, 1981

Mr. Francis Arthur
Resource Development Department
311 Natural Resources
Michigan State University
East Lansing, MI 48824

Dear Mr. Arthur:

I am responding to your survey of our county regarding the parcellation of land.

Several factors cause people to buy a 10 acre tract of land.

1. Desire for space
2. Consider the rural area a better place to raise a family
3. A desire to get back-to-the-earth type of living.
4. Attempt to supplement their income - gardening, raising small fruit and selling their production.
5. Lack choice to buy smaller tract (less than 10 acres) developers offer 10 plus acres to avoid plot act.
6. Naive buyer doesn't realize the extent of space purchased - later they become frustrated and use only a fraction of the acreage.
7. High wages and salary in area provide enough income to support the more extragant life-style.
8. They move to avoid urban social problems - crime, racial, ect.
9. Land speculators bought farms with the sale intention of dividing it into 10 plus parcels.
10. Farmers realize return on their land by selling off the frontage on roads.

Problems for local government:

1. Increase cost of services for roads, bridges, fire and police protection.
2. Demand for waste disposal systems - sewage and solid waste.
3. School class room space increase demand.
4. Conflict of values with the "natives".

Problems with a more global perspective: Increased consumption of Energy.

Leo W. Dorr
County Extension Director

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY · U S DEPARTMENT OF AGRICULTURE & COUNTIES COOPERATING
LAPEER COUNTY EXTENSION OFFICE • 1575 SUNCREST DRIVE • LAPEER, MICHIGAN 48446
(313) 667-0341

February 26, 1981

Raleigh Barlowe
Extension Specialist
Land & Natural Resources Policy
313 Natural Resources
Michigan State University
East Lansing, MI 48824

Dear Raleigh:

Why is Lapeer County being "parcellized" into 10 to 11 acres plots, and what problems does this bring?

1. Up to now a person could purchase 10 acres for little more than an improved lot in a subdivision in Oakland and Genesee Counties ($10,000.00)

2. FmHA and Federal Land Bank have provided ready financing - in the case of MMHA the rural FHA subdivision, has featured more folks from Flint and Pontiac. (This created more pressure from those who could afford it, to move out to get some land around them.)

3. We have had a large number of real estate people covering Lapeer County promoting the splits.

4. Land contact financing favors splits - easy quick commission - no red tape.

5. Many of our earlier splits are being split again now that the 10 years is up (under the plat act)

6. The Lapeer County Health department has "caved in" under pressure and now will approve almost any 10 acre site if people want to spend the money for a septic system built to their specifications.

7. The extension of M-53 (VanDyke) and the extension of M-21 from Lapeer to Port Huron has caused more speculation.

8. Most of our buyers now are third home owners and retired folks that want to move to their "final" dream home. (We still do have some river frontage, and some woods left.)

2. Barlowe -2/26/81

9. Gardner Real Estate have 4 offices surrounding Lapeer County, and they specialize in splits

10. The Glaciers came and went five times through Lapeer County. Much of our land base is "alfalfa" - animal agriculture type land - and you know what the beef industry has gone through. Our dairy numbers are holding at 218 farms, down from 250 in 1968. The area south of M-21, and west of US-24, and the four townships surrounding Lapeer are where most of the splits are occuring.

11. The back to the earth urge is getting stronger and stronger. A husband and wife with two incomes can out bid a farmer or retired land owner for land. We still have $850.00 per acre farm land, and $30.00 per acre land rent.

12. The impacts of the out migration is pressure on schools, lack of adequate roads, and road maintenance. Garbage removal and soild waste management are problems. Rural crime, substance abuse - (problems among young people coming from re-located families are frequent). In response, church growth, volunteerism community involvement is building. See attached 4-H growth rates 1980-81 enrollments are now over 2000.

Sincerely,

James M. Hutchinson

James M. Hutchinson
County Extension Director

JMH:mg

Attached is:

1. Land in farms by township 1940 to 1978
2. "Are you Concerned" - a slide tape script
3. Lapeer County Demographics taken from our soild waste project now in progress.
4. U.S. Metropolitan Area Projections
5. 4-H Enrollment
6. Raleigh Barlowe letter
7. Comprehensive Development Plan Summary

c.c. Helen Willis
Adger Carroll

Cooperative Extension Service
MICHIGAN STATE UNIVERSITY
U.S. Department of Agriculture and
Antrim County cooperating

ANTRIM COUNTY BUILDING
P.O. Box 427
Bellaire, Mi. 49615
(616) 533-8607, Ext. 31

February 23, 1981

Dr. Raleigh Barlowe
Extension Specialist
Land and Natural Resources Policy
313 Natural Resources
Michigan State University
East Lansing, MI 48824

Dear Raleigh,

This is in response to your February 10 letter in which you requested feedback on your study relative to the parceling of land tracts of eleven acres and less.

These comments have been put together as a result of a meeting between myself, Warren Studley Soil Conservation Service District Conservationist, and Karl Larson, retired Antrim County Extension Director and present part-time Kalkaska County Extension Director.

I. Perceptions about trends in creation of small tract holdings.

A. We see the trend continuing at a declining rate. We expect the rate to decline as transportation costs increase. Also associated with this is an adverse economic climate at the present time. Of course this may change.

At the present time there are many small tract parcels available for sale that are not moving which could be due to a variety of reasons. However, we also see further evidence of small tract holdings still being developed.

II. Forces favoring small acre parceling.

A. No effective controls: The Plat Act, as you know, provides an exemption of land over ten acres. It's obvious that small tract holdings slightly in excess of ten acres have been developed simply to avoid the Plat Act. In fact, in some ways it has created a problem because it has caused the development to be more haphazard than it was before with the 5 split limitation within the 10-year period.

B. Terms of acquisition: Real Estate people have made costs of acquiring land fairly attractive with requirements of low down payments and low monthly payments. Again, as the economy is tightened more people are probably out of the market at the present time than have been in the past.

