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TO PRIME FARMLAND IN TWO
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URBANIZATION AND ITS RELATIONSHIP TO PRIME FARMLAND IN TWO MICHIGAN COUNTIES

by

Martin Rossol

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ABSTRACT

URBANIZATION AND ITS RELATIONSHIP
TO PRIME FARMLAND IN TWO
MICHIGAN COUNTIES

by

Martin Rossol

The objectives of this study were to determine the area of urbanization not included on the Important Farmlands Inventory (IFI) in two Michigan counties, and to evaluate this area with respect to its use of prime farmland. Urbanization was defined by the study as economically irreversible development unrelated to agriculture, horticulture, forestry, fisheries, etc. A single-stage cluster sample design was used to evaluate forty-five sections in each county.

The research results indicated that smaller urban areas studied increased in both number and area over the study period. By 1980, these areas accounted for 35% and 24% of total urban areas in St. Clair and Washtenaw Counties, respectively. In 1964 the relative area of prime farmland used by these areas was similar to that used by the urban areas of the IFI. By 1980, relative usage of prime farmland increased dramatically in St. Clair County but remained stable in Washtenaw County. In 1980 more than 88% of the total prime farmland in each county still remained undeveloped.

ACKNOWLEDGMENTS

I would like first of all to thank the members of my graduate committee for their help and support during my graduate studies and associated research. There was much advice and counsel from Dr. Raleigh Barlowe, my major Professor. My research work grew out of a mutual concern and interest shared with Dr. Delbert Mokma, my minor Professor. My research was primarily funded, with the help of Dr. Daniel Chappelle, by the Michigan Agricultural Experiment Station.

My deep appreciation is also extended to my colleagues in the Department of Resource Development: especially my office-mates in Room 330. A good deal of my education occurred there with them.

As Graduate Secretary, Joann Silsby helped me enumerable times in a host of ways.

A special thanks to my parents for their prayers and support over the years, and thanks to my wife, Jennifer, for patiently bearing the brunt of my graduate school experience.

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CHAPTER ONE

PURPOSE OF THE STUDY

Introduction

Competition between agriculture, industry, home owners, and others for this nation's land resources is a well established and accepted phenomenon. It has only been in recent years, however, that many people have become concerned with the trend in shifts in land use. Irreversible shifts of agricultural, forest, open, and wetlands to urban or developed uses are now perceived to be a widespread problem. Although the vast surpluses of agricultural commodities which are being steadily produced by the nation's farming sector have kept this problem from being readily seen by large segments of our society, many believe these surpluses have resulted only with great cost in terms of land quality, increasing use of chemical fertilizers, pesticides, and a rather long term of "unnaturally" good climatic conditions that cannot be counted on in the years and decades to come.[1]

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[1] See, Louis M. Thompson, 1975. World Weather Patterns and Food Supply. J. Soil and Water Conv. 30(1): pp. 44-47.

We are becoming more aware of the fact that the actual physical quantity of land we have is limited and irreplacable, particularly the quantity of soils rich in natural fertility.

In Michigan we see the same phenomenon occurring. The importance of our agricultural land base has been driven sharply home with the current recession and slump in the auto industry. Many citizens believe we should put less reliance in the auto industry and more in our agricultural industry. A Michigan Public Opinion Survey conducted in 1979 indicated that 41% of the people surveyed thought that state government should spend more money on preserving prime and important lands from loss to urban development.[2]

The Problem

Many public and private groups and individuals are working to find answers that will help retard the present shifts in land use and for this work require varying types and amounts of information about Michigan's land resources, current land uses, projected future demands for land uses, and the whys and hows of shifts in land use, etc.

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[2] W. J. Kimball, et al., Report on Results of the Michigan Public Opinion Survey, Michigan Citizens Speak Out on Community Problems, Preferences and Government Spending. Michigan State Univ. Agr. Exp. Sta. No. 378, July 1979.

Available information indicates that between 1975 and 1979 Michigan lost 7.9 percent, or 900,000 acres of its farmland base to non-farm uses. While information of this nature indicates trends in land use patterns and the general area of these trends, much of it is too general to be of real help in terms of problem-solving or planning. Accurate information about specific areas of the state are critically needed.

When looking at this problem from the state level there are still questions as to how our land resources should be defined. The SCS LIM division is currently producing an Important Farmland Inventory (IFI) which delineates and inventories prime farmland, nonprime farmland, unique farmland, and urban built-up areas. Although it does provide important information, the IFI has shortcomings in terms of spatial and temporal dimensions of the information. The urban built-up areas are restricted to parcels of at least 10 acres, and these must have a density of one (urban) unit per acre or more. It is possible that much of the loss of farmland is occurring in aggregates smaller than 10 acres, but data on how much and where is scarce. If solutions to this problem are to be found, additional information will need to be forthcoming. All information has a cost. Generally speaking, the greater the precision, smaller the scale, and broader the scope, the greater the cost of the information. Information about land use is definitely needed; the scope, scale, and level

of precision of the information will all depend on how willing people (both public and private groups) are to pay the cost.

Perhaps a comment on the use of land use information is in order here. Though far from exhaustive, and rarely complete enough, information about land uses is available in significant quantities. A significant aspect of the problem at hand is the many ways the information is interpreted. Very often two individuals arrive at contradictory conclusions using the same information.[3] While this particular aspect of the larger problem is not under examination in this study, it should, nevertheless, be kept in mind whenever land use information or data are analyzed or interpreted.

Objectives of the Study

The concern over losses in our state's (and nation's) prime agricultural lands, and the realization of the lack of information about losses from smaller parcels than the parcels included on the IFI, prompted this researcher to undertake this study. The objectives of the study are as follows:

1. To estimate the amount of land which has been lost

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[3] See, R. Neal Sampson, Building a Political Commitment to Conservation. J. Soil and Water Conservation 37(5): pp. 252-54.

to non-farm uses in small aggregate units not included on the IFI in two southern Michigan counties, and to examine these changes over time.

2. To determine the change in urban losses on the IFI over time and together with data from study objective number one above, determine, if possible, the trends these losses have or may be taking.
3. To determine whether the net effect of all factors influencing land usage is biased either for or against use of prime farmland.
4. To evaluate the sampling method by which the area of small urban areas is estimated.

Definitions

The terms "prime", "nonprime", "unique", and "urban" will be used interchangeably with "prime farmland", "nonprime farmland", "unique farmland" and "urban land", respectively. This study assumes the same definitions for these terms as used in the IFI.[4]

The terms "urbanization", and to some extent "loss", are defined as a shift of land use from agriculture or other minimally or nondeveloped land to an irreversibly

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[4] U.S. Dept. of Agriculture. Soil Conservation Service, 1975. Revised Feb. 1981. Prime and Unique Farmlands. Land Inventory and Monitoring Memo #3. Washington D.C., 5 pp.

developed or urban use. By "irreversible" it is meant that the land surface has been altered to such an extent (foundation for a building, parking lot, roadway, etc.) that reversion to agriculture, forests, open-space, wetlands, etc., would not be economically or technologically feasible in the foreseeable future. "Loss" does not indicate ownership or intended use. Due to the nature of the data gathering technique, only physical losses observable from aerial photography are included.

Terms referring to the land such as "soil", "soil type", "capability class", are taken from the SCS Soil Survey and are defined in the same way. "Survey" and "soil survey" refer to the SCS Soil Survey of the given county.

CHAPTER TWO

HISTORICAL PERSPECTIVE

This study deals with the question and problem of the loss of farmlands in Michigan in particular, and the United States in general. In recent years there has been an ever increasing public outcry over the loss of farmland in absolute acres as well as the relative rate at which this loss is occurring. Before one can deal with this topic, several questions arise that should be considered.

The first question is whether there is any loss of land at all. This question is as old as the nation itself, and was voiced often as the population and demand for land grew. In hind sight we can say that a negative answer was correct years ago because of the tremendous land base we possessed. Today the truth or falsity of this argument is much more difficult to establish. Not only are we at the spatial limits of our land resources geographically speaking, but the land use mix is continually changing. One of the most difficult aspects of this whole area of inquiry is acquiring accurate information about the amount of land used for each purpose and the rate at which use requirements for a given area change.

One question often asked by concerned people is why

farmland has been singled out for "preservation" or "conservation" as opposed to essential forest lands, or essential open lands, etc. It appears that many people involved with the problem of land use have a difficult time answering this question. Answers have been sparse, and those given are general and brief. The problem arises in deciding at what point the development process should be halted.

This question can only be answered when society's goals with regard to land use have been clarified. If society desires to preserve land in its' "natural" condition, then a forest use is called for (or grassland, or marsh, depending on the location). If the concern is only with non-urban uses, then it would be much simpler to combine forest, agricultural, open space, etc., categories into one category. Many "conservationists" or "preservationists" seem to accept the conversion of forest lands to agricultural lands as a matter of course in a market system, but then reject a similar conversion of agricultural lands to urban uses. Other individuals who oppose "artificial" intervention tend to accept the workings of the market no matter what the outcome, believing that the market will allocate land resources in the most efficient and economic manner.[1] The course of action taken by many

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[1] See, Clifton B. Luttrell, Our "Shrinking" Farmland: Mirage or Potential Crisis? Review. Federal Reserve Bank of St. Louis. 62(8): p. 11.

groups and individuals is to ignore this question altogether, and only address the "loss" problem in terms of one or the other use, i.e., loss of forest lands, or loss of agricultural lands, but not both.

A second question, and one of vital importance, is "How do you define farmland, or essential farmlands?" The answer to this question has been the topic of debate for years, even before the outcry over the loss of farmland commenced. Because of its importance, this question will be dealt with in greater detail later in this chapter.

History of Land Classification

Since the start of recorded history man has attempted to classify the land he lived on and cultivated in terms of its uses. Biblical writers describe the Promised Land as "...a land flowing with milk and honey...". Egyptians were well aware of the value of alluvial lands created by annual flooding of the Nile River. In a series of essays on agriculture, John Taylor, in 1803, described various kinds of land in terms of it being marshy, or "...that country below the mountains is of a sandy soil...".[2] As the population moved west, it didn't take long for the

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[2] John Taylor, Arator: Being a Series of Agricultural Essays, Practical and Political: In Sixty-Four Numbers. M.E. Bradford, ed. Liberty Classics, Indianapolis, 1977.

great plains to be recognized as a gold mine of rich soils.

In 1934, the National Resources Board produced a report for the President in which physical factors of soil productivity were included as part of a rough classification scheme.[3] All land of the nation fell into "grades" 1-5, with 1 being the best agricultural land. The first gathering at the national level to discuss land classification occurred in 1940 at the University of Missouri. Much of the discussion revolved around the topic of defining what "classification", in regards to land, actually meant. There was considerable concern over the possibility of "freezing" land into one or the other classification.[4] This fear was likely due to the fact that the concept of a national land classification system was somewhat new, and in terms of a classification system being a tool for the decision maker, perhaps not understood as well as it is today.

At the present time there are various land classification systems being used by different groups and for different reasons. The one likely to be most widespread is the "capability classification" of the Soil Conservation Service (SCS). Technically speaking, the system is more

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[3] National Resources Board Report. 1934. Part II. Report of the Land Planning Committee. Section II: 108-152. U.S. Govt. Print. Off., Washington D.C.

[4] Proceedings of the First National Conference on Land Classification. 1940. Bulletin 421. Univ. Missouri Agr. Exp. Sta., Columbia, MO.

one of limitations than it is one of capabilities. All soils are brought under eight "Classes" (Class I - Class VIII). Soils in each Class are defined by the degree of limitations for agricultural purposes.

Another classification system is that of the National Inventory of Soil and Water Conservation Needs. This system emphasizes non-urban land resources and provides data related to uses, as well as conservation practices required for the maintenance or improvement of the soils under given uses. Data for the system are collected (there are provisions for monitoring and updating) by sampling techniques and inventories are determined through statistical estimation methods.[5] Other well known classification systems, or perhaps, indexes are the "Storie Index",[6] used primarily in California, and the "corn suitibility index",[7] used largely in the corn belt.

With this brief glance at historic land classification in the U.S., let us now turn to the actual concept of land classification itself, what it might mean, what it does and doesn't involve, and assumptions that need to be made before classification can begin.

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[5] National Inventory of Soil and Water Conservation Needs. 1967. Stat. Bul. No. 461, U.S. Dept. of Agr.

[6] Earl R. Storie, Revision of the Soil Rating Chart. Calif. Agr. Exp. Sta. 1959.

[7] T. E. Fenton, et al., Productivity of Some Iowa Soils. Iowa Agr. Home Econ. Exp. Sta. and Coop. Ext. Serv. Spec. Rep. 66. 1971.

Land Classification

Objectives of Land Classification

It is impossible to consider the problem of land classification without first addressing this area of objectives. The basis of classifying anything is first and foremost the purpose for which the information will eventually be used. What will the information be used for? What decisions will be based upon the information? What may be the impacts of wrong decisions due to wrong, or irrelevant information? Will the information be all inclusive, or will there be other sources from which additional information can be obtained? Who will use the information? Many more questions are on this list, but these, and the answers to these questions, indicate the complexity, and yet, necessity to deal thoroughly with objectives. This principle was clearly stated as early as 1940, in relation to land classification.[8] The intervening years have left the question of objectives unresolved in any final sense; it probably can't be either. The important thing is that to the extent possible, objectives need to be discussed, clearly stated, and realistically achievable under present technological and knowledge limits. Perhaps some

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[8] Proceedings of the First National Conference on Land Classification. 1940. Bulletin 421. Univ. Missouri Agr. Exp. Sta., Columbia, MO.

discussion about specific objectives will help to clarify this concept.

Assume for the present that land classification data are intended as a basis for land use decisions. One of the first questions which come to mind is whether this classification will be supplemented, or if it will stand alone as the sole source of information. The answer to this question will, to some degree, set the scope of the data. With supplemental information, land classification data could narrow in on purely physical characteristics of soils. For instance, rainfall and temperature data may not need to be included in a soil classification system if detailed climatic information is easily accessible. Alternatively, it might consider spacial aspects in addition to the physical; another approach might not consider physical characteristics at all, only spacial and cultural/political (ownership, jurisdiction, etc.). In other words, parameters for which there is no specific purpose or use should probably be excluded from a land classification system.

Will the land classification system be used in a local or regional level, or will it be used nationally? The answer to this question will clarify what should or should not be included in the system, or may also suggest a scale or aggregate size for various parameters. An index such as the Storie index need not include parameters of Minnesota soils because it is only being used in California.

Likewise, the SCS capability classification, if it is to be used nationally, needs to be general enough to be easily applied in every state, and to most soil conditions.

A very important point when thinking about land classification systems is whether or not there will be consideration of the temporal dimension. Will the data be used to make decisions over longer periods of time or only used once? Here the objective will indicate the need for updating of the data, monitoring, addition of parameters, possible technological advances which might affect data gathering, data analysis, and so forth.

Lest it be thought that a land classification scheme is strictly limited to data gathering and dissemination, consider that it may, in a crude sort of way, be evaluative of data. For example, one could, based on known technologies, index land in terms of it being a certain type of agricultural land actually or potentially. If a large coal deposit lay under the surface of a particular soil, which was presently highly productive agriculturally speaking, it may not have a high potential for retaining this agriculturally productive potential. Such evaluations could be built into a land classification system if desired.

Finally, some other objectives for a land classification may involve economic characteristics of land, economic returns based on the intensity of various inputs, i.e. oil, energy, pesticides, amendments, etc. Similarly,

information on environmental or spillover type costs could very well be an objective of a land classification in today's world.

Assumptions of Land Classification

These next few paragraphs briefly touch on assumptions which are frequently held when approaching the subject of land classification. Assumptions are seldom totally correct or incorrect; often they can't be proven either way. Therefore, it is important to realize that they exist, and consider their "coloring" influence when information from a land classification system is evaluated.

The first assumption is clearly stated by William W. Wood:

> "The basic assumption on which land classification is undertaken should be clearly understood. The traditional reliance upon market allocation of land is the issue. Since we have tentatively concluded that the market allocation system is not adequate to meet all present, let alone future, goals of society, a political decision is involved in such classification."[9]

The assumption made by Dr. Wood that the market no longer works in its allocation role is clearly stated. Whether or not it is right or wrong is another matter; important to us for the moment is the fact that it was stated. Having thus stated his assumption(s), his interpretations of land

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[9] William W. Wood, Review in "Perspectives on Prime Lands." U.S. Dept. of Agr. 1975.

classification information can be understood in light of his rejection of market forces.

A second, and probably more widely held assumption is that we are losing prime agricultural land. Thorough examination of current literature indicates that popular as this position may be, it is far from unanimous. People holding to one or the other view often draw opposite conclusions from the same classification information.[10]

A third assumption is that once information from a land classification system becomes available, solutions to the various land use conflicts will be found. This isn't necessarily the case. Knowing how and why an earthquake occurs doesn't really help control one. Likewise in land use; knowing all the information about land use and the factors influencing it doesn't guarantee that solutions to land use problems will be forthcoming.

The topics just discussed are foundational to the discussion of land use information, prime land classification, prime farmland classification, loss of different types of land, etc., and a good understanding of this study can only result if this foregoing information is understood.

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[10] See, R. Neil Sampson, Building a Political Commitment to Conservation. J. Soil and Water Conservation. 37(5): 252-254.

Definition of Prime Farmland

The purpose of this study is to determine irreversible losses of prime farmland to various aggregate sizes of urban (non-farm) developments or uses. Before beginning such a study it is necessary to define what is meant by the word "prime" or "prime farmland". The preceding part of this chapter laid a foundation upon which a discussion of definitions can occur. Many definitions have been given over the years, each having strong and weak points. Since this study is not concerned with developing a classification system or a new definition of farmland, it has adopted the U.S. Department of Agriculture's Soil Conservation Service (SCS) definition of prime farmland. A SCS subdivision, the Land Inventory and Monitoring Division (LIM), has been working in this area of prime farmland definition, identification, classification, and inventory. Their definition of prime farmland is both qualitative and quantitative in scope. It states:

> "Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forestland, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity,

> acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively errodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding."[11]

Comparing this qualitative definition with the previous discussion on objectives certainly reveals many things about this definition. More than physical criteria are involved in the definition. There is mention of "economically sustained high yields". The same phrase indicates a temporal dimension to the definition. Notice that inclusion in the prime category is somewhat restricted to "modern farming methods". Modern farming methods change, and therefore, future additions and subtractions into the prime category appear possible.

Following this qualitative aspect of the definition, the SCS added a basically quantitative definition that listed nine characteristics which land must have for it to be classified as prime farmland.[12] It is interesting to note that of all nine characteristics, not one is purely a physical property of soil. The characteristics of permeability and erodibility are nearly so, but these, as all the others, are greatly influenced by climate, topography, and management of the soil. In fact, the characteristics

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[11] Soil Conservation Service. U.S. Dept. of Agriculture. Advisory LIM-12, LIM Task Force Report. November 1974, and revision in February 1981.

[12] See Appendix C for the complete text of the definition.

which require certain levels of moisture during the growing season make ample provision for the application of irrigation water. The important thing to note is the fact that the definition is loose enough so that changes in farming technology, management techniques, economic conditions, and even climatic shifts can change which lands may or may not be included in the prime farmland classification.

Summary

The major topics of this Chapter focused on the historical background of land classification, and on foundational concepts upon which land classification systems must be based. In the following Chapter the emphasis shifts from a general discussion to the research conducted in two specific Michigan counties.

CHAPTER THREE

RESEARCH METHODS

Recognizing the fact that agricultural land is being shifted irreversibly into urban uses is not enough knowledge with which to gather data and "study the problem". Along with any information already available one needs to conceptualize how, why, when, and where these conversions may be occurring in order to determine what types of information would most readily help in the problem solving process. The discussion in the preceding chapter on objectives of a land classification system complements the present discussion.

The process of urbanization can be conceived as occurring in two ways. First, it occurs in large aggregates often referred to as subdivisions, industrial parks, shopping centers, etc. For numerous reasons these large urban aggregates usually border existing urban boundries, but may also occur at some distance from existing urban areas.

The second aspect of the urbanization process is that development which occurs outside the physical boundries of any subdivision. These developments may occur as a single house, store, shop, etc., or as several houses or urban

units bounding each other but having a cumulative area of less than 10 acres. This phenomenon of an urban use of small acreage located some distance from an urban center has not always occurred. Although no concrete empirical data exists concerning this type of land use, many informed individuals think that little of this type of development occurred prior to 1940.[1]

Several contributing causes could account for a majority of these individual units. A general increase since 1940 of the desire of the urban population to be closer to nature, decreases in transportation costs along with better roads, increasing personal incomes of the urban population in general, deteriorating conditions within larger urban centers, and lower property taxes are all factors that have contributed to the increased number of smaller urban developments.[2]

Because of their nature as relatively large acreages and their location near urban areas, much more information

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[1] This conclusion (including the date) was reached after conversations with various Michigan State University faculty members, county extention directors from St. Clair and Washtenaw Counties, district conservations from St. Clair, Washtenaw, and Eaton Counties, and county planners from the Washtenaw County Planning Commission in Ann Arbor and the St. Clair County Metropolitan Planning Commission in Port Huron.

[2] For a more complete discussion of the reasons for these small urban units See; Francis O. Arthur, An Analysis of Private Land Fragmentation by Land Holdings of Less Than 11 Acres in Michigan. Ph.D. Dissertation. Michigan State University, 1981.

is available dealing with the shifts in land use into these subdivisions than is known about the small units. Data are much easier and less costly to obtain for subdivisions, and until recently, few thought that these small acreages amounted to significant losses of agricultural lands. It is becoming apparent that in some areas these units could contribute a significant portion of the losses of agricultural lands, but because of their nature as small, somewhat isolated units, very little concrete information has been gathered about them. Consequently, most of the information that is available about these units are at large scales (county or regional levels), and provide little in terms of accurate estimates or actual measurements about the area of land which is being shifted into these smaller urban uses.