C. A desire to own land, especially in the north: There seems to be a feeling that owning land gives one proprietary rights over the great out-doors. Particularly with regard to recreational use and the feeling of being able to flex one's muscle a bit.

D. Lack of planning and zoning: The lack of this emphasis has enabled development of land in an undesirable manner. There is evidence to suggest that the zoned townships have gotten a much better handle on the situation. In fact some people have purchased land in zoned areas because of the protection afforded. County zoning was defeated twice in Antrim County and there is still not universal support for zoning as evidenced by a majority of townships in the county not yet zoned.

E. Geographic relationship to metropolitan areas: Antrim County is four or five hour's drive from Michigan's metropolitan areas as well as similar areas in Illinois, Ohio and Indiana. This has made it easy for people to spend weekends or longer in the area. It is unclear whether the increased transportation cost will influence this aspect or not.

F. Comparatively low land values have promoted parceling: Normally land values in northern Michigan are lower than comparable land in southern Michigan or many other parts of the country. It has also been noted that there are differences in land values on a micro level within the county with more parceling occurring in the lower valued land.

G. There has been a difference noted in the types of people purchasing secluded ten acre parcels versus those who purchase in sub-divisions which have also been developed in recent years. An observation was made that younger and middle-aged people tend to buy the more secluded areas for reasons stated above, whereas the older, possibly retired buyers are more concerned about proximity to services and amenities.

III. Problems caused by parceling.

A. The most serious is one of which you are well aware. Services, utilities, roads, law enforcement, fire protection and waste disposal are all areas which are adversely impacted by parceling.

B. Loss of high value agricultural land has occurred in some areas. This is particularly true of fruit sites which, unfortunately, are generally also attractive building sites. This has helped to drive up the costs of fruit land. Of course, high cherry prices some years didn't serve much to keep it down either.

C. Expectations of "imigrants" relative to those of "natives" appear to be somewhat higher as they view exceptable levels of services offered.

D. We have not noted an increased pressure on schools. What has happened apparently is that as school enrollments are declining in many parts of the country they are more or less remaining in a static condition in this area. I expect that in-migration is compensating for natural reduction. Related to this, however, would be an expanded need for school bus routes which is related to A. above.

One very serious problem which could result has to do with something that has not happened yet, but which we feel is worthy of comment. That has to do with a proposed change now being considered for Public Act 94, "Commercial Forest Act". We understand that there is a political movement afoot to alter the eligibility of land to include parcels smaller than the current 40 acre limitation. We feel that this would be very undesirable for several reasons. One, it would serve to increase demand for smaller tract parcels, thereby compounding the current problem. Two, it could drastically reduce the tax base leaving the local units in a much worse condition than they are currently. Philosophically, I personally feel that there should be some reasonable cost associated with owning land and reducing the eligibility requirements will certainly increase market demand in favor of small tract parcels especially for the non-economic sized parcels of which we are discussing.

I hope that these comments will help in your study.

Sincerely,

Burton J Stanley
County Extension Director

BJS/jh

cc: Warren Studley, SCS District Conservationist
Karl Larson, C.E.D., Kalkaska County
Dave Twining, County Planner

INTRODUCTORY THOUGHTS ABOUT TRENDS, FORCES, AND PROBLEMS OF SMALL LAND PARCELS

by Wayne Nierman, Oakland County
County Extension Director

Trends: A major portion of the land area has already been divided and sold in 10, 11, 12, or 15 acre parcels. It is no longer in process, for the most part it has happened.

Forces: Most people wishing to dissolve ownership of large parcels (100 acres or more) find the prospective buyers to be few in number. A hundred acre parcel is too small to farm as a single farm and too big for most city people seeking life in the country.

By breaking the parcels into 20-acre increments, higher per acre value and greater numbers of prospective buyers become available. Dividing the acreage into small 10-acre parcels further provides for increasing the value per acre while attracting still larger numbers of interested buyers.

To take the initial 100 acres, subdivide, plat, construct roads, sewers, and streets for subdivision development requiring an added period of time, doesn't appeal to most sellers. It involves added investment, compliance with state and local statutes, and entails an extended period of time for reclaiming one's initial investment. There is also the added element -- "Risk." I think most would see this alternative as not being worth the anguish.

Problems: Most land parcels larger than two to three acres have no useful purpose for the city of suburban family settling in the country. They simply don't know what to do with the six or seven remaining acres. Some elect horses and some livestock. For most, the vegetation at the time of purchase remains unmanaged throughout one's ownership.

Transportation routes, schools, fire protection, emergency medical service, and policy protection are soon over committed and require replanning and added revenues for expansion and modernization.

Rather than consolidating population growth near cities in regulated subdivision development, ten-acre parcels have distributed populations farther form business and occupation locations. It would seem that this distribution requires greater demands for energy in the form of transportation, communications, and electrical service.

For local governments, it means responding to the special interests and concerns of more people. It means hearing more complaints, processing more tax statements, added public hearings on community issues, and making decisions which have long-term economic and social consequences for the expanding constituency.

Often small parcels are sold at unusually high prices when contrasted to surrounding property. These increases are not fondly received by long-time permanent residents, thus often placing the burden of blame

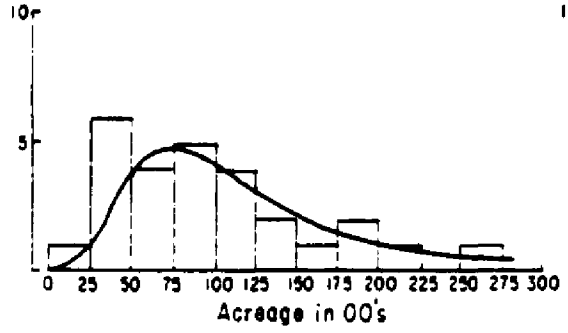
on the assessor. The blame should be placed on the buyer who purchases land above its existing market value. However, it is not easy for him to know what the fair market value should be either. Maybe the blame should go to the seller who over stated his price? On the other hand, the price was set in a "free market place." Who can say who is right?