Description of the Study Area

Two counties were chosen for examination. The basis of selection was two-fold: (1) data bases had to be available for both counties for each of the years under examination; (2) an attempt was made to select one county which had somewhat of an "urban" character and one which seemed to be more "rural". The counties selected are located in southeastern lower Michigan; one being Washtenaw County and the other St. Clair County (Figure 3-1).

Washtenaw County encompasses an area of 716 square

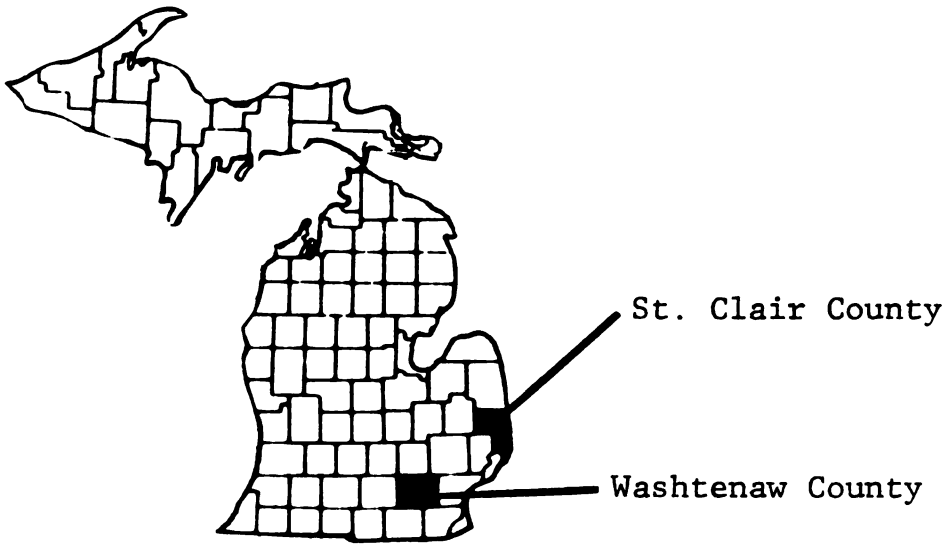

Figure 3-1. County Locations.

miles or 458,000 acres. The western portion of the county consists almost exclusively of moraines and outwash areas and is quite rolling. As one moves east the terrain gradually becomes less hilly until, in the south and eastern most part of the county, the landscape is nearly level lake plain. Ann Arbor and Ypsilanti are the two major urban centers and are located in the center and eastern part of the county. Education (The University of Michigan and Eastern Michigan University) and research and development are the primary industries. In 1980, the county population stood at 264,478, up 13.1 percent from 1970.[3] In terms of agriculture, the climatic conditions

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[3] U.S. Dept. of Commerce. Bureau of the Census. 1980 Census of Population and Housing, Advance Report. March 1981.

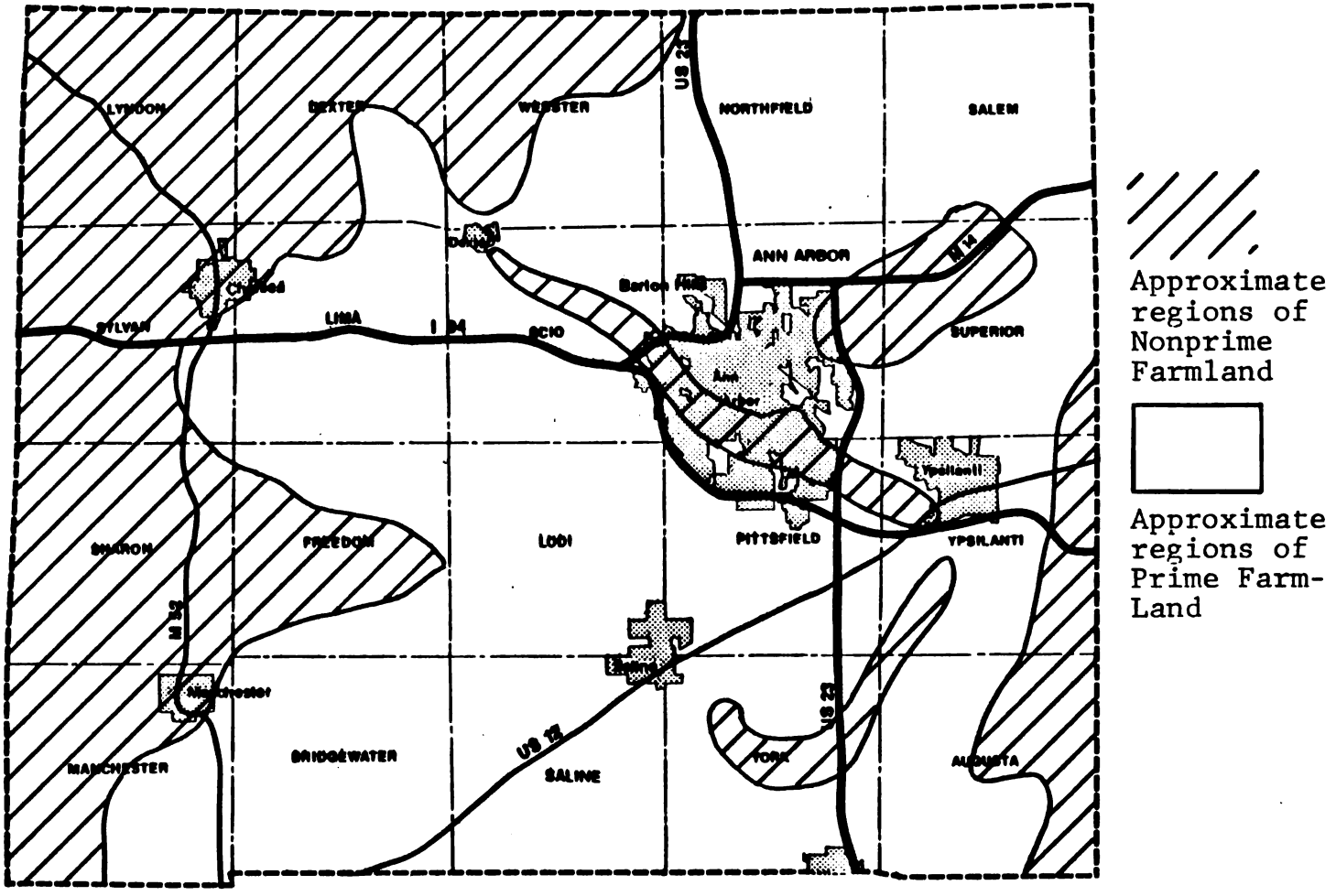

Figure 3-2. Washtenaw County.

are such that most common food and fiber crops can be grown. About 49 percent of the land area is mapped as prime agricultural mapping units as defined by the IFI, but not all of this land is under cultivation.

St. Clair County is the eastern most county of the state and is located approximately 60 miles northeast of Detroit. It is slightly larger than Washtenaw County, having an area of 473,600 acres, or 740 square miles. The county seat, Port Huron, is the major urban area, although urban development is found along most of the eastern boundry (along the St. Clair River). No single industry dominates the county economy. Salt is mined under the county, and there is a major natural gas storage area in the southeastern part of the county. The 1980 U.S. Census Data indicate that the 1980 population stood at 138,802, up 15.5 percent from 1970. A majority of the western two-thirds of St. Clair County is nearly level lake plain, while the eastern and southern areas are mostly moraines and outwash areas. Prime agricultural mapping units comprise 63 percent of the county, but slightly less area is under cultivation.

Sources of Data

In order to address the temporal dimension of losses of farmland via these large and small aggregates of urbanization, data were collected for two points in time: 1964

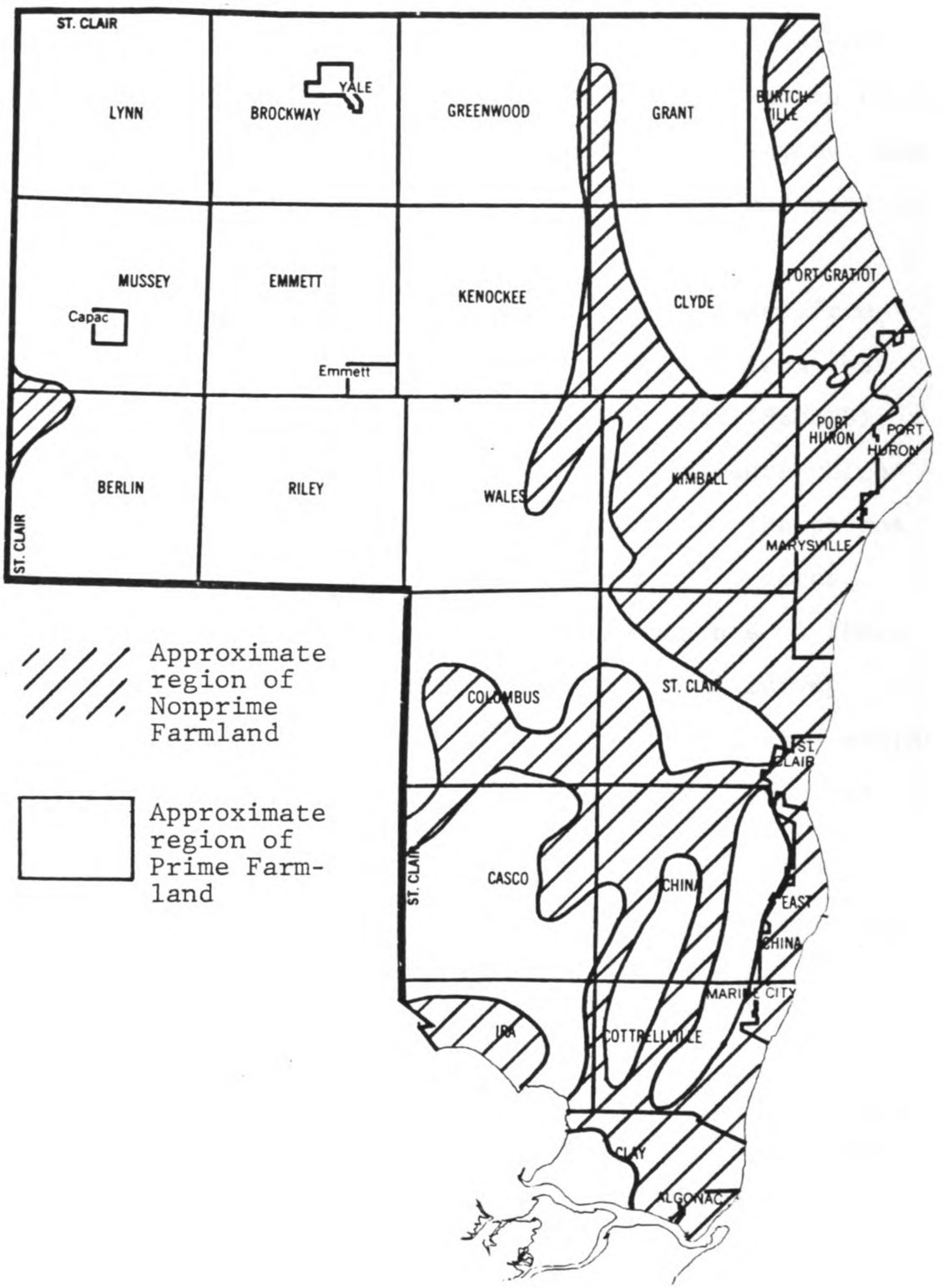

Figure 3-3. St. Clair County.

and 1979/1980. The range in years for the second date result because the IFI is dated 1979,[4] while data for the small urban areas were collected from aerial photographs taken in 1980. The IFI provided data on large urban areas for 1979, and also provided the definitions of prime, non-prime, unique farmlands, and urban built-up areas used in this study.

Urbanization data for small units were taken from aerial photographs dated 1980, and originated from the South Eastern Michigan Council of Governments (SEMCOG). The scale of the photos was 1:1000. Developments which were interpreted as non-farm were measured on the photos and later these measurements were converted to acres. Prime farmland and nonprime farmland components of these acreages were determined from the county Soil Survey Reports.[5] All the data for 1964 were obtained from aerial photographs at the SCS County Offices.[6] The scale was

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[4] U.S. Dept. of Agriculture. Soil Conservation Service. 1979. Important Farmlands, St. Clair County. Govt. Printing Office - 1980-653-472. Washington D.C.
U.S. Dept. of Agriculture. Soil Conservation Service. 1979. Important Farmlands, Washtenaw County. Govt. Printing Office - 1980-653-709. Washington D.C.

[5] U.S. Dept. of Agriculture. Soil Conservation Service. 1977. Soil Survey of Washtenaw County, Michigan. Govt. Printing Office - 1977-212-665/59. Washington D.C.
U.S. Dept. of Agriculture. Soil Conservation Service. 1974. Soil Survey of St. Clair County, Michigan. Govt. Printing Office - 1974. Washington D.C.

[6] U.S. Dept. of Agriculture. Aerial Photographs of Washtenaw County and St. Clair County; 1964. Washington D.C.

1:20,000. Large urban areas (LUA) were delineated on the soil survey and then measured for area using a dot grid. Time constraints limited the amount of data which could be collected. Data collection time for the small urban units (SUA) was reduced. To accomplish this reduction it was assumed that the area of each SUA remained constant over time, i.e. once a SUA was established, it would not increase or decrease in area. Each SUA (1980) was measured once to determine area. Then, to obtain data for 1964, all that was done was to determine which SUA were present (and use the area calculated for 1980 as the area for 1964).[7]

Study Variables

This study focuses primarily on two variables. The first is the amount of land (in acres) which has been lost to small urban acreages. This value is determined by statistical estimating procedures via a single-stage cluster sample. The second is the total amount of land in each county lost to all types of urbanization. This value was obtained via a census of the large urban areas to

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[7] The assumption of equal acreages over time is probably incorrect. The most likely change in area over time would be an increase. Urban uses tend to expand over time rather than shrink. Because there is no information about how these areas change, the assumption was made and any associated errors will be accepted.

which the estimate of the small urban area population total was added. Several other parameters can be estimated from the data and will be briefly discussed in a later chapter.

These two variables are further analyzed in terms of some spatial and temporal components. Each variable has a mix of two spatial components; that part which occurs on prime farmland and that which occurs on nonprime farmland. The temporal component of the variable is the number of acres lost (dependent variable) during a given time period (independent variable). Meaningful as these absolute values may be, they lend themselves to comparison much better as relative values in terms of total county land area, and total county prime farmland area. Therefore, variables were converted to their respective relative values before many of the comparisons were made.

Definition of Dependent Variables

The large urban areas are defined by the IFI as all land developed for non-production agricultural use, larger than 10 acres in area, with a density of one urban unit per acre minimum. Development refers to the physical alteration of the surface of the earth to such a degree that reversion to agricultural production is economically infeasible in the foreseeable future.

The SUA are identically defined with the exception of the area and density requirement. Urban use does not refer to "urban ownership", and therefore, the only area included

was that which was intimately associated with a particular urban use, e.g. buildings, driveways, garages, immediate yards, etc. Small urban units (especially old farmsteads) which would today be considered urban, i.e. not presently related to any ongoing farm operation, but which were in existance in 1940, are not included in the definition of small urban areas. Such units, although presently urban in use, have not, as a result of the use change, irreversably developed land previously available for agricultural use. Since such units were existing at 1940, the change in use had no effect on the land base available for agriculture. There obviously was room for interpretation error during the data gathering process, but at a scale of 1:1000 the error is minimal.

Assumptions

Limited data for the year 1940, as well as time and cost restraints appeared to preclude inclusion of 1940 data into the study. After discussions with numerous university, county, and state officials it appeared that 1940 data might possibly be included under certain assumptions.[8] There was general agreement with the proposition that small urban areas (as defined) were essentially non-existant in 1940. No attempt was made to determine the

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[8] See, Footnote 1.

exact reasons for this phenomenon, but it was thought that the reasons for their presence today (See, Arthur) were not acting as strongly in 1940 as they are today. Based on these discussions and the stated assumption, this study will include 1940 data as being zero where the SUA are concerned.

Sample Survey Design

All data for large urban areas (LUA) were compiled as a complete census. The distribution of the small acreages precluded a census due to time and financial constraints. The next alternative was to sample the population and estimate the desired parameter using statistical estimating techniques. Since no frame of the population was available or economically obtainable, a random sample of the desired units could not be made and another sampling procedure had to be used.

Since the sections of a county can easily be defined and enumerated, they were selected for the primary sampling unit. The units of interest are the individual urban acreages which might occur within the selected sections, and therefore, the sampling design was that of a single-stage cluster sample where a complete census of each cluster was taken.

The following discussion elaborates on the sampling process and estimation techniques and relies heavily on

Cochran.[9] Even within the framework of a single-stage cluster sample there are many options available in terms of design. Various population characteristics will influence what specific designs are applicable. Generally speaking, as the available information about population parameters increases, less biased and more consistent sampling methods can be used. For this study let,

Mo = the number of SUA in the county

Mi = the number of SUA in the ith cluster

yij = area of the jth SUA in the ith section

N = number of clusters in the population

n = number of clusters in the sample

then, $yi = \sum_{i=1}^{Mi} yij = Mi\bar{y}i$ = total area of the SUA in the ith cluster where, $\bar{y}i$ = mean area per SUA in the ith cluster.

Given a random sample of n clusters, an unbiased estimate of Y is $\hat{Y}$, where,

$$Y = \sum_{o=1}^{Mo} Yij = \text{total of all SUA in the population}$$

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} Yi$$

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[9] William G. Cochran, Sampling Techniques, Second Edition. John Wiley and Sons, Inc. New York, 1963.

and $\hat{Y}$'s variance is

$$V(\hat{Y}) = \frac{N^2(1-f)}{n} \cdot \frac{\sum_{i=1}^{N} (yi - \bar{Y})^2}{N-1}$$

where, f = n/N = the sampling fraction and $\bar{Y}$ = Y/N = population mean area per cluster. All these parameters are useful for estimating other parameters of the population, but are not necessarily required. Several are not available to this study. Mo is not available. It can only be estimated. Y is also not available since it is a function of Mo. The same is true for $\bar{Y}$.

It should be understood that these estimates are "snap-shots" of one county for only one date, and therefore must be recalculated for both counties and for each date under consideration. The data for both counties are found in Table 3-1.

Table 3-1. Statistical Estimation Data.

	St. Clair Co.			Washtenaw Co.		
	1940	1964	1980	1940	1964	1980
N	664	664	664	684	684	684
n	0	45	45	0	45	45
f	0	0.068	0.068	0	0.066	0.066
Y	0	4359	12536	0	3979	11997
V(Y)	0	58006	115330	0	74092	179258
V(Y)	0	240	340	0	272	432

The values of Mi, yij, yi, and $\bar{y}i$ can be found in various appendices. The conventional 0.05 significance level was rejected in this study and replaced by an $\alpha = 0.10$ significance level. It is an objective of the study to keep n as small as possible, and also, because this study is to reveal new information about urban land uses, to reduce the possibility of accepting a hypothesis which is wrong. Both of these objectives were accomplished by increasing the significance level and accepting the greater possibility of rejecting a true hypothesis. The estimation of $\hat{Y}$ was calculated at an $\alpha = 0.10$ (significance level). The resulting $100(1-\alpha)\%$ confidence interval for $\hat{Y}$ is given by

$$(\hat{Y} - z_{\alpha/2} \frac{\sqrt{V(\hat{Y})}}{\sqrt{n}}, \quad \hat{Y} + z_{\alpha/2} \frac{\sqrt{V(\hat{Y})}}{\sqrt{n}})$$

where $z_{\alpha/2}$ denotes the upper $\alpha/2$ point of the standard normal distribution. Calculating through with the sample data we find,

Table 3-2. Confidence Intervals of $\hat{Y}$.

	$\hat{Y}$	Confidence Interval
St. Cl. 1940	0	(0,0)
St. Cl. 1964	4359	(4418,4300)
St. Cl. 1980	12536	(12619,12453)
Wash. 1940	0	(0,0)
Wash. 1964	3979	(4046,3912)
Wash. 1980	11998	(12101,11895)

Objective three requires the estimation of the ratio of SUA acres on prime farmland to the total area of SUA in the sample. Let,

mi = total area of the SUA in the ith cluster

ai = area of the SUA in the ith cluster on prime farmland

pi = ai/mi = ratio of SUA on prime in the ith cluster

$p = \frac{\sum_{n} a_i}{\sum_{n} m_i}$ = ratio estimate of SUA on prime farmland for the population

This ratio is slightly biased, but this bias is seldom of practical importance.[10] The estimated variance of p is

$$v(p) = \frac{1-f}{nm^2} \cdot \frac{\Sigma a_i^2 - 2p\Sigma a_i m_i + p^2 \Sigma m_i^2}{n - 1}$$

where $\bar{m}$ = mi/n = average area of SUA per section in the sample. The following table gives the estimates for the sample data.

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[10] See, Cochran, p. 65.

Table 3-3. Estimation of p.

	St. Clair County		Washtenaw County	
year	1964	1980	1964	1980
$\bar{m}$ (acres)	6.61	18.88	5.82	17.54
p	0.29	0.48	0.40	0.45
v(p)	0.00399	0.00486	0.0053	0.00359

Description of Population

The single-stage cluster sample requires a random sample of n clusters from the population. To accomplish this using a random number table requires a listing of all clusters (sections) in the county. Not every section in the counties are included in the frame. Recall that

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} yi$$

where N = number of clusters in the county. The term N/n is a function of N, and is a multiplier to estimate $\hat{Y}$ from Σyi. The frame defining N should, therefore, only contain those clusters which have a probability of containing SUA.[11]

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[11] There are sampling techniques in which the probability of selecting any particular cluster is proportional to that cluster's size (area of SUA), but these techniques were beyond the scope of this study. (See, Cochran, p. 252.)

Both counties contained sections which had zero probability of containing any SUA. These were primarily those sections which were 100% urban on the IFI. There were also some sections which were greater than 90% urban. Including these sections in the frame, and consequently in N, would give an inflated estimate of Y, and therefore, they were excluded from the frame. Lake Huron shorelines, Lake St. Clair shorelines, and the St. Clair River presented additional problems with St. Clair County. These resulted in partial sections (section area < 640 acres), for which the probability of containing an estimated number of SUA was similarly reduced. These partial sections were excluded from the frame if they contained less than one-third of a section. Two islands at the mouth of the St. Clair River were also excluded from the frame. They are primarily delta and marsh. Although there is limited urban development on them this comes only at large expense for dredging and filling. The areas thus excluded were approximately 30 square miles (4% of county area) in St. Clair County and 31 square miles (4.4% county area) in Washtenaw County.[12]

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[12] While these partial sections were excluded from the frame for the purpose of estimating Y, they were included for the census of LUA area.

Sources of Error

Whenever data are gathered, the possibility for there to be errors in the data always exist. Depending on the character of the data and the method of data gathering, the error which may result has numerous possible sources. There are four major sources of error in this study.

1. Measurement error. These would include errors in actually measuring the urban areas, errors in converting the measurements to acres, and the like.
2. Interpretation error. In this category come the errors which might result by incorrect photo-interpretation, i.e. interpreting a rural (farm) use as being an urban use or the opposite. Photo-interpretation technique was checked with a small pre-sample and found to vary less than 5 percent. In the actual sampling process, Washtenaw County was sampled first and the County Planning Commission had use data on every building in the county against which the sample interpretation was checked and corrected. At a scale of 1:1000 interpretation was extremely good (as opposed to a scale of 1:40,000 in the pre-sample). In St. Clair County, no land use data were available for individual sites. The assumption was made that this source of error would be very minimal and

that the two types of interpretation errors would cancel each other out.

3. Sampling error. Whenever a sampling procedure is used to estimate a population parameter (as opposed to a census), a source of error known as sampling error is always introduced. This is a well known fact, and procedures exist to minimize and estimate this error for a given population parameter, if the variation of the parameter within the population and the sampling design and intensity is known.
4. Secondary Sources. Whenever a secondary data source is used, any errors in those data are automatically accepted. During the data gathering phase of this research, there were some discrepancies over the urban area on the IFI St. Clair County map. Instead of using SCS data for urbanization in St. Clair County, the urban area was remeasured and the new value was used in this study. In Washtenaw County, the urban area was also remeasured, but the values were so close (within 1%) that the IFI data were used.

CHAPTER FOUR

RESEARCH HYPOTHESES AND STATISTICAL METHODS

Chapters One through Three introduced this study, stated the purpose and objectives, discussed background material on the topic of land classification and its relationship to this study, and elaborated on the research methods and data gathering techniques. We now turn to a discussion of the research hypotheses around which this research centered, and the testing of these hypotheses.

Three research hypotheses are in primary focus. They relate to objectives one (1) and three (3) in Chapter One.

SIGNIFICANCE OF SMALL URBAN UNITS

It is hypothesized that:

> "The amount of land which has been lost to non-farm uses in small urban areas not included on the Important Farmlands Inventory in St. Clair and Washtenaw Counties is less than 10% of that on the IFI, and should be neglected as a source of loss".

Rejection of this null hypothesis leads one to accept the alternative hypothesis, which concludes that losses of lands to these small aggregates is indeed significant and should be considered. The researcher subjectively decided

that the cost of determining losses to small urban units was not worth it if these losses accounted for only an additional 10% to urban losses as presented by the IFI.

LOSSES OVER TIME

The second hypothesis examined also relates to objective one but focuses on the temporal dimension. There are two distinct time periods under consideration and each will be examined alone. Assuming rejection of the null hypothesis above, it is hypothesized that:

> "No land was lost to urbanization via small urban units between the years 1940-1964".
>
> "No land was lost to urbanization via small urban units between the years 1964-1980".

These hypotheses would be accepted if all the urbanization by small urban units had occurred by 1940 (or by 1964 in the case of the second hypothesis). Rejection of these null hypotheses would suggest that these types of losses have occurred at different rates and at different times.

URBANIZATION AND PRIME FARMLAND

The last hypothesis to be addressed examines whether or not the urbanization process of Washtenaw and St. Clair Counties is biased, in its effect, towards utilization of prime farmland. It is hypothesized that:

> "The ratio of urban developed area (SUA and LUA) occurring on prime farmland to total urban developed area in Washtenaw or St. Clair County

is significantly different than the ratio of prime farmland in the county".

It is not within the scope of this study to examine any individual factors which have an influence on land use decisions. Nevertheless, the test of this hypothesis will suggest whether the combined influence of all factors results in a disproportionate use of prime farmland for urbanization or not.

Hypotheses Testing

All hypotheses were tested at $\alpha = 0.10$ (significance level).[1] The first hypothesis analyzes the data to determine the significance of SUA in losses of farmland. Since no list of SUA exists, a single-stage cluster sample was chosen as the sample design. Population characteristics and prior information about these characteristics influence the type of cluster sample which can be used for estimating purposes. Greater prior knowledge of the population permits the use of less biased and more consistent sampling methods.

The test statistic used to test the first hypothesis is $\hat{Y}$. Recall from Chapter Three that

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[1] See, Chapter Three for the rationale behind the choice of this significance level.

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} Yi$$

and that $\hat{Y}$ is an unbiased estimate of Y, the total area of all SUA in the population. The null and alternative hypotheses can be stated as:

H0: $\hat{Y}1964 < 0.10$ (Total urban area on IFI-1964)

H1: $\hat{Y}1964 \geq 0.10$ (Total urban area on IFI-1964)

Six tests would be required: three per county; one for each year (the hypotheses for 1964 are given as examples). Since the sample size is large, the rejection region of a level 0.10 (α) test is

$$R: \quad \hat{Y}1964 \geq x + z_{\alpha} \ (s/n)$$

where

x = 0.10 (Total urban area on IFI-1964)

z = α point from the standard normal table

s = V(Y1964)

Table 4-1 lists the test results. No data was gathered for 1940, but based on the assumption that the number of SUA was zero (therefore their area also equals zero), the conclusion is drawn that their area is less than 10% of the 1940 LUA area.

Table 4-1. Test Results of Hypothesis One.

	St. Clair Co.	
1940	$R:\hat{Y}_{1940} \geq x_{1940} + z_{\alpha}\frac{s}{\sqrt{n}}$	R: 0 $\geq$ 0
1964	$R:\hat{Y}_{1964} \geq x_{1964} + z_{\alpha}\frac{s}{\sqrt{n}}$	R: 4359 $\geq$ 1665
1980	$R:\hat{Y}_{1980} \geq x_{1980} + z_{\alpha}\frac{s}{\sqrt{n}}$	R:12536 $\geq$ 2292
	Washtenaw Co.	
1940	$R:\hat{Y}_{1940} \geq x_{1940} + z_{\alpha}\frac{s}{\sqrt{n}}$	R: 0 $\geq$ 0
1964	$R:\hat{Y}_{1964} \geq x_{1964} + z_{\alpha}\frac{s}{\sqrt{n}}$	R: 2979 $\geq$ 2659
1980	$R:\hat{Y}_{1980} \geq x_{1980} + z_{\alpha}\frac{s}{\sqrt{n}}$	R:11998 $\geq$ 3728

Testing for Losses over Time

To test whether or not significant losses via SUA have occurred over time, $\hat{Y}$ is once again the test statistic. The null hypothesis is stated as:

$$H0: \hat{Y}1949 \geq \hat{Y}1964 \quad \text{vs} \quad H1: \hat{Y}1940 < \hat{Y}1964$$

The reject region for H0 is

$$R:\hat{Y}_{1940} < \hat{Y}_{1964} + z_{\alpha}\frac{s}{\sqrt{n}}$$

Table 4-2 contains the results of all four tests. Once again zero is entered as the value for 1940 so that the time trend hypotheses can be tested.

Table 4-2. Test Results of Hypothesis Two.

	1940 - 1964	
St. Clair Co.	$R:\hat{Y}_{1940} < \hat{Y}_{1964} + z_{\alpha} \frac{s}{\sqrt{n}}$	R: 0 < 4313
Washtenaw Co.	$R:\hat{Y}_{1940} < \hat{Y}_{1964} + z_{\alpha} \frac{s}{\sqrt{n}}$	R: 0 < 3927
	1964 - 1980	
St. Clair Co.	$R:\hat{Y}_{1964} < \hat{Y}_{1980} + z_{\alpha} \frac{s}{\sqrt{n}}$	R:4359 < 12471
Washtenaw Co.	$R:\hat{Y}_{1964} < \hat{Y}_{1980} + z_{\alpha} \frac{s}{\sqrt{n}}$	R:3979 < 11918

Urbanization and Prime Farmland

This hypothesis is taken in two steps. The SUA and the LUA are each looked at separately.

Consider the LUA first. There is no estimation involved because the data originates from a census as opposed to a sample. The test statistic is P. Let,

TA = the total county area

PR = the area of prime mapping units in the county

UP = area of LUA on prime farmland

U = total area of LUA on IFI

$$P = UP/U$$

The null hypothesis is stated as:

$$Ho: \quad P_{1964} \neq P'$$

$$Hi: \quad P_{1964} = P'$$

where P' = PR/TA ratio of prime farmland in the county (this value is assumed to be constant). The rejection region is

$$R: \quad P_{1964} = P' \pm (0.05)(P')$$

Table 4-3 contains the rejection regions for the tests.

Table 4-3. Test Results of Hypothesis Three for LUA.

St. Clair County	
R: $P_{1964} = P' \pm 5\% P'$	R: $.235 = .632 \pm .0316$
R: $P_{1980} = P' \pm 5\% P'$	R: $.265 = .632 \pm .0316$
Washtenaw County	
R: $P_{1964} = P' \pm 5\% P'$	R: $.407 = .493 \pm .0247$
R: $P_{1980} = P' \pm 5\% P'$	R: $.524 = .493 \pm .0247$

Secondly, consider the SUA and the test statistic p. Recall from Chapter Three that

$$p = \frac{\Sigma a_i}{\Sigma m_i} = \text{ratio estimate of SUA on prime farmland}$$

The null and alternative hypotheses are stated as:

$$\text{Ho:} \quad P' < p_{1964} - \frac{\sqrt{V(p)}}{\sqrt{n}} \text{ , or } P' > p_{1964} + z_{\alpha} \frac{\sqrt{V(p)}}{\sqrt{n}}$$

$$\text{Hi:} \quad p_{1964} - z_{\alpha} \frac{\sqrt{V(p)}}{\sqrt{n}} \leq P' \leq p_{1964} + z_{\alpha/z} \frac{\sqrt{V(p)}}{\sqrt{n}}$$

Table 4-4 contains the rejection region tabulations for all years. The values for the components of these inequalities are found in Table 3-3.

Table 4-4. Test Results of Hypothesis Three for SUA.

	R: $p_{1964}-z_{\alpha}\frac{\sqrt{V(p)}}{\sqrt{n}} \leq P' \leq p_{1964}+z_{\alpha}\frac{\sqrt{V(p)}}{\sqrt{n}}$		
St. Clair Co. 1964	R: .278	$\leq .632 \leq$	.302
Washtenaw Co. 1964	R: .386	$\leq .493 \leq$	.414
St. Clair Co. 1980	R: .467	$\leq .632 \leq$	.493
Washtenaw Co. 1980	R: .439	$\leq .493 \leq$	.461

CHAPTER FIVE

RESULTS AND CONCLUSIONS

The purpose of this research has been to learn about urbanization that occurs in small units which I have defined as Small Urban Units (SUA), and how this urbanization relates to prime farmland. Previous chapters have presented the subject matter, reviewed the historical perspective of land classification, and outlined the research procedures and statistical methods which were followed during the research process. The current chapter will focus on the results of the research and hypothesis testing, and present conclusions which the research results seem to imply.

Results

Significance of Small Urban Areas

The question of primary importance to this study is how much land area is actually being used for the development of SUA. In this section I will examine and discuss the first two research hypotheses. The scope of the discussion will be limited to the individual county until

both counties have been discussed, at which time the two counties will be compared and contrasted.

ST. CLAIR COUNTY

The first research hypothesis stated that SUA comprised less than 10% of the area utilized by LUA. One assumption of the research was that SUA were nonexistant in 1940. Based on this assumption, the hypothesis was not rejected for 1940. The null hypothesis was rejected for 1964 and 1980 in favor of the alternative hypothesis, which proposes that SUA are indeed significant users of urban land area. In 1964, SUA utilized 4,359 acres of land. In relative terms, this amounted to 20.3% of all urban land. More significantly, and the quantity in focus by the hypothesis, this area was equal to 25.5% of the 1964 LUA area, making it 1.5 times greater than the 10% assumed necessary for significance.

Between 1964 and 1980 the area of SUA tripled to 12,536 acres. During the same time period LUA increased at a much slower rate: from 17,112 acres to 23,570 acres, or approximately a 38% increase. This put SUA equal to 34.7% of the county urban area, while relative to LUA area it increased to 53.2%.

Recall the second research hypothesis, that no land was converted to SUA between 1940 and 1964, and between 1964 and 1980. The testing results are found in Table 4-2, and in both cases the null hypothesis is rejected in favor of the alternative hypothesis (at the 0.10 significance

level). These statistical tests support what seems obvious from the data; that the process of urban development via SUA has been occurring, albeit at different rates, since 1940.

Table 5-1. Urban Area of St. Clair County.

	Acres in 1964	% of LUA	% of Total Urban	Acres in 1980	% of LUA	% of Total Urban
LUA	17,112	100	79.7	23,570	100	65.3
SUA	4,359	25.5	20.3	12,536	53.2	34.7

Leaving the aspect of land quality aside for the moment, note the fact that between 1964 and 1980, more actual acres were consumed by SUA than by LUA (8,177 vs. 6,458 respectively). This is a very interesting phenomenon in light of the assumption that no SUA existed in 1940; by 1980 they occupied a full one-third of the county urban developed area, and were increasing at a faster rate than were LUA.

WASHTENAW COUNTY

Turning to Washtenaw County we find the data revealing a similar picture to that of St. Clair County. Testing the first research hypothesis also culminated in acceptance of the null hypothesis for 1940, and rejection of the null hypothesis for 1964 and 1980. SUA were assumed to be non-existant in 1940, thus acceptance of the null hypothesis for 1940. By 1964, SUA had increased to a total area of 3,979 acres. This accounted for 12.8% of the total county

developed area of 31,091 acres, and was equal to 14.7% of the LUA area of 27,112 acres. In the following 16 years, SUA increase by 8,018 acres to 11,997 acres, while LUA area rose 10,974 acres to 38,086 acres. Relatively speaking, SUA now stood at 24.0% of the total county developed area of 50,083 acres, and equal in area to 31.5% of the LUA area.

Table 5-2. Urban Area of Washtenaw County.

	Acres in 1964	% of LUA	% of Total Urban	Acres in 1980	% of LUA	% of Total Urban
LUA	27,112	100	87.2	38,086	100	76.0
SUA	3,979	14.7	12.8	11,997	31.5	24.0

As in St. Clair County, that which seemed obvious through subjective observation was supported by the results of statistical hypothesis testing. The test results from testing the second hypothesis affirmed the alternative hypothesis; that SUA area significantly increased in both time periods (1940-1964 and 1964-1980).

COMPARISON AND CONTRAST

St. Clair and Washtenaw Counties were selected for this study on the basis of several criteria. One primary criteria was the degree to which the county was developed or urbanized. Since no quantitative scale was available with which to evaluate the counties, the selection process was somewhat subjective in nature. Personal knowledge of the researcher and his advisors about the counties played

a major role in the selection process. Other factors included population data, amount of business and/or industry, the extent of the agricultural sector of the county, and availability of aerial photographs of the counties for similar dates.

On the basis of these criteria, St. Clair County was selected as the "rural" or "nonurbanized" county (in terms of its overall character), while Washtenaw County was included in order to have a contribution from a "urbanized" county. Since no similar study was on record, it was thought that there might be some significant differences as to the growth and character of the SUA within these two different types of counties. The research data do indeed reveal some interesting information about the two counties.

This portion of comparing and contrasting will only deal with urbanization as previously defined without further distinction. One of the following sections will address the relationship between urbanization and prime farmland.

Basic geographical data of the counties appears in Table 5-3. Both counties have nearly identical land areas

Table 5-3. County Physical Information.

	St. Clair County (acres)	Washtenaw County (acres)
Total Co. Area	473,600	458,000
Water Area	11,072	8,070
Land Area	462,528	449,930

(approximately 10,000 acres or 2% difference), making comparisons a bit easier. In 1964 the total urban areas for St. Clair County and Washtenaw County were 21,471 acres and 31,091 acres, respectively. Relative to the total county area these areas comprised 4.6% in St. Clair County and 6.9% in Washtenaw County. In this case the urban county had an additional 50% more developed land area than did the rural county. The question naturally arises about how these areas were divided between the LUA and the SUA. In St. Clair County, 79.7% of total was contributed by LUA and the remaining 20.3% were contributed by SUA. In Washtenaw County these proportions were 87.2% and 12.8%, respectively. This relationship is one which could possibly be used to describe the urban development of a given county, although further examination will not provide clear guides as to what ratios might be expected for a rural vs. an urban county. This relationship is also a very dynamic one, as we shall soon see, but it may be useful to indicate how concentrated the urbanization of the county is for any given date.

Turning to 1980, the interesting data is not only the "snapshot" view of each county, but also the relative aspects of what occurred, and how the various relationships changed over time. In St. Clair County there was a 68.2% increase in total urbanized area. For Washtenaw County the increase was slightly lower at 61.1%. The absolute increases in acres were 14,632 acres (to a total urban area

of 36,106 acres) in St. Clair County, and 18,992 (to a total urban area of 50,083) acres in Washtenaw County. While Washtenaw County showed a greater increase in absolute area, St. Clair County's urban area was growing at a slightly faster rate.

Results of testing the first hypothesis for 1980 supported the hypothesis (as it did for 1964) that SUA occupied at least 10% as much land area as LUA. Data for 1980 revealed that both counties experienced greater (relative) growth in the SUA sector of urban development than they did LUA growth. Recall the proportion of SUA to LUA in 1964. Setting these juxaposed to 1980 data results in Table 5-4, and Figures 5-1 and 5-2. The data disclose a tremendous increase in the area of SUA in St. Clair County, with a threefold increase in absolute area, amounting to a full one-third of the county's urbanization. Contrast this with Washtenaw County where the urban development was concentrated more in the LUA sector. In Washtenaw County the SUA increased from 12.8% of the urban area to 24.0%, or one-fourth of the urban area.

Table 5-4. Comparisons of Urban Areas.

	St. Clair County				Washtenaw County			
	1964		1980		1964		1980	
	acres	%	acres	%	acres	%	acres	%
LUA	17,112	79.7	23,570	65.3	27,112	87.2	38,086	76.0
SUA	4,359	20.3	12,536	34.7	3,979	12.8	11,997	24.0
Total	21,471	100.0	36,106	100.0	31,091	100.0	50,083	100.0

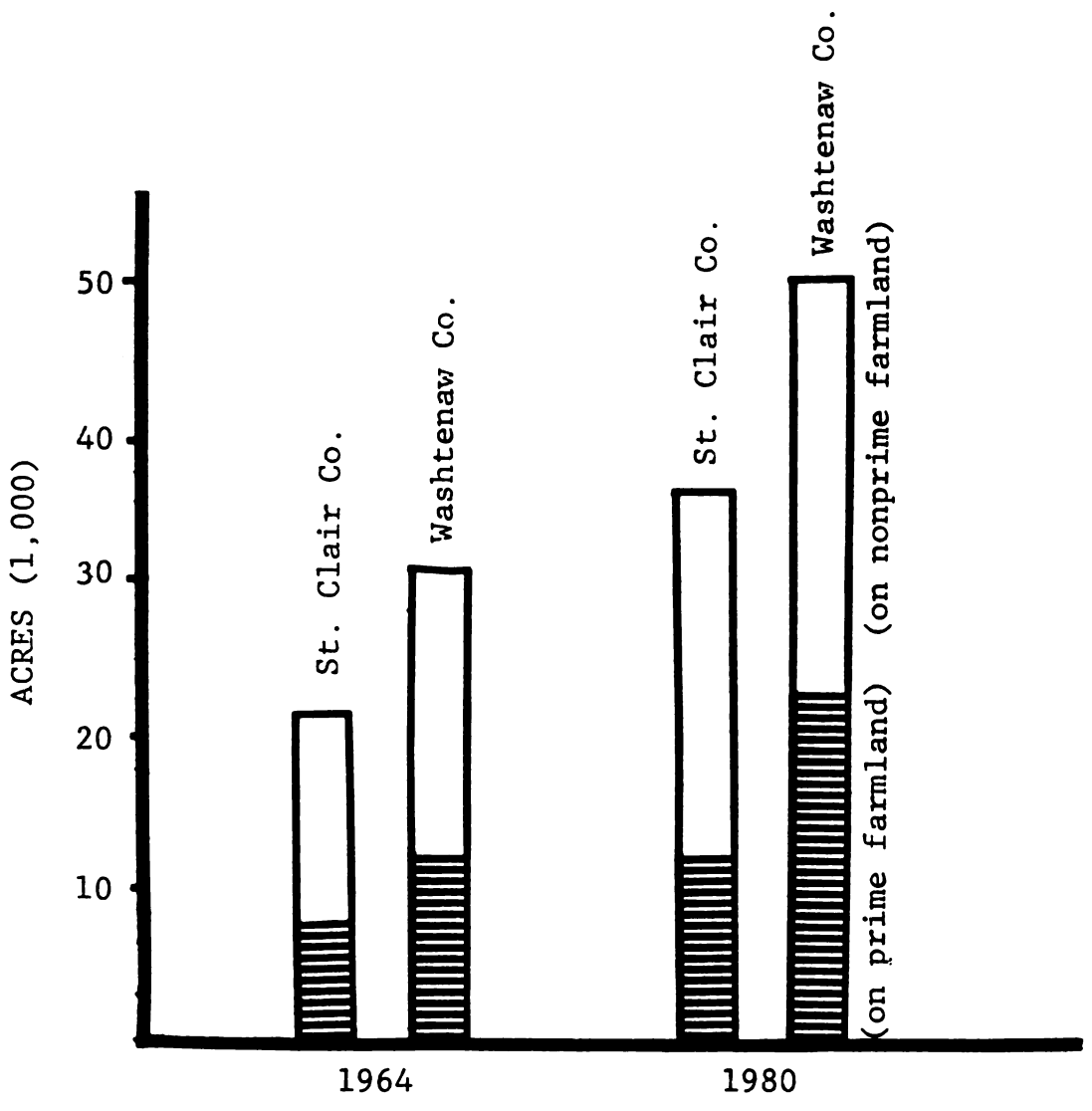

Figure 5-1. Total Area of Urbanization on Prime and Nonprime Farmland.