Wells, septic systems, and waste disposal add burdens to local governments. We have witnessed contamination of chemical waste disposal in landfill sites. Increasing population to rural areas makes it increasingly hazardous to bury and dispose of materials in landfill sites for fear it will penetrate the well water supplies. Landfill sites are becoming increasingly difficult to find, not to mention expensive. It is local government who must locate and monitor these facilities.

February 1981

APPENDIX 4-C

Frequency Histograms with Fitted Smooth Curves for Categories of Parcellation Data


10
5
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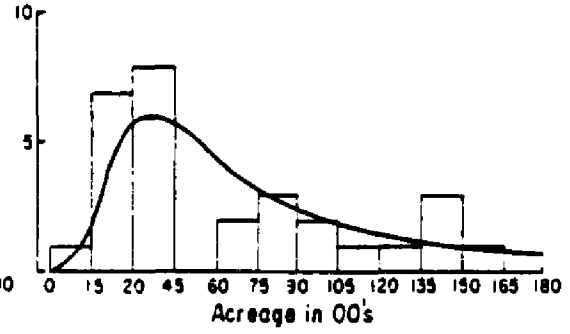
Acreage in 00's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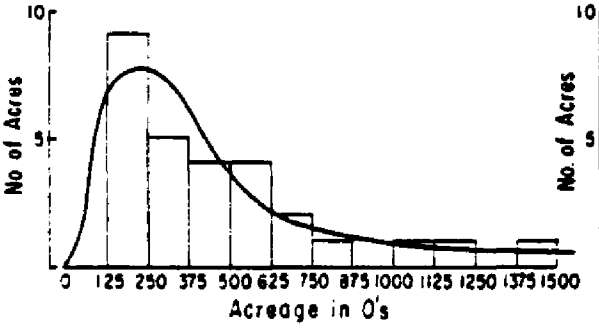
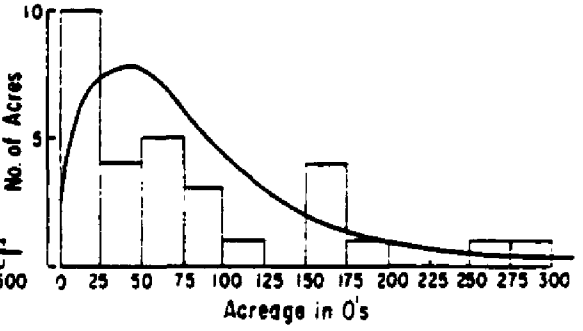
5
0 15 20 45 60 75 30 105 120 135 150 165 180
Acreage in 00's


No of Acres
10
5
0 125 250 375 500 625 750 875 1000 1125 1250 1375 1500
Acreage in 0's


No. of Acres
10
5
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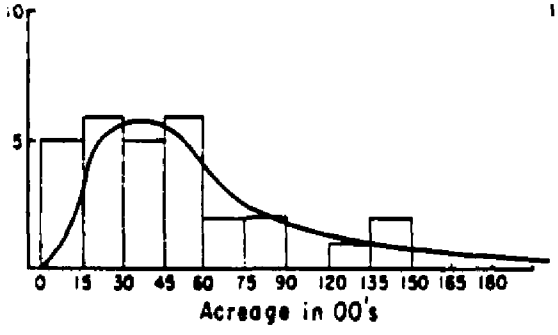
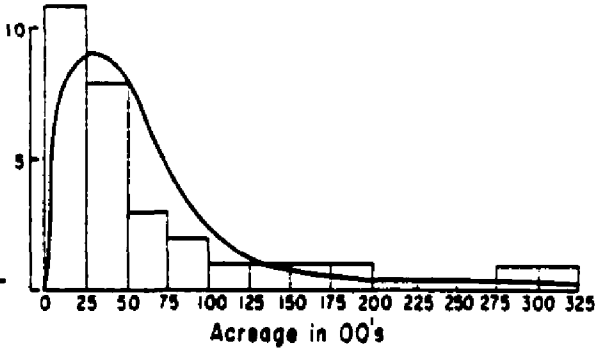
Acreage in 0's


10
5
0 15 30 45 60 75 90 120 135 150 165 180
Acreage in 00's


10
5
0 25 50 75 100 125 150 175 200 225 250 275 300 325
Acreage in 00's

APPENDIX 4-D

Descriptions of Variables used in Regression and Correlation Models

APPENDIX 4-D

Description of Variables Used

In Regression Equations

	Variable	Acronyms	Description and Measure
I	Parcellation	PAS	Dependent Variable (in acres)
	1. All Parcels	AAPAS	Amount of all parcels less than 11 acres
	2. "Large" Parcels	LAGPAS	Amount of parcels in the size range 10-11 acres
	3. "Small" Parcels	ASPAS	Amount of parcels less than 10 acres
	4. Minimum Lot Parcels	AMPAS	Amount of 10 acre parcels (Minimum-Lot provided in the Subdivision Control Act of 1967)
	5. Large-Lot Parcels	ALPAS	Amount of parcels in excess of the minimum-lot parcel (10+ acres)
II	Physical Determinants (P)		
	6.	LACO	Land area per county in square miles
	7.	PUBREC	Public land in recreational and forest activities as percent of total land area per county (1974)