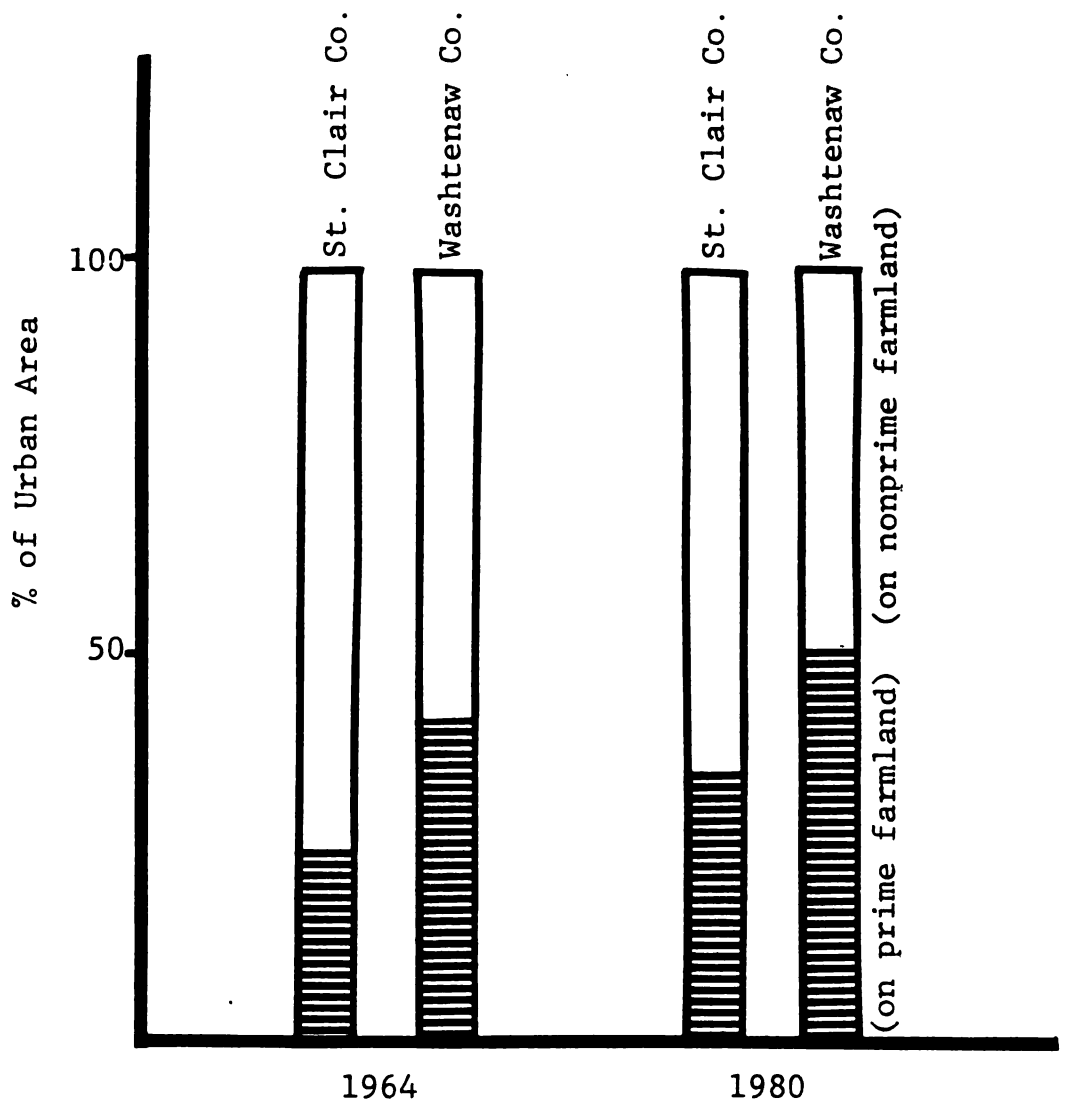

Figure 5-2. Percent of Urban Area on Prime and Nonprime Farmland.

The difference in relative value of SUA is one of the significant differences which distinguishes the two counties. The counties are nearly identical in terms of absolute area of SUA, as well as in SUA as a percent of the total county area (both counties had 0.0% SUA in 1940, 0.9% SUA in 1964, and 2.7% SUA in 1980). The real distinction between them lies in the fact that SUA comprise over one-third of the developed area in St. Clair County, while they barely comprise one-fourth of the same area in Washtenaw County. This is one major difference in the urbanization process of these two counties.

Related Comments

Other information can be gleaned from the data and some is worthy of comment. Efficient use of land is very difficult to define and measure. While land use efficiency is not the topic of this study, there is one interesting relationship (which defines this efficiency in a loose way) evident when this study's data are combined with that of the U.S. Census.[1] Dividing the total urbanized area (SUA + LUA) in each county by the population for the same date results in the ratio of urban acres per capita, or "efficiency ratio". By 1964 there is already a marked

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[1] U.S. Department of Commerce. Bureau of the Census. 1980 Census of Population and Housing, Advance Report (PHC80-V-24), Michigan. Issued March 1981.

difference between these two counties. This contrast becomes greater by 1980 due to a 36% increase in the efficiency ratio in St. Clair county and only a 20% increase of the same ratio in Washtenaw County. If the efficiency ratio of Washtenaw County were identical to that of St. Clair County (without reducing the 1980 population), it would have an urban area of approximately 69,000 acres.

Table 5-5. Urban Area Population.

	St. Clair County			Washtenaw County		
	urban area	population	area/person (acres)	urban area	population	area/person (acres)
1964	21,471	112,391	0.19	31,091	197,105	0.16
1980	36,105	138,802	0.26	50,083	264,748	0.19

Many factors affect this ratio. Included in the urban area is the area of all urban uses in addition to residential use. No distinction is made between the "efficiencies" of LUA and SUA. Further research may indicate why the ratios are what they are. Some types of industry and business certainly need greater amounts of land area to operate than other types. Other factors which could influence the ratio are zoning laws specifying area requirements, subdivision or platting regulations, the demand level for non-urban land uses, and the price which an acre

of land commands in each county.[2] Census data indicate that the number of persons per household is, and has been, on the decrease. Smaller families, increased divorce rates, alternative life styles, etc., are all factors influencing this trend, and consequently, they also cause an increase in the area of urban land required per individual. This relationship is very interesting, and one which opens many avenues of inquiry.

Area of Individual SUA

The two primary factors which together have the most influence on the total SUA area are, 1) the number of individual SUA in the county, and 2) the average area of each individual SUA. Additional data would be required in order to use some of the techniques available which estimate or measure the average area of SUA. Nevertheless, the data collected for this study allowed several techniques to be used.

An unbiased estimate of the average area is $\hat{\bar{Y}}$, where

$$\hat{\bar{Y}} = \frac{\sum_{n} yi}{\sum_{n} Mi} = \text{sample mean per element}$$

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[2] Although the price of land is mentioned as a factor influencing land use, price is actually the net effect of all other factors when they are evaluated by the economic/socio-political "market".

and

yi = total area of all elements in the ith unit

Mi = number of elements in the ith unit.

Another estimate is an unweighted mean of the urban unit means, $\bar{\bar{y}}'$, where

$$\bar{\bar{y}}' = \frac{1}{n} (\bar{y}_1 + \bar{y}_2 + \ldots + \bar{y}_n)$$

This particular estimate is both biased and inconsistent when the Mi vary (as they do in this study); nevertheless, this bias is relatively unimportant unless the yi is correlated with Mi (very little in this study). Table 5-6 contains the estimates currently under discussion.

Table 5-6. Estimate of Individual SUA Area.

	$\hat{\bar{\bar{Y}}}$ (area in acres)		$\bar{\bar{y}}'$ (area in acres)	
	1964	1980	1964	1980
St. Clair Co.	1.01	1.29	1.11	1.42
Washtenaw Co.	1.51	1.70	1.21	1.67

A discussion on the merits or faults of either estimate is beyond the scope of this study; the essential relationship is apparent using either estimate. The average developed area per individual SUA is larger for Washtenaw County than it is for St. Clair County in both 1964 and 1980. Contrast this information with that discussed previously on

developed urban area per capita. It would appear that the county with the greater developed urban area per capita would likely also have larger area per individual SUA, but as the information indicates, this is not necessarily the case. There can be large differences between the ways urban land is used within a single county. Intensive use of the LUA sector, as seems probable for Washtenaw County, does not automatically result in a corresponding intensity on that county's SUA. This fact is a prime example why it would often be useful to separate the SUA and LUA components of urban development when it comes under review.

If Washtenaw County has larger average areas for each individual SUA, the only way St. Clair County could end up with more total SUA area in the county would be if there were more individual units than in Washtenaw. Statistical analysis of this parameter is beyond the sphere of this study, nevertheless, the sample data of these two counties suggest that there is a large contrast in the number of individual SUA between St. Clair and Washtenaw Counties.

Table 5-7. Number of SUA in the Sample.

	St. Clair Co.	Washtenaw Co.
1964	292	173
1980	659	463

Many factors affect this situation as well. Mean household income dictate to some degree the amount of land that can be purchased for a home. Supply and demand for small

acreages have impacts on the prices these acreages command in the market. Availability of financing, either public (FHA) or private, will greatly influence the number of SUA developed. These are but a few influencing factors given as examples; there are many others.

Small Urban Units and Land Quality

The third and final research hypothesis will be examined and discussed in the remainder of this chapter. The discussion will commence with some comments concerning the hypothesis, the assumptions upon which the hypothesis is based, and how these relate to the two counties under examination.

Recall the third hypothesis:

> "The ratio of urban developed area (SUA and LUA) occurring on prime farmland is significantly different than the ratio of prime farmland in the county".

The subject of land use and land use decision-making is an extremely large and complicated area of study. The amount of material written about and related to this subject prior to 1970 is relatively small when contrasted to the voluminous quantity produced since. Even with this large source of information, all the factors affecting land use decision-making have not been exhaustively defined or quantified, and it is not the purpose, nor within the scope of this thesis to address that subject. Insofar as this

last hypothesis is influenced by the said factors, the assumptions under which the hypothesis is tested and examined need to be stated.

It is assumed that prime farmland and nonprime farmland are randomly distributed throughout the two counties. Visual inspection of the IFI maps reveal a distribution of prime farmland that is far from uniform, especially in St. Clair County, but also to some extent in Washtenaw County.

A significant amount of research has addressed the various factors which influence the location of urbanization. There are many factors which are known to have a measurable effect on land use decision-making. The data collected for this study could be processed to render additional information on the impact of some of these factors, but this would require statistical methods beyond the scope of this study (regression analysis, analysis of variation, analysis of covariation, etc.).

Examination of the data discloses a wealth of information which helps to illuminate the relationship between urban development and prime farmland; thus providing an appropriate introduction and background for additional research in this field. The following discussion will begin with a detailed look at St. Clair County, followed by Washtenaw County, and then some concluding remarks.

St. Clair County - 1964

Much of the discussion will be referring to Table 5-8.

Table 5-8. Relationships Between Urban Area and Prime Farmland for St. Clair County, 1964.

	Acres	%	% of Total Urban Area
LUA	17,112	100	79.7
- on prime farmland	4,022	23.5	18.7
- on nonprime farmland	13,090	76.5	61.0
SUA	4,359	100	20.3
- on prime farmland	1,264	29.0	5.9
- on nonprime farmland	3,094	71.0	14.4

The absolute values of urban development in the form of SUA and LUA have been previously discussed. They are now broken down into that which occurs on prime farmland and that occurring on nonprime farmland. In 1964, the 17,112 acres occupied by LUA accounted for 79.7% of the total urban development in the county. Of this area, 76.5% or 13,090 acres, were located on nonprime farmland. This is not surprising in view of the fact that the City of Port Huron, which comprises most of the LUA, occurs almost exclusively on nonprime farmland. In fact, most of the remaining 4,022 acres which do lie on prime farmland are contained by the smaller urban centers (other cities, towns, and villages) of the county. Most of these centers are located in areas where prime farmland is relatively prevalent.

Turning to the SUA of 1964, 29% of their area utilized prime farmland; slightly more than by the LUA. These data convincingly support the hypothesis that prior to the mid-1960's, most urbanization tended to occur in and close to major urban centers. In this particular case, the ratio of SUA on prime is very similar to that of LUA because of the juxtaposition of SUA and LUA.

The total urbanized area in 1964 was 21,471 acres (79.7% LUA, 20.3% SUA). One-fourth (24.6%) of this total occurred on prime farmland. In contrast, prime farmland underlies 63.2% of the county area. The obvious disparity between these values strongly suggests that the development process (in 1964) was nonrandom, i.e. the net effect of all factors influencing urban development was biased away from prime farmland. While statistically supported statements cannot be made, some factors which likely influenced this outcome warrant mentioning.

The most likely factor influencing the location of urban development in St. Clair County since 1940 is the City of Port Huron. Situated as a port at the mouth of Lake Huron (and the upper Great Lakes), this commerce center and transportation hub stimulated growth and development around itself. The fact that most of the immediate area was nonprime farmland appears to be coincidental (Figure 3-3); nevertheless, this had an immense impact on the quality of land utilized for urbanization. If SUA were located near existing LUA, the ratio of SUA area on prime

farmland should be very similar to the ratio of LUA area on prime farmland. While the ratio is slightly greater for SUA, it is very similar for these two categories in 1964.

St. Clair County - 1980

A significant change occurred between 1964 and 1980. Not only did total urban development increase nearly 69%, but there was also a marked shift in the character of this development.

Table 5-9. Relationships Between Urban Areas and Prime Farmland for St. Clair County, 1980.

	Acres	%	% of Total Urban Area
LUA	23,570	100	65.3
- on prime farmland	6,242	26.5	17.3
- on nonprime farmland	17,328	73.5	48.0
SUA	12,536	100	34.7
- on prime farmland	5,967	47.6	16.5
- on nonprime farmland	6,569	52.4	18.2

LUA area increased approximately 38%, from 17,112 acres to 23,570 acres. The proportion of this development occurring on prime farmland only rose three percentage points to 26.5%. The apparent phenomenon whereby LUA grew was expansion at the edge of existing LUA rather than creation of completely new LUA (although this did occasionally happen). Since the soil quality at the perimeter of LUA was more

likely to be similar to that under existing LUA than it was likely to be dissimilar, the LUA of 1980 had a ratio of prime farmland to total area similar to that of the 1964 LUA.

As was mentioned earlier, the amount of urban development occurring in the form of SUA rose substantially by 1980 in both absolute and relative terms. Of paramount interest is the relative shift of SUA from nonprime farmland to prime farmland. By 1980, 47.6% of all SUA were located on prime farmland. This is a marked increase from 1964, when it was 29%, and is suggestive of changes that occurred in the factors affecting SUA. There was a tremendous increase in the absolute amount of SUA, as well as the area of individual SUA. By 1980, an ever increasing number of SUA were being located further and further from the major urban centers (LUA), which in St. Clair County meant, that the SUA were located in areas which were predominately prime farmland.

Although the changing character of urbanization in St. Clair County is perhaps not dramatic, it certainly is significant. The tremendous shift in SUA provided the foundation for the change in the county as a whole. Urbanization between 1964 and 1980 increased 68.2% to 36,105 acres, with 33.8% of this total area falling on prime farmland.

Table 5-10. Total Urban Area and Prime Farmland in St. Clair County.

	1964		1980	
	acres	%	acres	%
Total Urban	21,471	100	36,106	100
- on prime farmland	5,286	24.6	12,209	33.8
- on nonprime farmland	16,184	75.4	23,897	66.2

Washtenaw County - 1964

As the "urban" county in this study, Washtenaw County definitely has a much larger absolute amount of urbanization than St. Clair County. This is of some interest, but it does not overshadow the significance that relative comparisons of urban development have.

Table 5-11. Relationships Between Urban Area and Prime Farmland for Washtenaw County, 1964.

	Acres	%	% of Total Urban Area
LUA	27,112	100	87.2
- on prime farmland	11,033	40.7	35.5
- on nonprime farmland	16,079	59.3	51.7
SUA	3,979	100	12.8
- on prime farmland	1,592	40.0	5.1
- on nonprime farmland	2,387	60.0	7.7

The information in Table 5-11 shows the 27,112 acres

as 87.2% of the total urban area in the county. Of the LUA total, 40.7%, or 11,033 acres fell on prime farmland, with the remaining 16,079 acres occurring on nonprime farmland. These values are in contrast to the ratio of prime farmland in the county which is 49.3%. This difference seems more apparent than most other differences contained in this study.

The Washtenaw County Important Farmlands Inventory Map reveals the spacial distribution of both prime farmland and nonprime farmland, as well as the location of LUA. Although prime farmland is assumed to be randomly distributed throughout the county, there are some areas where it is significantly absent: juxtaposed to rivers and lakes. Most of the nonprime farmland in these areas is composed of soils which supposedly developed in glacial drainage ways, outwash plains, and moraines, and are areas underlain by coarse textured material. It was (and is) in these areas that urban development first occurred as an indirect result of the importance of waterways for transportation, as well as a reliable water supply for a community's health and welfare. The major urban area (LUA) of the county is the metropolitan area of Ann Arbor and Ypsilanti. These two cities are primarily located on and beside the Huron River and its associated drainage way; this is probably the most significant factor influencing the ratio of developed area on prime farmland. The secondary, and perhaps more recent, factor which influenced the location of

LUA near rivers and lakes is the demand for secondary homes and recreational facilities near bodies of water.[3]

Corresponding to the LUA, the SUA, with a total of 3,979 acres, only occupied 12.8% of the total county developed area. The ratio of SUA on prime farmland at 40.0%, was essentially identical to that of the LUA. Since information about SUA are only estimated from a sample of the county area, it is much more difficult to adequately substantiate explanations about causes for them than it is for LUA.

In view of the fact that both SUA and LUA had equal proportions of their areas on prime farmland, the ratio of urban on prime farmland for total urban in the county was also 40.6%.

Washtenaw County - 1980

The LUA area increased by nearly 11,000 acres between 1964 and 1980 to a total area of 38,086 acres. This increase was larger than the corresponding increase in St. Clair County in both absolute and relative terms. What is noteworthy for the present discussion is the fact that over 80% of this increase occurred on prime farmland. This increasing use of prime farmland for urban development came about primarily as the result of urban growth that

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[3] See, Aurther, p. 59.

expanded around existing LUA, particularly Ann Arbor and Ypsilanti, as opposed to movement along the bodies of water on which they (LUA) were originally built. With 19,960 acres on prime farmland and 18,126 acres on nonprime farmland, the ratio of LUA on prime farmland in 1980 stood at 52.4%. That is significantly higher than the 40.7% of 1964.

Table 5-12. Relationship Between Urban Area and Prime Farmland for Washtenaw County, 1980.

	Acres	%	% of Total Urban Area
LUA	38,086	100	76.0
- on prime farmland	19,960	52.4	39.9
- on nonprime farmland	18,126	47.7	36.2
SUA	11,997	100	24.0
- on prime farmland	5,430	45.3	10.8
- on nonprime farmland	6,567	54.7	13.1

SUA area also increased during the same interval, only at a much greater relative rate. By 1980, total SUA area stood at 11,997 acres; a 200% increase over the 1964 value. This increased the portion of total urban area occupied by SUA to 24.0% (up from 12.8% in 1964). In spite of this rapid growth, the ratio of prime farmland utilization by SUA did not increase as much as it did for LUA. At 5,430 acres, this ratio stood at 45.3%, up from 40.0%.

Combining values for SUA and LUA, there is a 61% increase in total urbanization in the county from 1964 to 1980. The absolute amount was 50,083 acres, of which 25,390 acres, or 50.7% occurred on prime farmland. This is compared to the ratio of the prime farmland in the county of 49.3%. For the county as a whole, then, it appears that the urbanization process is "indifferent" to the agricultural quality or potential of the land on which it occurs. While this may adequately assess the development process in terms of its net result, no such inference can be made with respect to any one individual urban unit or development project based on this data.