APPENDIX 5-E

Statistics on Non-Platted Parcels

Table E-1 to Table E-8

APPENDIX 5 TABLE E-1

Holdings of Parcels Under 11 Acres by County and by Period 1963, 1970, 1977

County	Number Holdings of 11- Acre Parcels		
	1963	1970	1977
1 Allegan	1,904	2,180	3,114
2 Alpena	494	707	1,259
3 Antrim	239	395	1,307
4 Bay	1,326	1,482	2,980
5 Berrien	3,278	3,649	4,243
6 Calhoun	2,224	2,264	3,104
7 Cheboygan	516	937	1,492
8 Clare	218	451	1,200
9 Clinton	777	1,867	2,905
10 Crawford	1,259	991	1,695
11 Delta	1,118	1,353	1,882
12 Gogebic	393	436	779
13 Grand Traverse	229	505	1,372
14 Hillsdale	459	713	1,097
15 Houghton	211	460	857
16 Huron	232	361	1,234
17 Iosco	553	682	956
18 Iron	488	507	641
19 Lapeer	400	725	4,976
20 Livingston	1,147	2,252	5,293
21 Mackinac	188	348	514
22 Macomb	1,979	2,357	3,456
23 Manistee	636	1,112	1,796
24 Menominee	285	781	1,301
25 Monroe	2,209	2,556	3,369
26 Montcalm	921	1,249	2,444
27 Newaygo	1,592	2,029	3,265
28 Ottawa	1,916	2,392	3,265
29 St. Joseph	860	1,021	1,536
30 Schoolcraft	263	305	342
Total	28,316	37,067	65,392

APPENDIX 5 TABLE E-2

Distribution of Total Acres of Land Under 11- Acre Parcellation for 30 Selected Counties in Michigan 1963, 1970, 1977

Selected Counties	Acreages of 11- Acre Parcels		
	1963	1970	1977
1 Allegan	10,476	11,783	16,314
2 Alpena	2,138	2,781	6,194
3 Antrim	1,723	2,797	8,913
4 Bay	6,155	6,679	11,567
5 Berrien	19,344	20,720	24,499
6 Calhoun	9,528	10,303	13,659
7 Cheboygan	3,020	5,300	9,005
8 Clare	1,692	2,611	8,214
9 Clinton	4,102	8,385	12,769
10 Crawford	5,706	5,297	11,593
11 Delta	4,799	5,775	5,543
12 Gogebic	2,121	2,432	3,813
13 Grand Traverse	1,478	2,940	7,418
14 Hillsdale	2,943	4,082	6,610
15 Houghton	1,303	2,396	4,935
16 Huron	1,178	1,178	4,759
17 Iosco	2,298	3,047	5,422
18 Iron	2,681	1,803	3,482
19 Lapeer	2,784	4,793	27,501
20 Livingston	6,631	12,517	31,785
21 Mackinac	1,299	1,990	3,021
22 Macomb	11,196	13,222	17,792
23 Manistee	4,147	6,492	10,297
24 Menominee	1,645	3,384	4,969
25 Monroe	11,281	13,172	17,658
26 Montcalm	3,896	5,384	11,029
27 Newaygo	9,880	12,227	20,610
28 Ottawa	10,837	12,915	22,995
29 St. Joseph	4,333	5,064	7,598
30 Schoolcraft	1,438	1,654	1,900
Sample Total	151,952	197,568	344,859

APPENDIX 5 TABLE E-3

Trends in Parcels Less Than 10 Acres
For 30 Counties in Michigan
1963, 1970, 1977

County		Acreages of 10- Acre Parcels		
		1963	1970	1977
1	Allegan	5,601	6,185	8,520
2	Alpena	1,528	2,170	3,800
3	Antrim	633	959	2,971
4	Bay	4,378	4,790	9,084
5	Berrien	10,818	12,253	13,641
6	Calhoun	6,885	7,003	9,305
7	Cheboygan	1,478	2,485	3,546
8	Clare	436	3,841	2,045
9	Clinton	2,475	5,578	8,444
10	Crawford	4,193	3,393	4,113
11	Delta	3,710	4,578	6,075
12	Gogebic	1,370	1,501	2,490
13	Grand Traverse	698	1,388	3,841
14	Hillsdale	1,555	2,330	3,610
15	Houghton	661	1,488	2,381
16	Huron	788	1,076	3,411
17	Iosco	1,448	1,855	2,298
18	Iron	1,578	1,686	2,120
19	Lapeer	1,333	2,351	14,738
20	Livingston	3,575	6,791	14,118
21	Mackinac	478	1,120	1,541
22	Macomb	7,026	8,323	12,095
23	Manistee	1,838	3,115	4,958
24	Menominee	763	2,481	3,378
25	Monroe	7,628	8,825	11,823
26	Montcalm	2,666	3,498	6,523
27	Newaygo	4,218	5,281	7,571
28	Ottawa	6,838	8,258	15,220
29	St. Joseph	2,603	3,038	4,368
30	Schoolcraft	848	983	1,095
	Sample Total	90,237	118,622	129,143

APPENDIX 5 TABLE E-4

Trends in 10 Acre Parcels
For 30 Counties by Study Period

County	Acreage of 10 Acre Parcels		
	1963	1970	1977
1 Allegan	4,360	4,810	6,240
2 Alpena	510	590	1,890
3 Antrim	1,090	1,820	5,700
4 Bay	1,630	1,710	2,200
5 Berrien	6,730	6,430	8,170
6 Calhoun	1,950	2,260	3,430
7 Cheboygan	1,500	2,720	5,270
8 Clare	1,140	1,440	5,560
9 Clinton	1,490	2,250	3,370
10 Crawford	1,460	1,820	7,070
11 Delta	910	1,050	1,880
12 Gogebic	730	910	1,270
13 Grand Traverse	770	1,510	3,430
14 Hillsdale	1,020	1,290	2,170
15 Houghton	610	750	1,000
16 Huron	400	610	1,290
17 Iosco	840	1,160	3,040
18 Iron	1,050	1,070	1,320
19 Lapeer	1,430	2,200	12,080
20 Livingston	2,310	4,300	14,800
21 Mackinac	800	860	1,470
22 Macomb	3,130	3,670	4,080
23 Manistee	2,120	3,230	4,950
24 Menominee	650	840	1,350
25 Monroe	2,760	3,160	4,260
26 Montcalm	1,220	1,770	4,180
27 Newaygo	4,790	5,780	11,170
28 Ottawa	3,810	4,810	7,050
29 St. Joseph	1,320	1,480	2,180
30 Schoolcraft	580	650	700
Total	53,110	66,450	133,170

APPENDIX 5 TABLE E-5

Trends in 10+ Acre Parcels
For 30 Counties in Michigan
1963, 1970, 1977

County	Acreages of 10+ Acre Parcels		
	1960	1970	1977
1 Allegan	515	788	1,554
2 Alpena	0	21	504
3 Antrim	0	21	242
4 Bay	147	179	284
5 Berrien	1,796	2,037	2,688
6 Calhoun	693	1,040	924
7 Cheboygan	42	95	189
8 Clare	116	210	609
9 Clinton	137	557	956
10 Crawford	53	84	410
11 Delta	179	147	588
12 Gogebic	21	21	53
13 Grand Traverse	10	42	147
14 Hillsdale	368	462	839
15 Houghton	32	158	1,554
16 Huron	0	95	53
17 Iosco	10	32	84
18 Iron	53	10	42
19 Lapeer	21	242	683
20 Livingston	746	1,428	2,867
21 Mackinac	21	10	10
22 Macomb	1,040	1,229	1,617
23 Manistee	189	147	387
24 Menominee	32	63	221
25 Monroe	893	1,187	1,575
26 Montcalm	10	116	326
27 Newaygo	872	1,166	1,869
28 Ottawa	189	347	725
29 St. Joseph	410	540	1,050
30 Schoolcraft	10	21	105
Total Sample	8,605	12,496	23,146

APPENDIX 5 TABLE E-6

Trends in (10-11) Acre Parcels For 30 Counties
1963, 1970, 1977

County	Acreages of 10-11 Acre Parcels (Large Lots)		
	1963	1970	1977
1 Allegan	4,875	5,598	7,794
2 Alpena	510	611	2,394
3 Antrim	1,090	1,841	5,942
4 Bay	1,777	1,889	2,484
5 Berrien	8,526	8,467	10,858
6 Calhoun	2,643	3,300	4,354
7 Cheboygan	1,542	2,815	5,459
8 Clare	1,256	1,650	6,169
9 Clinton	1,627	2,807	4,326
10 Crawford	1,513	1,904	7,480
11 Delta	1,089	1,197	2,468
12 Gogebic	750	931	1,323
13 Grand Traverse	780	1,552	3,577
14 Hillsdale	1,388	1,752	3,000
15 Houghton	642	908	2,554
16 Huron	400	705	1,343
17 Iosco	850	1,192	3,124
18 Iron	1,103	1,080	1,362
19 Lapeer	1,451	2,442	12,763
20 Livingston	3,056	5,728	17,667
21 Mackinac	821	870	1,480
22 Macomb	4,170	4,899	5,697
23 Manistee	2,309	3,377	5,337
24 Menominee	682	903	1,531
25 Monroe	3,653	4,347	5,835
26 Montcalm	1,230	1,886	4,506
27 Newaygo	5,662	6,946	13,039
28 Ottawa	3,999	4,657	7,775
29 St. Joseph	1,730	2,020	3,230
30 Schoolcraft	590	671	805
Total Sample	61,715	78,946	155,716

APPENDIX 5 TABLE E-7

Trends in Number of Holdings of 10- Acre Parcels For 30 Counties 1963, 1970, 1977

County	Number of Holdings of 10- Acre Parcels		
	1963	1970	1977
1 Allegan	1,419	1,624	2,342
2 Alpena	495	646	1,022
3 Antrim	130	211	714
4 Bay	1,149	1,294	2,733
5 Berrien	2,434	2,812	3,170
6 Calhoun	1,963	1,939	2,673
7 Cheboygan	362	656	947
8 Clare	93	287	586
9 Clinton	615	1,589	2,477
10 Crawford	1,108	801	949
11 Delta	1,010	1,234	1,638
12 Gogebic	318	343	647
13 Grand Traverse	151	350	1,015
14 Hillsdale	322	540	801
15 Houghton	147	370	609
16 Huron	192	291	1,100
17 Iosco	468	563	644
18 Iron	378	399	505
19 Lapeer	255	482	3,703
20 Livingston	845	1,687	3,540
21 Mackinac	106	261	366
22 Macomb	1,567	1,873	2,838
23 Manistee	406	775	1,264
24 Menominee	217	691	1,145
25 Monroe	1,848	2,077	2,793
26 Montcalm	798	1,061	1,995
27 Newaygo	1,030	1,340	1,970
28 Ottawa	1,517	1,928	4,208
29 St. Joseph	689	821	1,218
30 Schoolcraft	204	238	263
Total Sample	22,186	29,183	49,871

APPENDIX 5 TABLE E-8

Trends in Number of Holdings of
Parcels (10-11) Acres for 30 Counties
1963, 1970, 1977

County	Number of Holdings of (10-11) Acres		
	1963	1970	1977
1 Allegan	485	556	772
2 Alpena	51	61	237
3 Antrim	109	184	593
4 Bay	177	188	247
5 Berrien	844	837	1,073
6 Calhoun	261	325	431
7 Cheboygan	154	281	545
8 Clare	125	164	614
9 Clinton	162	278	428
10 Crawford	151	190	746
11 Delta	108	119	244
12 Gogebic	75	93	132
13 Grand Traverse	78	155	357
14 Hillsdale	137	173	296
15 Houghton	64	90	248
16 Huron	40	70	134
17 Iosco	85	119	312
18 Iron	110	108	136
19 Lapeer	145	243	1,273
20 Livingston	302	566	1,753
21 Mackinac	82	87	148
22 Macomb	412	484	622
23 Manistee	230	337	532
24 Menominee	68	90	156
25 Monroe	361	429	576
26 Montcalm	123	188	449
27 Newaygo	562	689	1,295
28 Ottawa	399	464	774
29 St. Joseph	171	200	318
30 Schoolcraft	59	87	80
Total Sample	6,130	7,835	15,521