Contrasts and Comparisons Between the Counties

Another interesting aspect of this study is the difference or similarity between these two counties. In this section, the major contrasts and comparisons will be stated and briefly discussed. Any discussion should be prefaced by saying that data of any kind can be examined, compared, contrasted, interpreted, etc., in countless number of ways; in this section, no attempt will be made to exhaust these various alternatives.

LUA

All that can be said about LUA for 1940 (according to the study assumptions) is that they comprised 100% of all urban areas in both counties. Based on this assumption, comparisons can be made based on the relative changes in urban composition. Washtenaw County was included in the study as an "urban" county, and the data support such a distinction, at least where LUA and total urban area are concerned. For both dates, Washtenaw County's LUA is much larger in both absolute and relative terms. While the relative growth of LUA between 1964 and 1980 was nearly identical for both counties, the absolute amount was greater in Washtenaw County by approximately 4,500 acres, setting the counties even farther apart with respect to the percent of the county developed.

Table 5-13. Intercounty and Inter-year Comparisons of LUA and Prime Farmland.

	St. Clair County				Washtenaw County			
	1964		1980		1964		1980	
	Acres	%	Acres	%	Acres	%	Acres	%
LUA	17,112	100	23,570	100	27,112	100	38,086	100
- on prime farmland	4,022	23.5	6,242	26.5	11,033	40.7	19,960	52.4
- on nonprime farmland	13,090	76.5	17,328	73.5	16,079	59.3	18,126	47.7

There is more contrast between the counties when this growth is analyzed with respect to the quality of land that

the respective LUA consumed. The trend in both counties was for LUA to occupy an increasing percentage of prime farmland. In St. Clair County this shift only amounted to a few percentage points from 23.5% to 26.5%. In Washtenaw County this shift was significantly greater, going from 40.7% up to 52.4%; thus shifting the LUA of Washtenaw County from primarily nonprime farmland to prime farmland. The seemingly coincidental relationship between prime farmland and LUA provide the most rational explanation as to why the shift went in the direction it did; i.e. prime farmland was more prevalent than nonprime farmland at the perimeter of LUA in Washtenaw County, whereas nonprime farmland occupied nearly the entire area surrounding the major LUA in St. Clair County.[4] The data are not of the type which could indicate what possible impact changing attitudes and/or public policies on prime farmland have had on land use decisions. The data are strictly concerned with the physical state of urban development at a given point in time. Even if additional factors had been included, the time interval between 1964 and 1980 would have precluded discovery of any shift in land use patterns which may only have occurred within the last several years. Nevertheless, it would be difficult for even a subjective

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[4] This argument is based on the assumption that urban growth occurred adjacent to existing LUA. While no statistical evaluation was conducted, it seems as if this was the phenomenon that occurred.

interpretation of the data to conclude anything else but that attitudes about prime farmland have had virtually no influence on land use decisions.

SUA

In terms of absolute area, the SUA of these two counties are nearly identical. Both occupied approximately 4,000 acres in 1964 and increased to approximately 12,000 acres in 1980 (Figure 5-3). Since the total area of both counties is somewhat similar, the area of SUA relative to the county area was also identical for both counties in both years. This, however, is where the similarities end.

Table 5-14. Intercounty and Inter-year Comparisons of SUA and Prime Farmland.

	St. Clair County				Washtenaw County			
	1964		1980		1964		1980	
	Acres	%	Acres	%	Acres	%	Acres	%
SUA	4,358	100	12,536	100	3,979	100	11,997	100
- on prime farmland	1,264	29.0	5,967	47.6	1,592	40.0	5,430	45.3
- on nonprime farmland	3,094	71.0	6,569	52.4	2,387	60.0	6,567	54.7

The first contrast between the SUA of St. Clair County and Washtenaw County is the significance of SUA with respect to the total urban development of the county. In 1964 SUA in St. Clair County accounted for 20.3%, or one-fifth of the total urban area of the county. This is in

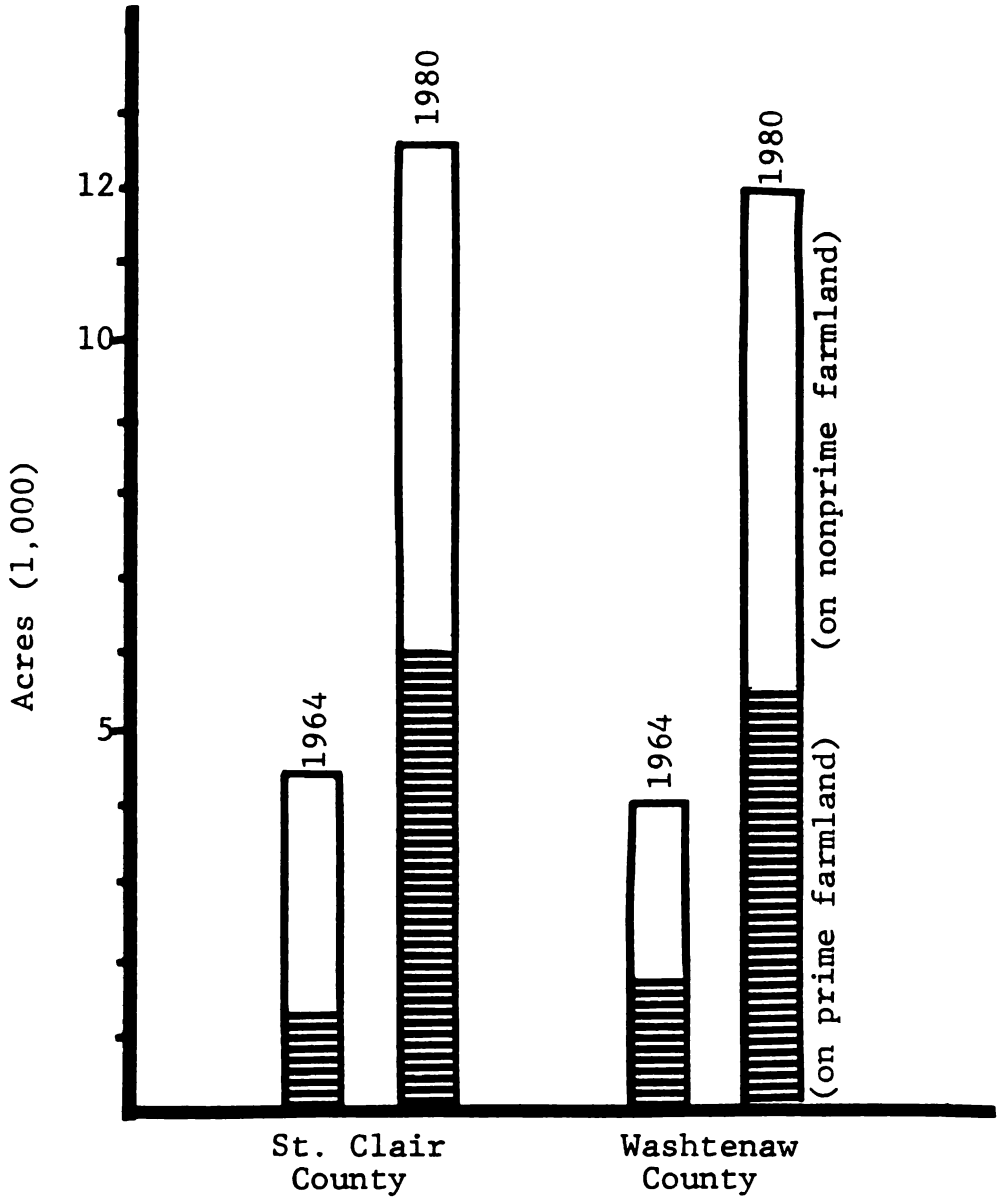

Figure 5-3. Area of SUA on Prime and Nonprime Farmland.

marked contrast to the 12.8% which SUA of Washtenaw County comprise. The proportion of SUA to total county development increased in both counties by 1980; in St. Clair County it rose to 34.7%, while in Washtenaw County it rose to 24.0% (Figure 5-4).

These relationships are not only interesting in what they reveal about the characteristics of a particular county's urban development, but they also suggest important aspects of the urbanization process which should be considered not only by state and national groups, but perhaps more so by county and local groups, organizations, and agencies which are involved with land resources.

The research data on SUA suggest that two contrasting urbanization processes are taking place in these two counties. In Washtenaw County the process of urban development has tended to be concentrated, i.e. expansion of, or addition to, the existing areas of development. The process in St. Clair County appears to be one in which much smaller areas of development, especially isolated, individual units, receive a good share of development energy. The contrast between the counties was somewhat greater in 1964 than in 1980, nevertheless, the situation is one in which the urbanization of Washtenaw County is significantly more concentrated, spatially speaking, than in St. Clair County.

This contrast is even greater when the factor of prime farmland is included in the analysis. Examination of the

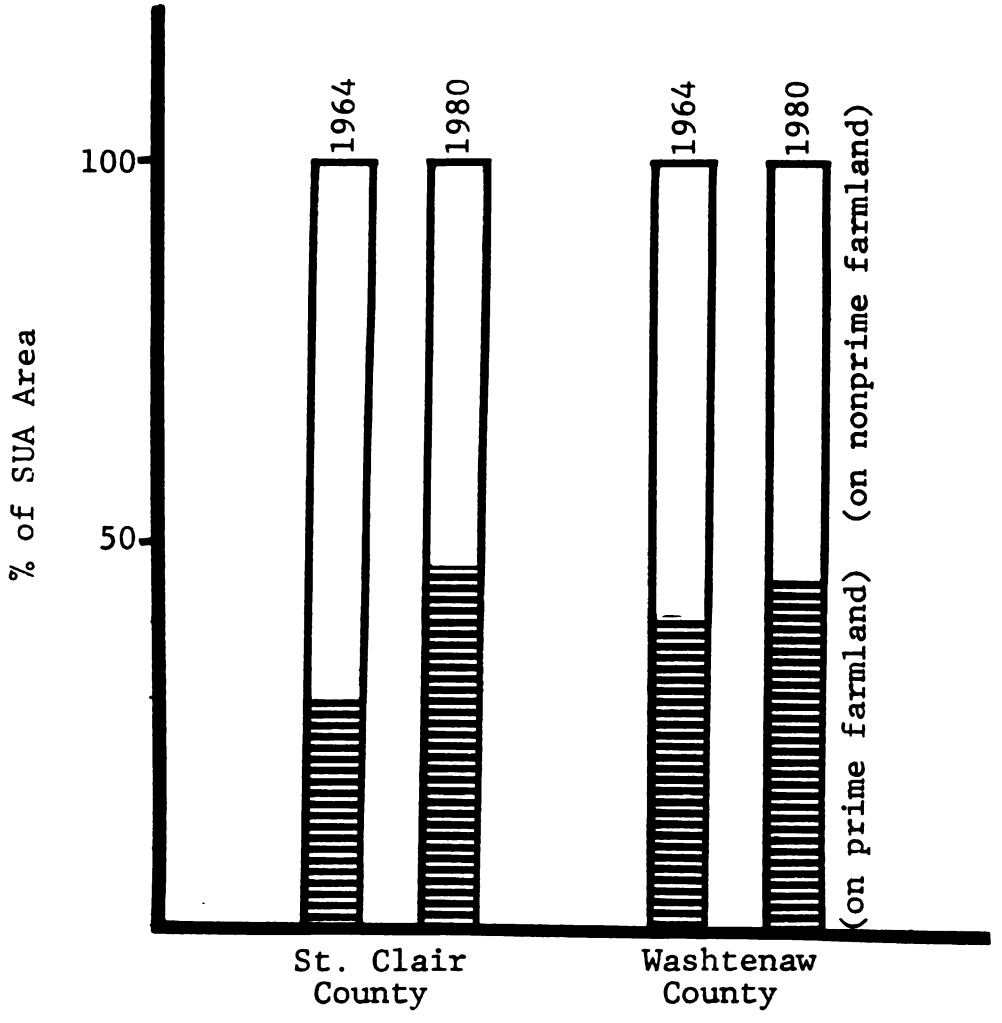

Figure 5-4. Percent of SUA Area on Prime and Nonprime Farmland.

SUA data indicates a marked difference between counties with respect to the ratio of SUA which have utilized prime farmland. In 1964, 29% of the SUA of St. Clair County occupied prime farmland. The proportion for the same date in Washtenaw County is 40.0%. These ratios are very similar to the ratios for the LUA at the same time, and, as previously mentioned, this suggests that SUA were primarily located near the boarders of LUA in 1964. This ratio increased slightly in 1980 for Washtenaw County, but not nearly as much as it did for St. Clair County. In Washtenaw County the ratio rose to 45.3%, as compared to St. Clair County, where it increased all the way up to 47.6%.

In Washtenaw County, this ratio is approaching the county prime farmland ratio of 49.3%. Without additional analysis, not much can be said about why the SUA of Washtenaw County utilize the land in the proportions they do. Because the ratios are different in St. Clair County, the same analysis can be taken one step further. If the ratio had remained similar to that of the LUA, one could have concluded that SUA were continuing to be located on the boarders of LUA. Since very little prime farmland is located around the LUA (primarily Port Huron), it seems very probable that additional SUA created after 1964 have been located at some distance from the major LUA.

Totals (SUA + LUA)

A third perspective of the data is a view of all urban development as a composite whole. When SUA are added to LUA (IFI data), the resulting information should be more realistic about losses of land to development than IFI information alone.

Table 5-15 presents the information on total urban development in the counties, and also a breakdown of this development: that occurring on prime farmland and that on nonprime farmland. In 1964, Washtenaw County had a total developed area of 31,091 acres, which was 9,620 acres more than St. Clair County. These values are not surprising in view of the population differences which existed at the time (approximately 197,100 and 112,400, respectively).

What is interesting to note is the contrasting ways that urban development has occurred in these two counties. While Washtenaw County has significantly more urban area, St. Clair County has a much higher proportion of its development in SUA (20.3% vs. 12.8%). Since both counties have approximately equal acres in the SUA category, a national or statewide program concerned with urban development might not distinguish between the counties. At the local level the situation is completely different. Assuming that urban development is a concern at all, it would make a substantial difference what percentage of the development was in the form of SUA and what was in LUA. It is conceivable that two counties both have 10,000 acres of

Table 5-15. Intercounty and Inter-year Comparisons of Total Urban Area and Prime Farmland.

	1964			
	St. Clair County		Washtenaw County	
	Acres	%	Acres	%
Total Urban	21,470	100	31,091	100
- on prime farmland	5,286	24.6	12,625	40.6
- on nonprime farmland	16,184	75.4	18,466	59.4

	1980			
	St. Clair County		Washtenaw County	
	Acres	%	Acres	%
Total Urban	36,105	100	50,083	100
- on prime farmland	12,209	33.8	25,390	50.7
- on nonprime farmland	23,896	66.2	24,693	49.3

SUA. In one this could be 60% - 70% of the total urban development while in the other it may only comprise 10% - 15% of the total urban area. If the population of both counties were interested in taking action to curb the growth of their urban areas, the actions taken would be much different for the county where the majority of the urbanization was in the form of SUA than in the county which had practically no SUA at all.

Both counties experienced substantial growth of their urban areas in the late 1960's and 1970's. The developed areas of Washtenaw and St. Clair Counties increased 61.1% and 68.2%, respectively; leaving Washtenaw County with 50,083 acres of urbanized area and St. Clair County with 36,105 acres. The SUA portion of these amounts increased at a significantly faster rate than the LUA fraction did. The result was that in 1980 SUA contributed a full one-third of the urbanization of St. Clair County and just under one-fourth of it in Washtenaw County.

The relationship between urbanization and population, however vaguely defined, can nevertheless be a reference or starting point for comparison of two or more areas. These relationships are listed for the counties under consideration in Table 5-5.

In primary focus is the ratio of urban developed area per person (as acres/person). Notice the difference between the two counties. In 1964, this value was approximately 18% larger for St. Clair County than for Washtenaw

County. By 1980 the difference had increased to 36%. In other words, by 1980, 36% more land had been developed per person in St. Clair County than in Washtenaw County. There are, understandably, many factors which have influenced this situation. All development is not directly associated with human shelter and direct human services. Urban development encompasses transportation, business, industrial, and other uses. Obviously, any given urban location is a unique setting with its own combination of uses. The counties vary in their relationship to transportation arteries, other major urban centers, major agricultural areas, recreational areas, distances from natural (and other) resources, all of which affect what types of development will occur. In this case, as probably for most, it is difficult to assign to various factors, their contribution to the location equation. The gross relationship to population indicates Washtenaw County as being more "efficient" in use of land resources.

The final subject for discussion is the matter of urbanization and prime farmland usage. The sections dealing with each county separately provide information on this matter. The similarity between the counties in 1964 is striking. In both counties, SUA and LUA have practically identical prime farmland usages. Such data would support the hypothesis that SUA were primarily located at the perimeter of LUA. The ratio of urbanization on prime farmland for the total urban area of the counties were 24.6% for

St. Clair County and 40.6% for Washtenaw County. Between 1964 and 1980, the use of prime farmland by urban development more than doubled in both counties. The ratio for the county total in Washtenaw County rose to 50.7%; with slightly more coming from LUA. In this case, the ratio is essentially equal to the ratio of prime farmland in the county. This "county total" is fine, but one needs to examine the component parts of the total if a more realistic understanding of the situation is desired.

In St. Clair County, the increase in prime farmland usage came from SUA. In fact, the increase (by SUA) is quite significant: from 29.0% to 47.6%, increasing the total county usage from 24.6% to 33.8%. As mentioned in a previous section, the impact of Port Huron being located on essentially nonprime farmland is probably the strongest influence on the data. The large increase in prime farmland usage by SUA is strongly indicative of a movement of SUA away from urban centers to more isolated areas (it just so happens that the rural, isolated areas in St. Clair County have relatively large proportions of prime farmland). Available information about why individuals locate where they do would also support that hypothesis.[4]

It is always interesting to note whether or not an awareness of a situation by the population in general influences that situation. The concept of prime farmland

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[4] See, Arthur, Francis O., Appendix 3-B-2.

and the possible significance of development on this prime farmland has only been identified and widely publicized since the mid to late 1960's. No attempt was made by this study to quantify or measure the impact of this knowledge on prime farmland utilization by urban development. If it has had any effect at all, this effect has been more than nullified by other factors, and we see the net result: significant increases in the losses of prime farmland to urbanization.

Significance of Urbanization

The last section of this chapter focuses on the question of how significant the loss of prime farmland to the urbanization process actually is in St. Clair and Washtenaw County. This question should not be confused or combined with that addressed by the first research hypothesis: "Is the loss of land via SUA significant?". That is a completely different question, and was answered affirmatively by this study.

Table 5-16 (Figure 5-5) lists the various categories of land discussed thus far in this thesis. Along with the absolute area is the relative area of each category with respect to the total county area. Several values are worth noting. In 1964, 4.6% of St. Clair County had been urbanized (by study definition). The SUA in 1964 utilized only 0.9% of the entire county area; while SUA on prime farmland were down to 0.3%. The same values for Washtenaw

Table 5-16. Urban Area and Relationships to Total County Area.

	1964			
	St. Clair County		Washtenaw County	
	Acres	% of County Area	Acres	% of County Area
LUA	17,112	3.7	27,112	6.0
- on prime	4,022	0.9	11,033	2.5
- on nonprime	13,090	2.8	16,079	3.6
SUA	4,359	0.9	3,979	0.9
- on prime	1,264	0.3	1,592	0.4
- on nonprime	3,094	0.7	2,387	0.5
Total Urban	21,471	4.6	31,091	6.9
- on prime	5,286	1.1	12,625	2.8
- on nonprime	16,184	3.5	18,466	4.1

	1980			
	St. Clair County		Washtenaw County	
	Acres	% of County Area	Acres	% of County Area
LUA	23,570	5.1	38,086	8.5
- on prime	6,242	1.3	19,960	4.4
- on nonprime	17,328	3.7	18,126	4.0
SUA	12,536	2.7	11,997	2.7
- on prime	5,967	1.3	5,430	1.2
- on nonprime	6,569	1.4	6,567	1.5
Total Urban	36,105	7.8	50,083	11.1
- on prime	12,209	2.6	25,390	5.6
- on nonprime	23,896	5.2	24,693	5.5

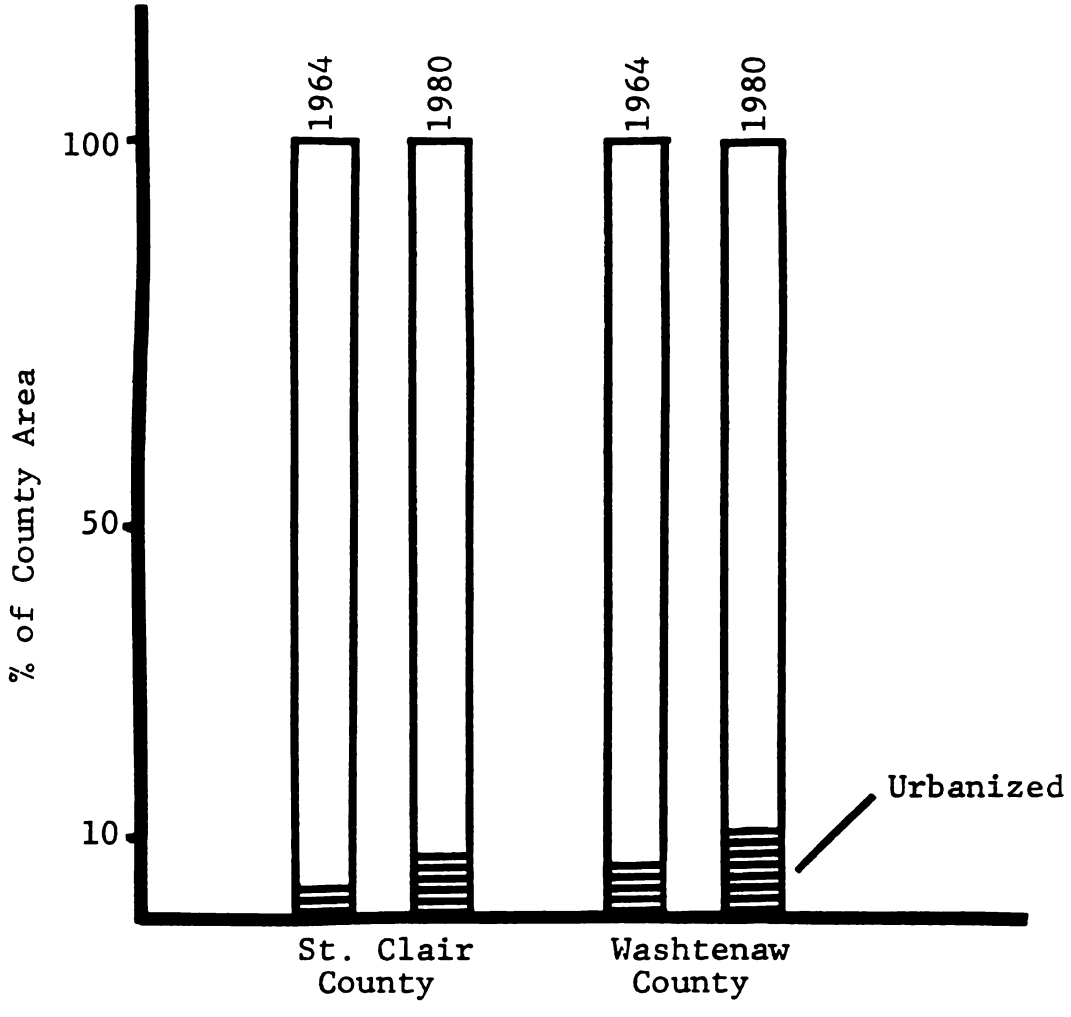

Figure 5-5. Percent of County Area Urbanized.