APPENDIX 5-F

Quinquannial Projection Estimates of Amount of Parcellation in Michigan by Size Unit (1980-2000)

APPENDIX 5 TABLE F-1

Quinquannial Projection Estimates of Amount of Parcellation in Michigan by Size Unit (1980-2000)

Projected Year	Size Unit and Parcellation in Acres			
	10- Acre Parcels	10 Acre Parcels	10+ Acre Parcels	10 & 10+ Acre Parcels
1980	644,862	448,243	80,754	528,997
1985	764,090	540,351	102,723	643,074
1990	882,818	631,289	123,290	754,587
1995	1,000,585	733,511	146,702	880,213
2000	1,120,218	830,105	165,174	995,279

APPENDIX 5-G

Summary Data For - Parcellation Density Scores for 1963, 1970 and 1977; Projected Estimates for Year 2000

Table G-1 to Table G-4

APPENDIX 5 TABLE G-1

Derivation of Weighted Parcellation Densities
For 30 Counties (1963 = 100)

	County	Land Area x 640 (Ai) Acres	Pop. Density 1960 (Di) Persons Per Square Mile	11-Acre Parcels 1963 (PAi)Acres	Weighted D. 1963
1	Allegan	826	70	10,476	1.47
2	Alpena	565	50	2,038	.30
3	Antrim	476	22	1,723	.13
4	Bay	447	240	6,155	5.47
5	Berrien	580	258	19,344	14.24
6	Calhoun	709	196	9,528	4.36
7	Cheboygan	721	20	3,020	.14
8	Clare	571	20	1,692	.10
9	Clinton	572	67	4,102	.80
10	Crawford	561	9	5,706	.15
11	Delta	1,177	29	4,799	.20
12	Gogebic	1,107	22	2,121	.07
13	Grand Traverse	462	72	1,478	.38
14	Hillsdale	600	58	2,943	.47
15	Houghton	1,017	35	1,303	.07
16	Huron	819	41	1,178	.10
17	Iosco	544	30	2,298	.21
18	Iron	1,171	14	1,681	.05
19	Lapeer	658	64	2,784	.45
20	Livingston	572	103	6,631	1.98
21	Mackinac	1,014	11	1,299	.02
22	Macomb	480	844	11,196	32.57
23	Manistee	552	34	4,147	.42
24	Menominee	1,034	24	1,645	.06
25	Monroe	557	179	11,281	5.60
26	Montcalm	712	50	3,896	.45
27	Newaygo	849	28	9,880	.54
28	Ottawa	563	175	10,837	5.57
29	St. Joseph	506	83	4,333	1.18
30	Schoolcraft	1,181	8	1,438	.02
	Sample Average	704	82	5,065	1.00

Coefficient
$\emptyset_{1963} = 1.059$

Parcellation Density: $\underline{WPD} = \emptyset \frac{Di\ PAi}{640\ Ai}$

*Area figures are not repeated for 1970, 1977 and 2000 AD.

APPENDIX 5 TABLE G-2

Weighted Parcellation Density Index by
By County and for 1970 (1963 = 100)

		Population Density (1970)	11- Acre Parcels (1970)	Weighted Parcellation Density (1970)
1	Allegan	81	11,783	1.91
2	Alpena	54	2,781	4.40
3	Antrim	27	2,800	.13
4	Bay	263	6,679	6.50
5	Berrien	283	20,720	16.73
6	Calhoun	200	10,303	5.88
7	Cheboygan	23	5,300	.28
8	Clare	29	5,491	.46
9	Clinton	85	8,385	2.06
10	Crawford	12	5,297	.19
11	Delta	31	5,775	.25
12	Gogebic	19	2,432	.07
13	Grand Traverse	84	2,940	.88
14	Hillsdale	62	4,082	.70
15	Houghton	34	2,396	.13
16	Huron	42	1,781	.15
17	Iosco	46	3,047	.43
18	Iron	19	2,766	.07
19	Lapeer	80	4,793	.96
20	Livingston	103	12,519	3.73
21	Mackinac	10	1,990	3.00
22	Macomb	1,303	13,222	59.39
23	Manistee	36	6,492	.70
24	Menominee	24	3,384	.13
25	Monroe	213	13,172	8.33
26	Montcalm	56	5,384	.70
27	Newaygo	33	12,227	.79
28	Ottawa	228	12,915	8.65
29	St. Joseph	94	5,058	1.55
30	Schoolcraft	7	1,654	.02
Sample Average		94	6,586	1.46

$\emptyset_{1963} = 1.0590$

$WPD_{1963} = 1.00$

APPENDIX 5 TABLE G-3

Derivation of Weighted Parcellation Density Index For 30 Counties 1977 (1963 = 100)

County	Population Density (1980)	11- Acre Parcels (1977)	Weighted Parc. Density Index (1977)
1 Allegan	98	16,314	3.20
2 Alpena	57	6,194	1.03
3 Antrim	34	8,913	1.05
4 Bay	268	11,568	11.48
5 Berrien	295	24,499	20.62
6 Calhoun	199	13,659	6.34
7 Cheboygan	29	9,005	.60
8 Clare	42	8,214	1.00
9 Clinton	97	12,770	3.21
10 Crawford	17	11,593	.58
11 Delta	33	8,543	.22
12 Gogebic	18	3,813	.10
13 Grand Traverse	118	7,418	3.13
14 Hillsdale	70	6,610	1.27
15 Houghton	37	4,935	.30
16 Huron	44	4,754	.42
17 Iosco	52	5,422	.86
18 Iron	12	3,482	.06
19 Lapeer	106	27,501	7.33
20 Livingston	175	31,785	16.09
21 Mackinac	10	3,021	5.00
22 Macomb	1,447	17,792	88.75
23 Manistee	42	10,295	1.29
24 Menominee	25	4,696	.20
25 Monroe	240	17,658	12.59
26 Montcalm	67	11,029	1.72
27 Newaygo	41	20,610	1.65
28 Ottawa·	279	22,995	18.86
29 St. Joseph	111	7,598	2.76
30 Schoolcraft	7	1,900	.02
Sample Average	107	11,495	2.89