County were 6.9%, 0.9%, and 0.4%, respectively, and essentially identical with St. Clair County. The growth of urban development between 1964 and 1980 increased all these ratios. Total urban development, as a percent of the county area, rose to 7.8%, SUA rose to 2.7% of the county area, and SUA on prime farmland increased to 1.3% of the total county area. Once again, the 1980 figures for Washtenaw County were 11.1%, 2.7%, and 1.2%, respectively.

At this point it may prove beneficial to restate how urbanization is defined by this study. Urbanization or development is defined as the process whereby an area of land is "improved" or "altered" to such a degree that reversion to a condition usable for agricultural production is physically and/or economically unfeasible in the foreseeable future. The use must be "actual" as opposed to planned or intended. Ownership is not a criteria; only those areas of a parcel which are "urbanized" fall into the urban category.

The matter of significance is basically a subjective one, and closely associated with the goals or purposes of the individual or group assigning significance to things, projects, ideas, events, etc. Consider the urbanization of 10 acres. The significance of this event will be quite different for the owner of the adjacent "eighty" than it will be for the county planning board member. Similarly, assigning significance to the urbanization of these two counties will have different results depending on who is

involved.

For example, take the 11.1% urbanized area of Washtenaw County in 1980. Is this "loss" of land significant? County Planners may not think so. Users of the portion urbanized in the last ten years more than likely also question its significance. Individuals and groups which sold the land to "developers" probably didn't think that their few acres would contribute much to the "losses". The adjacent land owner may consider it very significant.

The answer to whether or not the land lost to urbanization is significant is proving to be complex. Although information on more southern Michigan counties would contribute significantly, the data by themselves provide little help for making the determination. Meaningful answers will only be "discovered" when the goals and objectives of a group or individual are clearly defined, and the interrelationship between the goals and objectives, the urbanization process, and the results of this process is well thought out. The purpose of this study was not to make the determination of significance, but to provide information, heretofore unavailable, upon which such a determination could be made.

Residual Prime Farmland

One final table of information will summarize the data in relationship to losses of prime farmland. While all these figures are interesting, several are perhaps more

Table 5-17. Urbanization and Available Prime Farmland.

	1964			
	St. Clair County		Washtenaw County	
	Acres on prime	% of prime mapping units	Acres on prime	% of prime mapping units
LUA	4,022	1.4	11,033	5.0
SUA	1,264	0.4	1,529	0.7
Prime Farmland Mapping Units	292,337	100.0	221,825	100.0
Available Prime Farmland	287,051	98.2	209,200	94.3

	1980			
	St. Clair County		Washtenaw County	
	Acres on prime	% of prime mapping units	Acres on prime	% of prime mapping units
LUA	6,242	2.1	19,960	9.0
SUA	5,967	2.0	5,430	2.4
Prime Farmland Mapping Units	292,337	100.0	221,825	100.0
Available Prime Farmland	280,128	95.8	196,435	88.6

important than the others. The category labeled "available prime farmland" indicates how much of the county's prime farmland is still potentially available for use in agricultural production. It is quite apparent that Washtenaw County has lost a good deal more of its prime farmland base than has St. Clair County. In Washtenaw County, the losses have come primarily from LUA; in St. Clair County the losses of prime farmland initially resulted from LUA, but then were increasingly the result of SUA development. If the loss of prime farmland is indeed a concern, then such information is vital if the problem is to be properly addressed and/or dealt with.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

The previous chapter contained a considerable amount of material to digest. This final chapter will summarize the major findings of this study and offer suggestions for future inquiry based on these findings.

Growth of SUA Area

The first objective of this study was to determine how much land was actually being consumed by what has been defined as SUA. There has been much talk and conjecture about how significant these losses were, and this researcher hoped to shed some objective light on the subject.

The research results indicate that a significant portion of both counties' urban areas are comprised of SUA. By 1980, this portion was 34.7% in St. Clair County and 24.0% in Washtenaw County. If urbanization is significant at all, then it stands to reason that any category of urbanization which comprises one-fourth of the developed area must be significant.

The second study objective focused on how the area of SUA in the counties changed over time. In addition to mere amount of SUA, it is important to note the fact that

SUA area was increasing at a rate several times faster than was LUA area. If this trend continues, then perhaps SUA should be monitored more closely in the future, particularly in areas where they are seemingly predominate now.

All this said, one must also add a comment about the absolute amount of SUA in the counties. As a percent of the total county land area, SUA only occupy 2.7% in both counties (1980). While this is a substantial increase from the 0.9% (both counties) in 1964, there cannot help but be some question about exactly how significant this amount really is. The answer, in large part, is dependent on what objectives the definition of "significant" is based. While this 2.7% loss may be significant to some groups or individuals, there are many who might simply shrug it off. It is important to remember that while SUA do remove some land area from potential agricultural use, they do not do so without providing a benefit or service to individuals, groups, or society. Whether or not these benefits are worth the cost in land loss or whether or not these benefits could be provided in other less costly ways is a completely different area of inquiry and one which will need to receive attention in the future.

Urban Area on Prime Farmland

The third objective was to determine how much prime farmland had been utilized by LUA and SUA in the development process. The research data did not suggest any bias

against the use of prime farmland for urban development; in fact, it was discovered that the use of prime farmland by both SUA and LUA increased between the three periods observed. In Washtenaw County, LUA had a greater increase in prime farmland usage than SUA, while in St. Clair County this situation was reversed.

To balance this apparent trend another relationship was examined; this one relating to the amount of prime farmland in the county. The research results indicated that of the total amount of prime farmland which ever existed in the county, the amount still undeveloped in 1980 was 88.6% in Washtenaw County and 95.8% in St. Clair County. On this basis one must conclude that most of the prime farmland in either county has not been affected by the urbanization process. This is not to say that the amount is insignificant; that conclusion must be drawn by other individuals and groups on the basis of their objectives or goals. One must also be careful not to project SUA land usage on the state or national level on the basis of this research. Conditions in other parts of the state and county may be considerably different than they are in the two counties examined here.

Research Findings and the Important Farmlands Inventory

The primary objective of this study was to determine the area of land which is being utilized by SUA. The reasons behind this objective are the facts that SUA were

not included in the Important Farmlands Inventory, and visual observation of different areas in the state of Michigan left this researcher and others with the impression that SUA may be significant users of prime farmland.

The research results suggest a two fold response. The concept of objectives was discussed in Chapter Two and that discussion is very applicable now. There are some objectives that the IFI is designed to accomplish. Two of the primary ones are to provide data on the amount of prime, unique, and locally important farmlands which are present in the nation, and to provide data about the extent of urban development as it relates to the aforementioned farmlands. The IFI is to be used to provide general planning information and not specific information for any given site.

Based on the general nature of the IFI information and the site specific nature of the SUA alone, one could not argue for inclusion of SUA on the IFI. Nevertheless, the fact that SUA comprise one-third of the urban area in St. Clair County and one-fourth of the urban area in Washtenaw County provide a strong argument for including them. A very plausible solution might be to include the estimate of the total county SUA area and the ratio of SUA on prime farmland to total SUA area, but no other information about the SUA. This would provide a truer picture of urbanization in the county and leave with local groups or individuals the choice whether or not to pursue SUA any

further.

The Sampling Method

This researcher did not find any studies which had similar objectives in focus; and therefore, the sampling procedure was designed specifically with this study in mind. It was difficult to determine beforehand whether or not the design would give meaningful results. There is room for much improvement in sampling and analytical design. Two major changes are:

1. Based on the variability of the data, a smaller sample of sections would give acceptable accuracy. With a sample size of 45 sections, one can be 90% sure that the estimate of total county SUA area in St. Clair County varies less than 1.3% in 1964 and less than 0.7% in 1980. The same probability holds for Washtenaw County where the corresponding maximum deviations are 1.7% and 0.9%.

   Since 1980 Washtenaw County data are more variable than the corresponding St. Clair County data, let me use them as an example. Assuming that I was willing to accept an estimate of the county SUA that varied less than 2.0%, a sample of 9 sections would be sufficient to provide the required accuracy. This is considerably smaller than the 45 sections sampled in this study. While the actual sample size required for a 2.0%

maximum variability is dependent on the variability of the SUA in the county, a sample of 10 to 15 sections should give adequate results for all but the most variable counties, and could always be enlarged if necessary.[1]

2. If a computer was available to analyze the data, it may be advantageous to include several additional variables in the study. These might include distance of section from a Central Business District or distance of section from major transportation artery. Use of a computer would also allow more extensive analysis of the data, especially with regard to inter-cluster and intra-cluster relationships.

Recommendations

The knowledge gained from this study is valuable in its own right. Nevertheless, this knowledge is also helpful for indicating new areas of inquiry for the future.

1. Additional counties should be sampled for data about SUA. If the losses of prime farmland (and land in general) are not greater than what has

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[1] A complete discussion on the topic of sample size determination can be found in any introductory text on Statistical Methods or Sampling. Or see, Gouri K. Bhattacharyya, and Richard A. Johnson, 1977. Statistical Concepts and Methods. John Wiley and Sons, New York, 639 pp.

been found in these two counties, then the significance of SUA as consumers of prime farmland may be in question.

2. Additional work needs to be done on the sampling method to make it easier and quicker to sample a county. This would allow a greater number of counties to be sampled.
3. These results should be taken to various levels of local, state, and national interest groups. Their response and feelings about the significance of SUA would be interesting.

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APPENDIX A

SAMPLE DATA

APPENDIX A

SAMPLE DATA

St. Clair County - 1980 (1964 - *)

Unit	Acres on prime	Acres on nonprime	Total acres
		Lynn 11	
1*	1.80	0	1.80
2	1.58	0	1.58
3*	0.86	0	0.86
4	1.07	0	1.07
		Lynn 14	
1	3.49	0	3.49
2	0.89	0	0.89
3	0.95	0	0.95
		Lynn 35	
1	1.31	0	1.31
2	0.69	0	0.69
3	1.82	0	1.82
4*	1.01	0	1.01
		Brockway 3	
1	3.34	0	3.34
2	1.07	0	1.07
3	3.85	0	3.85
4	1.42	0.25	1.67
5	1.73	0.43	2.16

* indicates units existing in 1964.

Unit	Acres on prime	Acres on nonprime	Total acres
		Brockway 3 (continued)	
6	1.05	0	1.05
7	1.65	0	1.65
8	0.57	0	0.57
		Brockway 26	
1*	2.27	0	2.27
2	0	1.40	1.40
		Grant 1	
1*	1.89	0	1.89
2	0	0.86	0.86
3*	0	1.36	1.36
4	0	0.69	0.69
5	0	0.44	0.44
6	0	0.81	0.81
		Grant 30	
1*	0		
2	0.66	0.69	1.35
3*	0	1.01	1.01
4*	0	1.95	1.95
5	0	2.89	2.89
6	0	1.28	1.28
7	0	1.47	1.47
8	0	1.98	1.98
9	0	1.53	1.53
10	0	1.38	1.38
11	0	0.83	0.83
12	0	1.09	1.09
13*	0	1.70	1.70
		Grant 35	
1	0	0.98	0.98
2*	0.88	0.38	1.26
3*	1.32	0	1.32
4	0.82	0	0.82
5	0.82	0	0.82
6	1.32	0	1.32
7	1.32	0	1.32
8	0.59	1.88	2.47
9	0	2.11	2.11

Unit	Acres on prime	Acres on nonprime	Total acres
		Emmet 17	
1	0.61	0	0.61
2*	1.28	0	1.28
3	0.46	0.70	1.16
4	0	2.39	2.39
5	0	3.03	3.03
6*	1.22	0	1.22
7*	1.39	0	1.39
8	5.01	0	5.01
9*	1.03	0	1.03
10	4.24	0	4.24
11	0.77	0	0.77
12*	0	1.74	1.74
		Emmet 21	
1	1.26	0	1.26
2*	1.17	0	1.17
3	1.11	0	1.11
4*	0.41	0	0.41
5*	2.26	0	2.26
6	1.60	0	1.60
7	0.93	0	0.93
8	2.00	0	2.00
9*	0.33	0	0.33
10	2.21	0	2.21
11*	1.03	0	1.03
12*	0.55	0	0.55
13	1.23	0	1.23
14	1.23	0	1.23
15	2.45	0	2.45
		Kenockee 3	
1	0.36	0	0.36
2	4.14	0	4.14
3	0.90	0	0.90
		Kenockee 32	
1	1.47	1.05	2.52
2	5.08	0	5.08
3	3.09	0	3.09
4	3.09	0	3.09
5	3.19	0	3.19
6	1.51	0	1.51
7	0.82	0	0.82

Unit	Acres on prime	Acres on nonprime	Total acres
		Kenockee 32 (continued)	
8	2.01	0	2.01
9*	0.58	0.21	0.79
		Kenockee 34	
1	1.76	0	1.76
2	1.94	0	1.94
3	1.54	0	1.54
4	1.80	0	1.80
5	1.95	0	1.95
6*	0.52	0	0.52
		Clyde 2	
1	0	2.00	2.00
2	1.17	0	1.17
3	0.53	0	0.53
4	0	0.73	0.73
5	0	0.84	0.84
6	1.54	0	1.54
7	0.80	0	0.80
8	0.85	0	0.85
9	1.41	0	1.41
10	1.16	0.78	1.94
11	1.61	0	1.61
12	1.65	0	1.65
		Clyde 11	
1	2.39	0	2.39
2*	0	0.46	0.46
3	1.92	0	1.92
4*	2.01	0	2.01
5*	3.43	0	3.43
6*	0	0.85	0.85
		Clyde 18	
1	0	1.31	1.31
2*	0	0.76	0.76
3*	1.34	0	1.34
4	0	1.41	1.41
5*	0	1.29	1.29
6*	0	0.59	0.59
7*	0	0.55	0.55

Unit	Acres on prime	Acres on nonprime	Total acres
		Clyde 18 (continued)	
8	0	0.44	0.44
9	2.35	0	2.35
10	0	1.56	1.56
11	0	2.06	2.06
12*	0	0.92	0.92
13	0	0.92	0.92
14	0	1.14	1.14
15	0	2.26	2.26
16	0	1.03	1.03
17	0	1.29	1.29
18	0	0.73	0.73
19*	0	1.00	1.00
20*	0	1.00	1.00
21*	0	1.00	1.00
22	0	1.00	1.00
23	0	1.00	1.00
24	0	1.00	1.00
25	0	1.00	1.00
		Clyde 30	
1	0	1.20	1.20
2*	1.02	1.55	2.57
3*	1.67	0	1.67
4*	0	1.75	1.75
5*	0	1.23	1.23
6	0	1.07	1.07
7	0	0.93	0.93
8	0	2.13	2.13
9	0	0.91	0.91
10	0	1.18	1.18
11	0	1.18	1.18
12	0	1.19	1.19
13*	0	0.49	0.49
14	0	0.69	0.69
15*	0	1.62	1.62
16	0	1.03	1.03
17	0	0.64	0.64
18	0	2.57	2.57
19	0	1.31	1.31
20*	0	2.74	2.74
21*	0	1.53	1.53
22	0	1.98	1.98
23	0	1.08	1.08

Unit	Acres on prime	Acres on nonprime	Total acres
		Fort Gratiot 7	
1	0	0.99	0.99
2*	0	1.02	1.02
3*	0	1.59	1.59
4	0	0.71	0.71
5	0	0.80	0.80
6	0	0.94	0.94
7	0	0.99	0.99
8	0	1.18	1.18
9	2.44	0	2.44
10	1.63	0	1.63
11	0.17	1.52	1.69
12	1.36	0	1.36
13	0.90	0	0.90
14	1.06	0	1.06
15	2.30	0	2.30
		Berlin 10	
1	1.48	0	1.48
2*	1.32	0	1.32
3	0.73	0	0.73
4	0	0.39	0.39
5	0.92	0	0.92
6	1.46	0	1.46
7	2.80	0	2.80
8	0.59	0	0.59
9*	0.64	0	0.64
		Berlin 26	
1*	1.14	0	1.14
2	0.98	0	0.98
3*	0.47	0	0.47
4*	0.99	0	0.99
5*	0.99	0	0.99
6	0.52	0	0.52
7	1.84	0	1.84
8	1.06	0	1.06
9	1.08	0	1.08
10	1.53	0	1.53
11	1.59	0	1.59
12	1.44	0	1.44
13	1.08	0	1.08
14	1.37	0	1.37
15	1.13	0	1.13
16	2.20	0	2.20
17	1.54	0	1.54

Unit	Acres on prime	Acres on nonprime	Total acres
		Berlin 26 (continued)	
18	1.17	0	1.17
19	1.17	0	1.17
20	1.17	0	1.17
21	1.17	0	1.17
22*	0.43	0	0.43
23*	0.95	0	0.95
24*	0.55	0	0.55
25*	0.26	0	0.26
		Riley 7	
1	1.88	0	1.88
2	1.37	0	1.37
3	1.37	0	1.37
4	1.53	0	1.53
5*	0.49	0	0.49
6	0.97	0	0.97
7	1.36	0	1.36
8	1.49	0	1.49
9	2.14	0	2.14
10*	1.49	0	1.49
11	1.90	0	1.90
12*	1.27	0	1.27
13	1.00	0	1.00
14	1.80	0	1.80
		Riley 29	
1*	2.21	0	2.21
2	1.21	0	1.21
3	1.10	0	1.10
4*	1.10	0	1.10
5	0.79	0	0.79
6*	0.49	0	0.49
		Riley 33	
1	1.25	0	1.25
2*	0.65	0	0.65
3	3.31	0	3.31
		Riley 36	
1*	0.29	0	0.29
2*	0.47	0	0.47

Unit	Acres on prime	Acres on nonprime	Total acres
		Riley 36 (continued)	
3	1.32	0	1.32
4	1.32	0	1.32
5	0.98	0	0.98
6	1.16	0	1.16
7	1.69	0	1.69
8	0	1.18	1.18
		Wales 3	
1	0.56	0.31	0.87
2*	0.89	0	0.89
3*	1.25	0	1.25
4	0.85	0	0.85
5	1.07	0	1.07
6*	0.73	0	0.73
7*	0.48	0	0.48
8*	1.05	0	1.05
9*	0.44	0	0.44
10*	1.23	0	1.23
11*	0.97	0	0.97
12*	0.77	0	0.77
13*	0.72	0	0.72
14*	0.74	0	0.74
15*	1.29	0	1.29
16*	0.84	0	0.84
17	3.79	0	3.79
18	1.09	0	1.09
19*	0.88	0	0.88
20	0	1.94	1.94
		Wales 4	
1	2.00	0	2.00
2	1.18	0	1.18
3*	2.51	0	2.51
4*	1.37	0	1.37
5*	0.99	0	0.99
6	0.91	0	0.91
7	1.81	0	1.81
		Wales 33	
1	1.28	0	1.28
2	1.07	0	1.07
3	1.38	0	1.38
4	1.44	0	1.44

Unit	Acres on prime	Acres on nonprime	Total acres
		Wales 33 (continued)	
5	3.06	0	3.06
6	1.36	0	1.36
7	0.73	0	0.73
8	0.57	0	0.57
9*	1.19	0	1.19
10*	0.71	0	0.71
11	2.78	0	2.78
12	1.26	0	1.26
13	1.62	0	1.62
14*	1.29	0	1.29
		Kimball 19	
1	0	1.40	1.40
2	0	0.85	0.85
3*	0	1.98	1.98
4	0.44	0	0.44
5	0.29	0	0.29
6	0.44	0	0.44
7*	0.55	0	0.55
8*	0.55	0	0.55
9	0	1.99	1.99
10*	0	0.50	0.50
11*	0	0.77	0.77
12*	0.88	0	0.88
13*	2.34	0	2.34
14	1.70	0	1.70
15	1.23	0.31	1.54
16	0	0.84	0.84
17	0	0.84	0.84
18	0	1.83	1.83
19	0	1.82	1.82
		Kimball 21	
1*	0	1.54	1.54
2*	0	1.52	1.52
3*	0	0.57	0.57
4	0	0.61	0.61
5*	0	0.25	0.25
6	0	1.45	1.45
7*	0	0.88	0.88
8*	0	0.44	0.44
9	0	0.85	0.85
10*	0	0.74	0.74
11*	0	0.81	0.81

Unit	Acres on prime	Acres on nonprime	Total acres
		Kimball 21 (continued)	
12*	0	0.65	0.65
13*	0	1.21	1.21
14*	0	2.41	2.41
15*	0	0.88	0.88
16*	0	1.08	1.08
17	0	0.43	0.43
18	0	0.43	0.43
19	0	0.42	0.42
20	0	0.42	0.42
21	0	0.28	0.28
22	0	0.28	0.28
23	0	0.28	0.28
24	0	0.28	0.28
25	0	0.28	0.28
26	0	0.28	0.28
27	0	2.94	2.94
28*	0	0.96	0.96
29	0	1.32	1.32
30	0	1.32	1.32
31	0	1.09	1.09
32	0	1.39	1.39
33	0	0.59	0.59
34*	0	1.47	1.47
35	0	1.54	1.54
36	0	1.07	1.07
		Kimball 26	
1*	0	1.18	1.18
2*	0	0.88	0.88
3	0	0.99	0.99
4	0	0.99	0.99
5	0	0.99	0.99
6*	0	0.99	0.99
7	0	1.68	1.68
8*	0	0.74	0.74
9*	0	1.71	1.71
10*	0	1.05	1.05
11*	0	0.93	0.93
12*	0	1.03	1.03
13*	0	1.44	1.44
14*	0	1.07	1.07
15*	0	1.65	1.65
16	0	1.52	1.52
17	0	2.39	2.39
18	0	2.40	2.40
19*	0	0.84	0.84
20*	0	1.52	1.52

Unit	Acres on prime	Acres on nonprime	Total acres
		Kimball 26 (continued)	
21	0	1.62	1.62
22	0	0.75	0.75
23*	0	1.36	1.36
24*	0	1.09	1.09
25*	0	1.09	1.09
26*	0	0.82	0.82
27*	0	0.82	0.82
28*	0	0.81	0.81
29*	0	0.81	0.81
30	0	0.45	0.45
31	0	0.46	0.46
32	0	0.66	0.66
33	0	0.83	0.83
34	0	0.66	0.66
35	0	0.58	0.58
36	0	0.73	0.73
37	0	2.72	2.72
		Kimball 29	
1	1.03	0	1.03
2	2.32	0	2.32
3	1.42	0	1.42
4	3.01	0	3.01
5	1.32	0	1.32
6	1.09	0	1.09
7	2.83	0	2.83
8*	1.23	0	1.23
9	0.50	0	0.50
10	0	0.50	0.50
11*	0	0.97	0.97
12	0	0.38	0.38
13	0	0.38	0.38
14	0	0.38	0.38
15	0	1.44	1.44
16	0	1.62	1.62
17	0	0.76	0.76
18	0	1.59	1.59
19	0	3.25	3.25
20	0	1.46	1.46
21	0	2.89	2.89
22	0	1.82	1.82
23*	0	1.59	1.59
24	0	2.71	2.71

Unit	Acres on prime	Acres on nonprime	Total acres
		Kimball 34	
1*	0	3.83	3.83
2	0	1.60	1.60
3*	0	0.66	0.66
4	0	0.74	0.74
5*	0	1.29	1.29
6	0	1.82	1.82
7*	0	1.39	1.39
8	0	1.98	1.98
9	0	0.59	0.59
10	0	0.51	0.51
11*	0	2.79	2.79
12*	0	0.53	0.53
13*	0	1.11	1.11
14*	0	1.18	1.18
15*	0	1.83	1.83
16*	0	1.85	1.85
17	0	0.54	0.54
18	0	0.45	0.45
19*	0	1.47	1.47
20	0	0.55	0.55
21*	0	0.96	0.96
22	0	1.07	1.07
23	0	1.32	1.32
24	0	1.29	1.29
25	0	0.77	0.77
26	0	0.74	0.74
27	0	2.08	2.08
28*	0	2.83	2.83
29	0	0.92	0.92
30*	0	0.90	0.90
31	0	1.38	1.38
32	0	4.83	4.83
33	0	3.31	3.31
34	0	2.28	2.28
35	0	1.73	1.73
36	0	1.46	1.46
37	0	2.11	2.11
38	0	5.58	5.58
39*	0	0.68	0.68
		Port Huron 7	
1*	0	0.61	0.61
2*	0	0.61	0.61
3	0	0.61	0.61
4*	0	1.64	1.64
5	0	0.62	0.62
6	0	0.43	0.43

Unit	Acres on prime	Acres on nonprime	Total acres
		Port Huron 7 (continued)	
7	0	0.55	0.55
8*	0	0.81	0.81
9*	0	0.55	0.55
10*	0	1.10	1.10
11*	0	1.10	1.10
12*	0	0.33	0.33
13*	0	0.33	0.33
14*	0	0.69	0.69
15*	0	0.38	0.38
16*	0	0.88	0.88
17*	0	0.79	0.79
18*	0	1.32	1.32
19*	0	1.08	1.08
20*	0	1.41	1.41
21*	0	0.54	0.54
22*	0	0.68	0.68
23*	0	1.18	1.18
24*	0	1.12	1.12
25*	0	1.06	1.06
26*	0	0.81	0.81
27*	0	0.81	0.81
28*	0	0.81	0.81
29*	0	0.81	0.81
30*	0	0.51	0.51
31*	0	0.69	0.69
32*	0	0.67	0.67
33*	0	0.92	0.92
34*	0	0.50	0.50
35*	0	0.46	0.46
36*	0	1.45	1.45
37*	0	0.77	0.77
38*	0	0.51	0.51
39	0	5.58	5.58
40	0	2.06	2.06
		Port Huron 20	
1*	0	0.96	0.96
2*	0	0.96	0.96
3	0	0.51	0.51
4	0	1.32	1.32
5	0	1.09	1.09
6*	0	0.66	0.66
7*	0	1.03	1.03
8*	0	0.33	0.33
9*	0	0.33	0.33
10	0	1.29	1.29
11	0	0.55	0.55

Unit	Acres on prime	Acres on nonprime	Total acres
		Port Huron 20 (continued)	
12	0	0.44	0.44
13	0	0.59	0.59
14*	0	0.74	0.74
15*	0	0.55	0.55
16*	0	0.55	0.55
		Columbus 11	
1	2.87	0	2.87
2	2.87	0	2.87
3	2.77	0	2.77
4	1.23	0.53	1.76
5	0.72	0.31	1.03
6	2.42	0.61	3.03
7*	0.37	0.37	0.74
8	0.37	0.37	0.74
9	0.37	0.37	0.74
10	1.12	0	1.12
11*	1.06	0	1.06
12*	1.59	0	1.59
13	1.39	0	1.39
14*	1.07	0	1.07
15*	0	0.67	0.67
16	0	0.88	0.88
17	0.62	0	0.62
18	1.84	0	1.84
19	0.91	0	0.91
20	0.85	0	0.85
21	0.66	0	0.66
22	0.66	0	0.66
23	1.62	0	1.62
		Columbus 32	
1*	0	3.35	3.35
2	0	1.59	1.59
3	0	1.56	1.56
4	0.78	0.78	1.56
5	0.88	0	0.88
6	3.19	0	3.19
7*	0.92	0.37	1.29
8	0.92	0.18	1.10
9*	0	1.21	1.21
10*	0	1.06	1.06
11	1.00	0	1.00

Unit	Acres on prime	Acres on nonprime	Total acres
		St. Clair 14	
1*	0	1.98	1.98
2	2.51	2.56	5.07
3	0.74	0	0.74
4*	0	0.89	0.89
5*	0	2.44	2.44
		St. Clair 15	
1	0	2.12	2.12
2	0	3.01	3.01
3	1.82	0.10	1.92
4	0	0.20	0.20
		St. Clair 36	
1*	0	0.49	0.49
2*	0	0.49	0.49
3*	0	0.49	0.49
4*	0	0.49	0.49
5*	0	0.49	0.49
6*	0	0.49	0.49
7*	0	0.49	0.49
8*	0	0.49	0.49
9*	0	0.49	0.49
10*	0	0.49	0.49
11*	0	0.49	0.49
12*	0	0.49	0.49
13*	0	0.49	0.49
14*	0	0.49	0.49
15*	0	0.49	0.49
16*	0	0.49	0.49
17*	0	0.49	0.49
18*	0	0.49	0.49
19*	0	0.68	0.68
20*	0	0.68	0.68
21*	0	0.68	0.68
22*	0	0.68	0.68
23*	0	0.68	0.68
24*	0	0.68	0.68
25*	0	0.68	0.68
26*	0	0.68	0.68
27*	0	0.68	0.68
28*	0	0.68	0.68
29	0	0.68	0.68
30	0	0.68	0.68
31	0	0.68	0.68
32	0	0.68	0.68

Unit	Acres on prime	Acres on nonprime	Total acres
		St. Clair 36 (continued)	
33	0	0.69	0.69
34	0	0.69	0.69
35	0	0.69	0.69
36	0	0.69	0.69
		China 2	
1	0	2.26	2.26
2	0	1.44	1.44
3	0	2.02	2.02
4*	0	1.98	1.98
5*	0	2.03	2.03
6*	0	0.66	0.66
7	0	1.08	1.08
8	0	1.72	1.72
9	0.83	0.83	1.65
10*	0.80	0	0.80
11*	0.80	0	0.80
12*	0.60	0.20	0.80
13*	0	2.97	2.97
14*	0	0.90	0.90
15*	0	0.96	0.96
16*	0	0.96	0.96
17*	0	0.96	0.96
18*	0	0.83	0.83
19*	0	1.59	1.59
20*	0.90	0.09	1.00
		China 13	
1	0	2.02	2.02
2*	0	0.93	0.93
3	0	1.92	1.92
4	0.73	0	0.73
5*	0.69	0	0.69
		China 25	
1*	2.00	0	2.00
2*	1.66	0	1.66
3	1.27	0	1.27
4	1.09	0	1.09
5	1.09	0	1.09
6	1.09	0	1.09
7	2.48	0	2.48
8*	0.72	0	0.72

Unit	Acres on prime	Acres on nonprime	Total acres
		China 25 (continued)	
9*	1.00	0	1.00
10*	0.62	0	0.62
11*	0	0.62	0.62
12*	0	0.62	0.62
13*	0	0.62	0.62
14*	0	0.62	0.62
15	0	0.62	0.62
16	0	0.62	0.62
17	0	0.62	0.62
18*	0	0.90	0.90
19*	0	0.90	0.90
20	0	0.90	0.90
21	0	0.90	0.90
22*	0	0.90	0.90
23	0.61	0	0.61
24	0.61	0	0.61
25*	0	0.88	0.88
26	0	2.21	2.21
27*	0	2.46	2.46
28*	0	2.46	2.46
29	0	2.43	2.43
30*	0	1.05	1.05
		Casco 23	
1	1.10	1.10	2.20
2	0.85	0	0.85
3	4.37	0	4.37
4	2.13	0	2.13
5	1.84	0	1.84
6	4.60	0	4.60
7	2.39	0	2.39
8	1.49	0	1.49
9	1.35	0	1.35
10	0.85	0	0.85
11	1.56	0.67	2.23
12	0.89	0.60	1.49
13*	2.76	0	2.76
14*	2.32	0	2.32
15	0.88	0.59	1.47
16	1.15	0.77	1.92
17*	0	1.30	1.30
18	0	2.37	2.37
19	0	1.45	1.45
20	0	2.78	2.78

Unit	Acres on prime	Acres on nonprime	Total acres
		Cothreville 16	
1*	1.32	0	1.32
2*	0	0.81	0.81
3	1.06	0	1.06
4	0	1.70	1.70
5	0	0.83	0.83
6	0	4.01	4.01
7	0	2.59	2.59
8*	0	1.01	1.01
9	0	1.01	1.01
10*	0	1.10	1.10
11*	0	0.57	0.57
		Cothreville 17	
1	0	1.32	1.32
2*	1.03	0	1.03
3*	0.59	0	0.59
4*	0.44	0	0.44

Washtenaw County - 1980 (1964 - *)

Unit	Acres on prime	Acres on nonprime	Total acres
		Lyndon 10	
-	0	0	0
		Dexter 6	
1*	0	0.87	0.87
2*	0	0.87	0.87
3*	0	0.67	0.67
4*	0	0.67	0.67
		Dexter 32	
1	0	2.68	2.68
2	0	1.39	1.39
3	0	1.84	1.84
4*	0	0.94	0.94
5*	0	0.69	0.69
6	0	4.54	4.54
7	0	0.69	0.69
8*	0	0.50	0.50
		Webster 13	
1	1.55	0	1.55
2	4.44	0	4.44
3	2.64	0	2.64
4	1.59	1.59	3.17
5*	4.86	0	4.86
6*	3.51	0	3.51
7	1.75	0.76	2.51
8	0.99	0	0.99
9	1.54	0.39	1.93
10	0	2.62	2.62
11	0.64	1.71	2.35
12	0.89	0	0.89
13	0.89	0	0.89
14	0.89	0	0.89
15	0	1.65	1.65

* indicates units existing in 1964.

Unit	Acres on prime	Acres on nonprime	Total acres
		Webster 13 (continued)	
16	2.06	0	2.06
17	1.59	0	1.59
18	1.76	0	1.76
19	0	1.65	1.65
20	1.29	0	1.29
21	3.36	0	3.36
		Northfield 14	
1	2.34	1.21	3.55
2	3.23	0	3.23
3	0	1.16	1.16
4	2.55	0	2.55
5*	0.82	1.44	2.26
		Salem 1	
1*	1.18	0	1.18
2*	1.18	0	1.18
3*	2.94	0	2.94
4	1.80	0	1.80
5*	1.47	0	1.47
6*	1.47	0	1.47
7	0.92	0	0.92
8	1.19	0	1.19
9*	3.17	0	3.17
10	1.32	0	1.32
11*	1.21	0	1.21
12*	1.10	0	1.10
13*	1.10	0	1.10
14*	1.21	0	1.21
15	1.11	0	1.11
16*	0	0.59	0.59
17*	0	0.50	0.50
18*	0	0.66	0.66
19	0	0.86	0.86
20	0	1.47	1.47
21*	0	0.37	0.37
22*	2.35	0	2.35
23*	1.29	0	1.29
24*	0.88	0	0.88
25	3.12	0	3.12
26*	1.80	0	1.80
27	0.74	0.85	1.59
28*	1.47	0	1.47

Unit	Acres on prime	Acres on nonprime	Total acres
		Salem 5	
1*	0	1.06	1.06
2*	0.47	1.88	2.35
3	1.03	0	1.03
4	3.31	0	3.31
5	0.88	0	0.88
6	0.96	0	0.96
7	1.03	0	1.03
8	1.03	0	1.03
		Salem 6	
1*	0	0.73	0.73
2*	0	0.59	0.59
3	0	0.92	0.92
4	0	2.42	2.42
5	0	2.03	2.03
6	1.47	0	1.47
7	3.09	0	3.09
8	3.11	0	3.11
9	3.29	0	3.29
10	0.92	0	0.92
11	2.54	0.55	3.09
12	1.43	0	1.43
13	2.06	0	2.06
14	2.20	0	2.20
15	6.23	0	6.23
16	0	3.78	3.78
17	0	2.02	2.02
18	1.18	0	1.18
		Salem 22	
1	0	1.37	1.37
2	0	2.35	2.35
3	0	3.10	3.10
4	0	4.82	4.82
5	0	4.19	4.19
6	0	3.35	3.35
7	0	2.93	2.93
8	0	4.99	4.99
9	0	2.04	2.04
10*	0	3.38	3.38
11*	0	2.78	2.78
12*	0.95	0	0.95
13	0	0.24	0.24
14	0	2.26	2.26
15	0	2.04	2.04

Unit	Acres on prime	Acres on nonprime	Total acres
		Salem 23	
1*	1.83	0	1.83
2	0	0.89	0.89
3	0	1.73	1.73
4*	1.30	0.12	1.42
5	0.99	0.99	1.98
6	0.55	0	0.55
7	0.55	0	0.55
8*	2.29	0	2.29
9	1.63	0	1.63
10	0.91	0	0.91
11*	2.98	0	2.98
12	1.76	0	1.76
13	1.32	0	1.32
14	1.27	0	1.27
15	2.52	0	2.52
16	1.72	0	1.72
17	4.35	0	4.35
		Salem 24	
1	3.29	0	3.29
2	3.26	0	3.26
3*	0	1.40	1.40
4	0	2.03	2.03
5	0	1.62	1.62
6*	0	1.88	1.88
7*	0	2.38	2.38
8	0	1.77	1.77
9	0	3.12	3.12
10	3.88	0	3.88
11*	3.58	0	3.58
12	0	2.28	2.28
13*	4.90	0	4.90
14*	3.96	0	3.96
		Lima 6	
1*	0	1.82	1.82
2	0	1.49	1.49
3*	0	1.62	1.62
4	0	1.62	1.62
5	0	0.91	0.91
6*	0	2.36	2.36

Unit	Acres on prime	Acres on nonprime	Total acres
		Lima 17	
1	0	3.39	3.39
2	3.64	0.33	3.97
3	3.21	0.10	3.31
		Scio 17	
1	3.14	0	3.14
		Scio 36	
1	0.57	0	0.57
2*	0.59	0	0.59
3*	0	1.16	1.16
4*	0	1.16	1.16
5*	0.33	0	0.33
6*	0.87	0	0.87
7*	1.01	0.20	1.21
8*	0.60	0.61	1.21
9*	0.52	0.69	1.21
10*	0.88	0.33	1.21
11*	1.21	0	1.21
12	0.88	0.33	1.21
13	0.88	0.33	1.21
		Ann Arbor 3	
1	0.88	0	0.88
		Superior 10	
1*	2.23	3.76	5.99
2	2.50	1.89	4.48
3*	1.86	0	1.86
4*	4.65	0	4.65
5*	2.48	0	2.48
6*	2.48	0	2.48
7*	1.47	0	1.47
8*	0.61	0	0.61
9*	0	3.96	3.96
10	1.03	1.29	2.32
11	3.34	0	3.34
12	0	2.94	2.94
13	2.52	0.18	2.70
14*	1.30	1.81	3.11
15	0.60	0.59	1.19

Unit	Acres on prime	Acres on nonprime	Total acres
		Superior 10 (continued)	
16	0.14	0.41	0.55
17*	1.32	0	1.32
18*	2.57	0	2.57
		Superior 33	
1*	1.18	0	1.18
2*	1.03	0	1.03
3*	0.73	0	0.73
4*	0.73	0	0.73
5*	0.44	0	0.44
6	1.18	0	1.18
7*	0	2.06	2.06
8*	0	0.73	0.73
9*	0	0.73	0.73
10	0	0.37	0.37
11	0	0.37	0.37
12	0	0.73	0.73
13	0	1.09	1.09
14*	0	0.88	0.88
15*	0	1.10	1.10
		Sharon 6	
1	0	1.32	1.32
		Sharon 11	
1	0.61	0	0.61
		Sharon 14	
1	0	2.19	2.19
2	0	3.31	3.31
3	0	1.47	1.47
4	0	2.02	2.02
5	0	1.42	1.42
6	0.42	1.47	1.47
7	0	0.73	0.73
8	0	0.59	0.59
9	1.06	0	1.06
10	1.28	0	1.28
11*	0	1.41	1.41
12	1.80	0	1.80
13	0.88	0	0.88

Unit	Acres on prime	Acres on nonprime	Total acres
		Sharon 18	
1	0	1.21	1.21
2	0	0.87	0.87
3*	0	2.13	2.13
4*	0	1.88	1.88
		Sharon 20	
1*	0	2.64	2.64
2*	0	2.12	2.12
3	0	3.01	3.01
4	0	1.18	1.18
5	0	1.00	1.00
6	0	1.29	1.29
7	0	3.36	3.36
8*	0	1.47	1.47
		Freedom 14	
1	1.16	0.54	1.70
2	0	1.53	1.53
3	0.26	0	0.26
4*	0.73	0	0.73
5*	0.73	0	0.73
6	0.73	0	0.73
		Freedom 21	
1	0.92	0	0.92
2	0.92	0	0.92
3	1.10	0	1.10
4	0	1.48	1.48
5	0.99	0	0.99
6	0.99	0	0.99
7	0.99	0	0.99
8*	0.70	0	0.70
9*	0.70	0	0.70
10*	0.70	0	0.70
11*	0.70	0	0.70
12*	0.70	0	0.70
13*	0.70	0	0.70
		Freedom 25	
1	0	2.55	2.55

Unit	Acres on prime	Acres on nonprime	Total acres
		Freedom 25 (continued)	
2	2.23	0	2.23
3	0.64	0	0.64
4	0	1.54	1.54
5*	0	0.44	0.44
		Lodi 15	
1	0	4.34	4.34
2	0	4.34	4.34
3	0	4.34	4.34
4*	3.81	0	3.81
5	1.50	2.25	3.75
6	0.68	2.52	3.15
7	0	3.27	3.27
		Lodi 16	
-	0	0	0
		Lodi 23	
1	1.31	0	1.31
2	1.02	0	1.02
3*	1.13	0	1.13
4*	1.12	0	1.12
5*	0.81	0	0.81
		Lodi 25	
1*	2.85	0	2.85
		Pittsfield 19	
1	1.06	0	1.06
2	0.89	0	0.89
3*	0.85	0	0.85
4*	1.37	0	1.37
5*	0.66	0	0.66
6*	0	0.66	0.66
7	0	0.57	0.57
8	0	0.37	0.37