$\emptyset_{1963} = 1.0590$

$WPD_{1963} = 100$

APPENDIX 5 TABLE G-4

Weighted Parcellation Density* Index for 2000 AD (Projected) (1963 = 100)

County	11- Acre Parcels	WPD Index 2000
1 Allegan	25,368	4.98
2 Alpena	12,577	2.10
3 Antrim	19,885	2.35
4 Bay	19,731	19.57
5 Berrien	32,567	27.41
6 Calhoun	20,015	9.30
7 Cheboygan	18,600	1.24
8 Clare	5,757	.70
9 Clinton	26,991	7.57
10 Crawford	20,147	1.01
11 Delta	14,395	.67
12 Gogebic	6,414	.17
13 Grand Traverse	16,673	7.05
14 Hillsdale	12,403	2.39
15 Houghton	10,661	.64
16 Huron	10,246	.91
17 Iosco	10,283	1.63
18 Iron	4,372	.07
19 Lapeer	64,658	17.24
20 Livingston	70,880	35.88
21 Mackinac	5,793	.09
22 Macomb	29,685	148.07
23 Manistee	20,157	2.53
24 Menominee	11,941	.48
25 Monroe	27,702	19.75
26 Montcalm	22,055	3.43
27 Newaygo	37,232	2.98
28 Ottawa	41,635	34.14
29 St. Joseph	12,661	4.60
30 Schoolcraft	2,654	.03
Sample Average	21,138	5.32

*WPD for 2000 AD is based on 1980 population density.

APPENDIX 5-H

Trends in District and Regional Parcellation Agreages

Table H-1 to Table H-4

APPENDIX 5 TABLE H-1

Trends in District Parcellation Amounts (11- Acres)
Actual and Projected For 30 Study Counties

District	Year							
	1963	1970	1977	1980	1985	1990	1995	2000
1 S.E.S.L.P.	32,051	42,995	13,845	19483	94,410	109,336	124,262	139,189
2 S.W.S.L.P.	43,681	41,864	62,070	64,340	70,908	77,475	84,043	90,610
3 C.E.S.L.P.	14,219	21,638	56,592	61,083	76,216	91,349	106,482	121,616
4 C.W.S.L.P.	26,305	36,017	62,848	67,825	80,877	93,928	106,979	120,030
5 E.N.L.P.	13,062	16,425	32,214	34,247	41,087	47,927	54,767	61,607
6 W.N.L.P.	7,348	12,232	26,626	29,172	36,057	42,942	49,827	56,712
7 E.U.P.	7,536	9,419	13,464	14,374	16,491	18,608	20,725	22,843
8 W.U.P.	7,750	10,948	17,199	18,715	22,090	25,464	28,839	32,214
Total	151,952	197,568	344,859	369,237	438,136	507,029	575,924	644,821

APPENDIX 5 TABLE H-2

Trends in District Large-Lot (10-10.9) Parcellation Amounts - Actual and Projected

District	1963	1970	1977	1980	1985	1990	1995	2000
1 S.E.S.L.P.	12,267	16,726	32,199	34,634	41,753	48,872	55,998	63,109
2 S.W.S.L.P.	17,774	19,385	26,236	30,905	35,976	41,046	46,116	51,187
3 C.E.S.L.P.	5,255	7,843	20,916	22,524	28,118	33,711	39,304	44,897
4 C.W.S.L.P.	12,147	15,139	31,489	33,407	40,315	47,223	54,131	61,039
5 E.N.L.P.	4,415	6,522	18,457	19,828	24,843	29,858	34,873	37,888
6 W.N.L.P.	4,179	6,770	14,858	16,230	20,044	23,858	27,672	31,486
7 E.U.P.	2,500	2,738	4,753	4,939	5,743	6,547	7,351	8,156
8 W.U.P.	3,178	3,822	6,810	7,198	8,459	9,792	11,089	12,386
Total	81,715	78,945	155,718	169,665	205,287	240,907	276,534	312,148

APPENDIX 5 TABLE H-3

Trends in Regional Parcellation Amounts (11- Acre Parcels)
Actual and Projected for 30 Selected Counties

Region		1963	1970	1977	1980	1985	1990	1995	2000
1	E.S.L.P.	46,270	64,633	130,437	140,566	170,626	200,685	230,744	260,805
2	W.S.L.P.	68,294	78,390	116,704	123,334	140,625	157,914	175,203	192,492
3	N.L.P.	22,102	34,142	67,054	72,250	88,304	104,358	120,413	136,467
4	U.P.	15,286	20,367	30,663	33,089	38,581	44,072	49,564	55,057

APPENDIX 5 TABLE H-4

Trends in Regional Large Lot (10-10.9) Parcellation,
Actual and Projected for 30 Selected Counties

Region		1963	1970	1977	1980	1985	1990	1995	2000
1	E.S.L.P.	17,522	24,569	53,115	57,158	69,871	82,583	95,302	108,006
2	W.S.L.P.	28,665	32,874	51,556	57,798	68,002	78,225	88,449	98,673
3	N.L.P.	9,850	14,492	39,484	41,572	53,176	63,760	74,343	84,927
4	U.P.	5,678	6,560	11,563	12,137	14,238	16,339	18,440	20,552