Unit	Acres on prime	Acres on nonprime	Total acres
		Pittsfield 31	
1*	0.85	0.21	1.06
2	1.29	0	1.29
		Ypsilanti 19	
1	0	2.06	2.06
2*	0.51	1.02	1.53
3	1.76	0	1.76
4	0	1.00	1.00
5*	0	2.57	2.57
6	0	0.88	0.88
7	0	2.57	2.57
8*	0	1.84	1.84
9	0	3.49	3.49
10*	0	3.37	3.37
11	2.91	0	2.91
12	0.62	0.41	1.03
13	1.10	0.28	1.38
14	0.92	0.86	1.78
15	1.16	1.52	2.68
16*	0.64	0.90	1.54
17*	0	1.76	1.76
18	0	0.99	0.99
19	0	0.99	0.99
20	0	1.15	1.15
21	0	1.38	1.38
22*	0	0.68	0.68
23*	0	0.57	0.57
24*	0	0.91	0.91
25*	0	2.64	2.64
26	0	1.18	1.18
27	0	1.10	1.10
28*	0	2.39	2.39
29*	0	2.38	2.38
30*	0	1.14	1.14
31	1.76	0	1.76
32	1.77	0	1.77
		Manchester 11	
1	0	1.65	1.65
2	0	1.39	1.39
3	0	1.25	1.25
4*	0	0.87	0.87
5*	0	2.23	2.23
6*	0	1.61	1.61
7	0	0.93	0.93

Unit	Acres on prime	Acres on nonprime	Total acres
		Manchester 11 (continued)	
8	0	0.78	0.78
9	0	0.78	0.78
10	0	1.40	1.40
11	0	1.56	1.56
12*	0	0.97	0.97
13	0	1.65	1.65
14	0	0.81	0.81
15	0	1.10	1.10
16	0	1.00	1.00
17	0	1.10	1.10
18*	0	1.18	1.18
19*	0	1.29	1.29
20	0	1.18	1.18
21	0	1.01	1.01
		Bridgewater 9	
1	4.13	0	4.13
2	2.05	0.79	2.84
3	0	1.50	1.50
4	1.15	0.76	1.91
5	0	1.29	1.29
		Bridgewater 33	
1	1.49	0	1.49
		Saline 14	
1*	0.60	0	0.60
2	0	2.82	2.82
3	1.08	0.95	2.05
4	0.88	0	0.88
5	1.00	0	1.00
6	0.46	0	0.46
7	0.71	0	0.71
8	1.41	0.47	1.88
9	3.76	0.29	4.05
10*	0.58	1.89	2.47
11	1.29	0	1.29
12	1.54	0	1.54
13	3.96	0	3.96
14	1.01	0	1.01
15	1.01	0	1.01
16	1.49	0	1.49
17	1.11	0	1.11

Unit	Acres on prime	Acres on nonprime	Total acres
		Saline 14 (continued)	
18	1.11	0	1.11
19	2.02	0	2.02
		Saline 22	
1	0	1.88	1.88
2	0	0.97	0.97
		York 7	
1	0	1.13	1.13
2*	0	0.97	0.97
3*	0	0.97	0.97
4*	0	0.97	0.97
5	0	1.05	1.05
		York 16	
1	3.04	0	3.04
2	1.55	2.48	4.03
3	1.32	0	1.32
4	0.30	1.10	1.40
5	0.30	1.10	1.40
6	0.30	1.10	1.40
7	0.30	1.10	1.40
8	0.30	1.10	1.40
9	0.96	2.77	3.72
10	1.40	0	1.40
11	1.40	0	1.40
12	1.40	0	1.40
13	1.01	0	1.01
14	0	1.47	1.47
15	0	3.60	3.60
16	0	2.25	2.25
17	0	2.57	2.57
18	0	2.89	2.89
19	0	5.42	5.42
20	0	3.09	3.09
21	0	1.23	1.23
22	0.73	0	0.73
23	2.53	2.54	2.53
24	0	2.72	2.72
25*	0	0.44	0.44
26*	0	0.71	0.71
27	1.13	0	0
28	0	1.01	1.01

Unit	Acres on prime	Acres on nonprime	Total acres
		York 16 (continued)	
29*	0	0.82	0.82
30*	0	0.92	0.92
31	0	1.73	1.73
32	0	2.16	2.16
33	0	1.14	1.14
34	0	1.74	1.74
35*	0	0.92	0.92
36*	0	1.89	1.89
37	0	1.02	1.02
38*	0	1.02	1.02
39	0	0.89	0.89
40*	0	1.70	1.70
41	0	1.70	1.70
42*	0	1.70	1.70
43*	0	1.70	1.70
44*	0	0.77	0.77
45	0	1.36	1.36
46*	0	0.93	0.93
47*	0	1.18	1.18
		York 26	
1*	1.65	0	1.65
2	1.19	0	1.19
3*	0.71	0	0.71
4*	0.76	0	0.76
5	1.06	0	1.06
6*	0	1.34	1.34
		York 32	
1	4.14	0	4.14
		Augusta 14	
1*	0	1.32	1.32
2*	0.96	0.97	1.93
3*	1.00	2.01	3.01
4*	0	2.57	2.57
5*	0	4.41	4.41
6*	0	1.85	1.85
7*	0	0.73	0.73
8*	0	0.83	0.83
9*	0	1.21	1.21
10	0	0.61	0.61
11*	0	0.81	0.81

Unit	Acres on prime	Acres on nonprime	Total acres
		Augusta 14 (continued)	
12*	0	1.63	1.63
13	0	1.06	1.06
14	0	1.06	1.06
15*	0	1.14	1.14
16	0	1.84	1.84
17	0	0.98	0.98
18	0	1.40	1.40
19	0.99	0	0.99
20	0	0.97	0.97
21	0	2.70	2.70
22	0	1.76	1.76
23	1.38	0	1.38
24*	2.26	0	2.26
25	0.99	0	0.99
26	0.92	0	0.92
27*	0.99	0	0.99
28*	0.87	0.12	0.99
		Augusta 15	
1*	0.57	0	0.57
2	0.69	0.07	0.76
3	0.82	0.21	1.03
4	0.82	0.21	1.03
5*	0	0.57	0.57
6*	0	2.45	2.45
7	0	0.84	0.84
8*	0	0.49	0.49
9*	0	0.93	0.93
10*	0.90	0.23	1.13
11*	0.43	0.43	0.86
12*	0.55	0.55	1.10
		Augusta 16	
1	0	0.84	0.84
2*	0.37	0.36	0.73
3	0	0.96	0.96
4	0	0.44	0.44
5	0	0.44	0.44
6	0	1.59	1.59
7	0	1.94	1.94
8	0	1.26	1.26
9	0	1.26	1.26
10	0	1.39	1.39
11	0	2.69	2.69
12*	0	0.58	0.58

Unit	Acres on prime	Acres on nonprime	Total acres
		Augusta 16 (continued)	
13*	1.32	0	0
14*	0	0.48	0.48
15*	0	0.69	0.69

APPENDIX B

TOTALS AND AVERAGES OF SAMPLE DATA

APPENDIX B

TOTALS AND AVERAGES OF SAMPLE DATA

St. Clair County

Township - Section	Mi 1964	Mi 1980	yi 1964	yi 1980	$\bar{y}i$ 1964	$\bar{y}i$ 1980
Lynn - 11	2	4	2.66	5.30	1.33	1.33
Lynn - 14	0	3	0	5.33	0	1.78
Lynn - 35	1	4	1.01	4.82	1.01	1.21
Brockway - 3	0	8	0	15.37	0	1.92
Brockway - 26	1	2	2.27	3.67	2.27	1.83
Grant - 1	2	6	3.24	6.05	1.62	1.01
Grant - 30	4	13	5.35	18.45	1.34	1.42
Grant - 35	2	9	2.59	12.44	1.29	1.38
Emmet - 17	5	12	5.99	23.86	1.20	1.99
Emmett - 21	8	15	7.86	19.77	0.98	1.32
Kenockee - 3	0	3	0	5.40	0	1.80
Kenockee - 32	1	9	0.80	22.09	0.80	2.45
Kenockee - 34	1	6	0.52	9.50	0.52	1.58
Clyde - 2	0	12	0	15.07	0	1.26
Clyde - 11	4	6	6.74	11.04	1.69	1.84
Clyde - 18	9	25	8.41	28.92	0.94	1.16
Clyde - 30	8	23	13.58	32.66	1.70	1.42
Fort Gratiot - 7	2	15	2.61	19.58	1.30	1.31
Berlin - 10	2	9	1.96	10.32	0.98	1.15
Berlin - 26	8	25	5.78	27.83	0.72	1.11
Riley - 7	3	14	3.24	20.05	1.08	1.43
Riley - 29	3	6	3.80	6.90	1.27	1.15
Riley - 33	1	3	0.65	5.20	0.65	1.73
Riley - 36	2	8	0.76	8.42	0.38	1.05
Wales - 3	14	20	12.28	22.67	0.88	1.13
Wales - 4	3	7	4.88	10.78	1.63	1.54
Wales - 33	3	14	3.22	19.72	1.07	1.41
Kimball - 19	7	19	7.57	21.54	1.08	1.13
Kimball - 21	15	36	15.41	32.95	1.03	0.92
Kimball - 26	19	37	20.99	42.21	1.10	1.14
Kimball - 29	3	24	3.79	36.40	1.26	1.52
Kimball - 34	15	39	23.29	62.13	1.55	1.59
Port Huron - 7	35	38	29.97	30.12	0.86	0.79
Port Huron - 20	9	16	6.10	11.89	0.68	0.74
Columbus - 11	5	23	5.12	31.48	1.03	1.37
Columbus - 32	4	11	6.90	17.78	1.73	1.62

St. Clair County (continued)

Township - Section	Mi 1964	Mi 1980	yi 1964	yi 1980	$\bar{y}i$ 1964	$\bar{y}i$ 1980
St. Clair - 14	3	5	5.31	11.12	1.77	2.22
St. Clair - 17	1	4	1.91	7.24	1.91	1.81
St. Clair - 36	28	36	15.61	21.07	0.56	0.59
China - 2	14	20	17.24	27.42	1.23	1.37
China - 13	3	5	7.69	6.28	2.56	1.26
China - 25	16	30	18.04	34.61	1.23	1.15
Casco - 23	3	20	6.37	42.14	2.13	2.11
Cothreville - 16	5	11	4.82	16.01	0.96	1.46
Cothreville - 17	3	4	2.06	6.01	0.67	1.50
Total/Average	6.47	14.53	6.56	18.88	-	-

Washtenaw County

Township - Section	Mi 1964	Mi 1980	yi 1964	yi 1980	$\bar{y}i$ 1964	$\bar{y}i$ 1980
Lyndon - 10	0	0	0	0	0	0
Dexter - 6	4	4	3.08	3.08	0.77	0.77
Dexter - 32	3	8	2.13	13.27	0.71	1.66
Webster - 13	2	21	8.37	46.60	4.19	2.22
Northfield - 14	1	5	2.26	12.75	2.26	2.55
Salem - 1	19	28	25.94	40.32	1.37	1.44
Salem - 5	2	8	3.41	11.65	1.71	1.46
Salem - 6	2	18	1.32	40.56	0.66	2.25
Salem - 22	3	15	7.11	40.79	2.37	2.72
Salem - 23	4	17	8.52	29.70	2.13	1.75
Salem - 24	6	14	18.10	39.62	3.02	2.83
Lima - 6	3	6	5.80	9.82	1.93	1.64
Lima - 17	0	3	0	10.67	0	3.56
Scio - 17	0	1	0	3.14	0	3.14
Scio - 36	10	13	10.16	13.15	1.02	1.01
Ann Arbor - 3	0	1	0	0.88	0	0.88
Superior - 10	11	18	30.09	48.02	2.74	2.67
Superior - 33	10	15	9.61	13.35	0.96	0.89
Sharon - 6	0	1	0	1.32	0	1.32
Sharon - 11	0	1	0	0.61	0	0.61
Sharon - 14	1	13	1.41	20.10	1.41	1.55
Sharon - 18	2	4	4.01	6.09	2.00	1.52
Sharon - 20	3	8	6.60	16.07	2.20	2.01
Freedom - 14	2	6	1.46	5.68	0.73	0.95
Freedom - 21	6	13	4.20	11.59	0.70	0.89
Freedom - 25	1	5	0.44	7.49	0.44	1.50

Washtenaw County (continued

Township - Section		Mi 1964	Mi 1980	yi 1964	yi 1980	$\bar{y}i$ 1964	$\bar{y}i$ 1980
Lodi	- 15	1	7	3.81	27.00	3.81	3.86
Lodi	- 16	0	0	0	0	0	0
Lodi	- 23	3	5	3.06	5.39	1.02	1.08
Lodi	- 25	1	1	2.85	2.85	2.85	2.85
Pittsfield	- 19	4	8	3.54	6.43	0.89	0.80
Pittsfield	- 31	1	2	1.06	2.32	1.06	1.18
Ypsilanti	- 19	13	32	23.32	55.18	1.79	1.72
Manchester	- 11	6	21	8.15	25.74	1.36	1.23
Bridgewater	- 9	0	5	0	11.67	0	2.33
Bridgewater	- 33	0	1	0	1.49	0	1.49
Saline	- 14	2	19	3.07	31.46	1.54	1.66
Saline	- 22	0	2	0	2.85	0	1.43
York	- 7	3	5	2.91	5.09	0.97	1.02
York	- 16	13	47	14.70	83.94	1.13	1.79
York	- 26	4	6	4.46	6.71	1.12	1.12
York	- 32	0	1	0	4.14	0	4.14
Augusta	- 14	15	28	25.68	42.34	1.72	1.51
Augusta	- 15	8	12	8.06	11.76	1.01	0.98
Augusta	- 16	4	15	3.11	16.61	0.78	1.11
Total/Average		3.84	10.29	5.82	17.54	-	-

APPENDIX C

IMPORTANT FARMLANDS INVENTORY CRITERIA

510.05 Important farmlands inventory

PART 657 - PRIME AND UNIQUE FARMLANDS
Subpart A - Important Farmlands Inventory

Sec. 657.1 Purpose.
657.2 Policy.
657.3 Applicability.
657.4 SCS Responsibilities.
657.5 Identification of important farmlands.

Authority: 16 U.S.C. 590a-f, q; 7 CFR 2.62; Pub. L. 95-87; 42 U.S.C. 4321 et seq.

Subpart A - Important Farmlands Inventory

§ 657.1 Purpose.

SCS is concerned about any action that tends to impair the productive capacity of American agriculture. The Nation needs to know the extent and location of the best land for producing food, feed, fiber, forage, and oilseed crops. In addition to prime and unique farmlands, farmlands that are of statewide and local importance for producing these crops also need to be identified.

§ 657.2 Policy.

It is SCS policy to make and keep current an inventory of the prime farmland and unique farmland of the Nation. This inventory is to be carried out in cooperation with other interested agencies at the national, State, and local levels of Government. The objective of the inventory is to identify the extent and location of important rural lands needed to produce food, feed, fiber, forage, and oilseed crops.

§ 657.3 Applicability.

Inventories made under this memorandum do not constitute a designation of any land area to a specific land use. Such designations are the responsibility of appropriate local and State officials.

§ 657.4 SCS Responsibilities.

(a) State Conservationist. Each SCS State Conservationist is to:

(1) Provide leadership for inventories of important farmlands for the State, county, or other subdivision of the State. Each is to work with appropriate agencies of State government and others to establish priorities for making these inventories.

(2) Identify the soil mapping units within the State that qualify as prime. In doing this, State Conservationists, in consultation with the cooperators of the National Cooperative Soil Survey, have the flexibility to make local deviation from the permeability criterion or to be more restrictive for other specific criteria in order to assure the most accurate identification of prime farmlands for a State. Each is to invite representatives of the Governor's office, agencies of the State government, and others to identify farmlands of statewide importance and unique farmlands that are to be inventoried within the framework of this memorandum.

(3) Prepare a statewide list of:

(i) Soil mapping units that meet the criteria for prime farmland;

(ii) Soil mapping units that are farmlands of statewide importance if the criteria used were based on soil information; and

(iii) Specific high-value food and fiber crops that are grown and, when combined with other favorable factors, qualify lands to meet the criteria for unique farmlands. Copies are to be furnished to SCS Field Offices and to SCS Technical Service Centers (TSC's). (See 7 CFR 600.3, 600.6.)

(4) Coordinate soil mapping units that qualify as prime farmlands with adjacent States, including the States responsible for the soil series. Since farmlands of statewide importance and unique farmlands are designated by others at the State level, the soil mapping units and areas identified need not be coordinated among States.

(5) Instruct SCS District Conservationists to arrange local review of lands identified as prime, unique, and additional farmlands of statewide importance by Conservation Districts and representatives of local agencies. This review is to determine if additional farmland should be identified to meet local decisionmaking needs.

(6) Make and publish each important farmland inventory on a base map of national map accuracy at an intermediate scale of 1:50,000 or 1:100,000. State Conservationists who need base maps of other scales are to submit their requests with justification to the Administrator for consideration.

(b) Technical Service Centers. Field Representatives are to provide requested technical assistance to State Conservationists in inventorying prime and unique farmlands (see 7 CFR 600.2). This includes reviewing statewide lists of soil mapping units that meet the criteria for prime farmlands and resolving coordination problems that may occur among States for specific soil series or soil mapping units.

(c) National Office. The Assistant Administrator for Field Services (see 7 CFR 600.2) is to provide national leadership in preparing guidelines for inventorying prime farmlands and for national statistics and reports of prime farmlands.

§ 657.5 Identification of important farmlands.

(a) Prime farmlands.

(1) General. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity,

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acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding. Examples of soils that qualify as prime farmland are Palouse silt loam, 0 to 7 percent slopes; Brookston silty clay loam, drained; and Tama silty clay loam, 0 to 5 percent slopes.

(2) Specific criteria. Prime farmlands meet all the following criteria: Terms used in this section are defined in USDA publications: "Soil Taxonomy, Agriculture Handbook 436"; "Soil Survey Manual, Agriculture Handbook 18"; "Rainfall-Erosion Losses from Cropland, Agriculture Handbook 282"; "Wind Erosion Forces in the United States and Their Use in Predicting Soil Loss, Agriculture Handbook 346"; and "Saline and Alkali Soils, Agriculture Handbook 60."

(i) The soils have:

(A) Aquic, udic, ustic, or xeric moisture regimes and sufficient available water capacity within a depth of 40 inches (1 meter), or in the root zone (root zone is the part of the soil that is penetrated or can be penetrated by plant roots) if the root zone is less than 40 inches deep, to produce the commonly grown cultivated crops (cultivated crops include, but are not limited to, grain, forage, fiber, oilseed, sugar beets, sugarcane, vegetables, tobacco, orchard, vineyard, and bush fruit crops) adapted to the region in 7 or more years out of 10; or

(B) Xeric or ustic moisture regimes in which the available water capacity is limited, but the area has a developed irrigation water supply that is dependable (a dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years for the crops commonly grown) and of adequate quality; or,

(C) Aridic or torric moisture regimes and the area has a developed irrigation water supply that is dependable and of adequate quality; and,

(ii) The soils have a temperature regime that is frigid, mesic, thermic, or hyperthermic (pergelic and cryic regimes are excluded). These are soils that, at a depth of 20 inches (50 cm), have a mean annual temperature higher than 32° F (0° C). In addition, the mean summer temperature at this depth in soils with an O horizon is higher than 47° F (8° C); in soils that have no O horizon, the mean summer temperature is higher than 59° F (15° C); and,

(iii) The soils have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone is less than 40 inches deep; and,

(iv) The soils either have no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown; and,

(v) The soils can be managed so that, in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone is less than 40 inches deep, during part of each year the conductivity of the saturation extract is less than 4 mmhos/cm and the exchangable sodium percentage (ESP) is less than 15; and,

(vi) The soils are not flooded frequently during the growing season (less often than once in 2 years); and,

(vii) The product of K (erodibility factor) x percent slope is less than 2.0, and the product of I (soils erodibility) x C (climatic factor) does not exceed 60; and

(viii) The soils have a permeability rate of at least 0.06 inch (0.15 cm) per hour in the upper 20 inches (50 cm) and the mean annual soil temperature at a depth of 20 inches (50 cm) is less than 59° F (15° C); the permeability rate is not a limiting factor if the mean annual soil temperature is 59° F (15° C) or higher; and,

(ix) Less than 10 percent of the surface layer (upper 6 inches) in these soils consists of rock fragments coarser than 3 inches (7.6 cm).

(b) Unique farmland.

(1) General. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods. Examples of such crops are citrus, tree nuts, olives, cranberries, fruit, and vegetables.

(2) Specific characteristics of unique farmland.

(i) Is used for a specific high-value food or fiber crop.

(ii) Has a moisture supply that is adequate for the specific crop. The supply is from stored moisture, precipitation, or a developed irrigation system.

(iii) Combines favorable factors of soil quality, growing season, temperature, humidity, air drainage, elevation, aspect, or other conditions, such as nearness to market, that favor the growth of a specific food or fiber crop.

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(c) Additional farmland of statewide importance. This is land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Criteria for defining and delineating this land are to be determined by the appropriate State agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable. In some States, additional farmlands of statewide importance may include tracts of land that have been designated for agriculture by State law.

(d) Additional farmland of local importance. In some local areas there is concern for certain additional farmlands for the production of food, feed, fiber, forage, and oilseed crops, even though these lands are not identified as having national or statewide importance. Where appropriate, these lands are to be identified by the local agency or agencies concerned. In places, additional farmlands of local importance may include tracts of land that have been designated for agriculture by local ordinance.

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