APPENDIX 5-I

Subdivision Trend Equations by District

APPENDIX 5-I

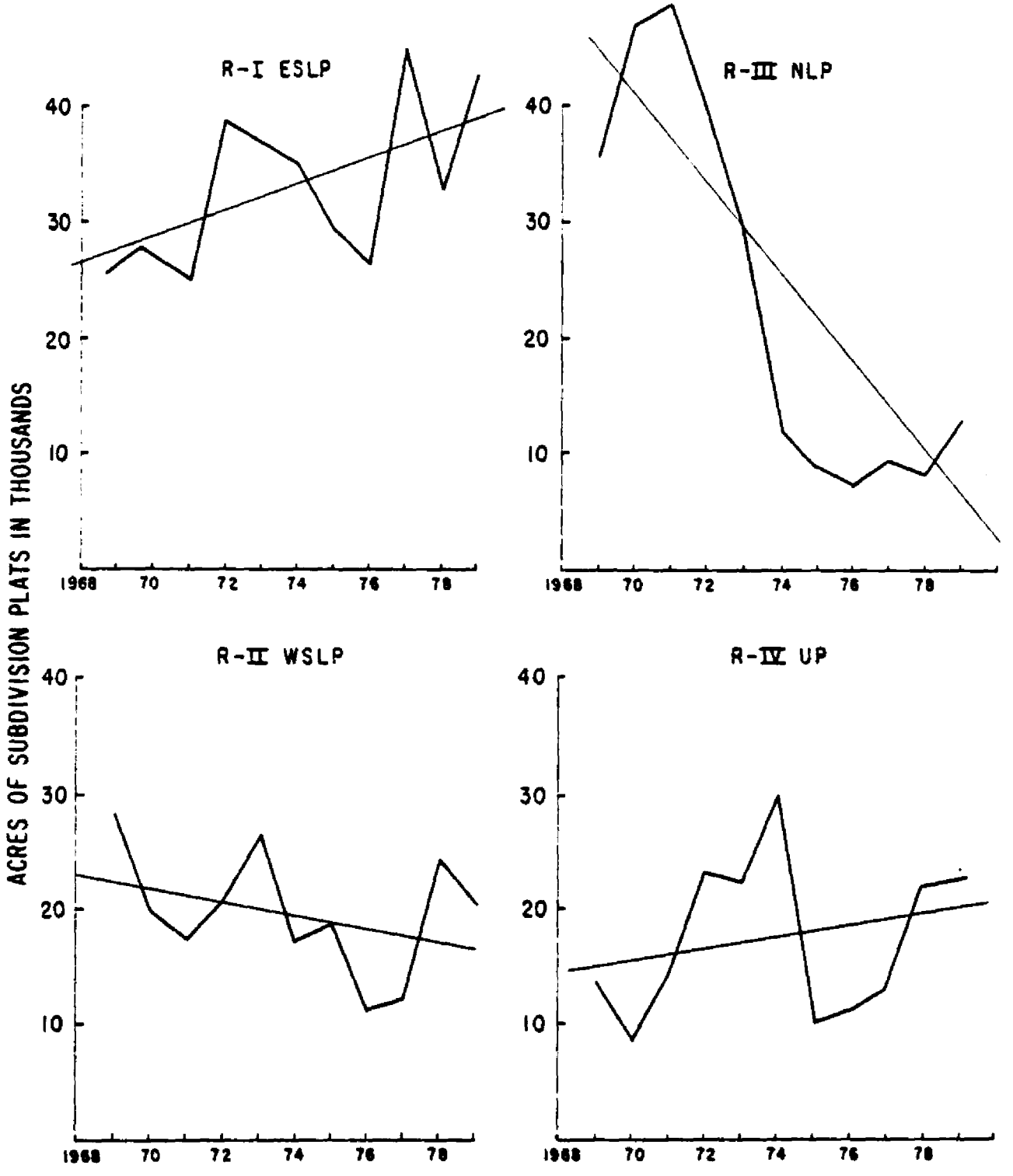
Trends in Acreage Under Subdivision by Districts (1969-1979) Using Predictive Equation of the Form $A = b_o + b_1T + E_i$

Code	District	Predictive Equation	Statistics	Zero Year	r-Significant at
D-01	S.E.S.L.P.	$A_{01} = 847.1 + 90.5T$	$r = .08$ $s = 395.8$ $\bar{A}_1 = 139.0$	(1959)	99%
D-02	S.W.S.L.P.	$A_{02} = 645.0 - 22.5T$	$r = -0.5$ $s = 157.2$ $\bar{A}_2 = 509.4$	(1977)	85%
D-03	C.E.S.L.P.	$A_{03} = 473.4 - 29.6T$	$r = 0.5$ $s = 187.6$ $\bar{A}_3 = 295.5$	(1985)	85%
D-04	C.W.S.L.P.	$A_{04} = 1417.0 - 86.4T$	$r = -0.7$ $s = 402.2$ $\bar{A}_4 = 898.5$	(1985)	95%-99%
D-05	E.N.L.P.	$A_{05} = 1470.2 - 133.8T$	$r = -0.8$ $s = 573.6$ $\bar{A}_5 = 667.5$	(1980)	99%
D-06	W.N.L.P.	$A_{06} = 2610.4 - 218.0T$	$r = -0.8$ $s = 945.6$ $\bar{A}_6 = 1302.2$	(1981)	99%
D-07	E.U.P.	$A_{07} = 152.9 + 1.7T$	$r = 0.1$ $s = 85.1$ $\bar{A}_7 = 162.9$	(1977)	<80%
D-08	W.U.P.	$A_{08} = 138.8 + 9.2T$	$r = 0.3$ $s = 119.0$ $\bar{A}_8 = 193.9$	(1954)	<80%

A = Acreage T = Trend

APPENDIX 5-J

Subdivision Trend Graphs by Region


R-I ESLP
R-III NLP
R-II WSLP
R-IV UP
ACRES OF SUBDIVISION PLATS IN THOUSANDS
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