RELATIONSHIPS OF LAND USES TO LAND CHARACTER OF LANSING AND ENVIRONS

By

HARRY A. DOEHNE

AN ABSTRACT

Submitted to the School for Advanced Graduate Studies of
Michigan State University of Agriculture and
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Approved: Louis A. Wolfanger

HARRY A. DOEHNE

THESIS ABSTRACT

The movement of urban activity to a more rural environment has reached significant proportions in the past twenty years. One of the consequences resulting from this urbanization is that development occurs with little or no regard for the natural characteristics of the environment. Excellent and inferior agricultural land is developed indiscriminately, the land most often used being that which is most easily developed.

An absolute shortage of land does not exist but the amount of good agricultural land is steadily diminishing. At the same time, because of a growing population, the demands upon the diminishing agricultural land will continue to increase. The need for protecting good agricultural land is becoming increasingly apparent to the informed observer.

The object of this study is to determine the disposition of urban lands in the Lansing area. It aims to ascertain the relation of all land uses to land character and to determine the compatibility of the uses to the types of soils of the area.

The population of the Lansing area is one of the most rapidly growing in Michigan. An estimate based on the number of electricity customers and building statistics indicates that the area has added 36,000 persons between 1950 and 1957

and space has had to be provided for 10,000 to 11,500 new dwelling units.

The land uses were correlated with the suitability of land for agriculture on the basis of six land classes. Distribution of land uses within a ten mile radius of the capitol building in Lansing shows that the area is still dominated by agriculture with 62.9 per cent of the area in agricultural use. Of the land in agriculture, 72.9 per cent is in the best two agricultural land classes. Urban uses account for 15.2 per cent of the total acreage. However, of the land in urban usage, 75.2 per cent is in the two best agricultural land classes. Analysis shows that a greater percentage of the land best suited to agriculture is idle in the more urbanized sections than in the more rural sections.

The results of the study indicate that the land in Agricultural Land Classes I and II, the best agricultural lands, need protection from urban encroachment if we are interested in preserving them. The author suggests that the solution of the problem rests in part upon an inventory of the resources of the area. A simplified soil survey map delineating the areas which are most suitable for urban development or agriculture is one of the appraisal tools which planners might find useful.

Methods are suggested by which soil survey data may be utilized to guide rational urban development and yet produce a balanced environment which recognizes the desirability of maintaining our good soils in agricultural production.

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Statement of the Problem

Urban encroachment on agricultural land.--The movement of urban activities to a more rural environment has reached significant proportions in the past twenty years. Suburban subdivisions and homes, rural non-farm residences, shopping centers and decentralized industries attest to the new non-agricultural interest in rural real estate.

Improved road networks, the increased use of automotive transportation, and the desire for single-family dwelling units in a more spacious setting have been major causes for this phenomenon. Industries seeking larger, more easily developed sites have accelerated the migration and commercial enterprises have followed to provide services for the expanding market.

It has been claimed that one of the consequences resulting from this urbanizing pattern is that development occurs with little or no regard for the natural characteristics of the landscape. Excellent and inferior agricultural land is said to be developed indiscriminately. Sometimes practically no consideration is given to soil characteristics, depth of the water table, or subsurface features.

Because choice of building sites is largely economically directed, the land most often acquired is that which is most easily developed. Well-drained soils and level land are requisites for the builder. Unfortunately, this land usually comprises the best agricultural soils. Large acreages of these good soils are being taken out of production each year.

Indirectly affecting the efficiency of land use is speculative holding of acreages awaiting ripening into urban usage. Land still in agricultural uses which is enveloped by idle or urbanized acreage has difficulty in maintaining the agricultural economy in the face of competing uses and increasing tax burdens.

Spread of urbanization in Michigan.--In southern Michigan, of the land taken out of agricultural production and put to other uses, a large portion has been converted to private use such as residential construction. But public facilities such as the usual 300 foot highway require 30 to 35 acres per mile and complicated cloverleaf intersections take 60 or even 120 acres each.

Students of economics and industry believe future development of Michigan will occur in the direction of a highly industrialized state. This will accelerate the demand for land for all types of urban and suburban uses. Land will be needed for new and expanding industrial sites, for more dwellings to house the industrial workers and those who provide them with services, and for community facilities such as recreational areas, service areas and roads. The increase in leisure time has placed a new emphasis on outdoor living and recreation which will result in a more generous utilization of space for these purposes.

Protection of good agricultural land.--An absolute shortage of land does not exist but the amount of good agricultural land is steadily diminishing. At the same time, because of a growing population, the demands upon the decreasing supply of agricultural land will continue to increase. The question of protecting these good areas is becoming more serious in the thinking of the informed observer.

During this period of agricultural surpluses the problem of a dwindling supply of good agricultural land does not seem very urgent but if the trend continues, we may eventually find ourselves with a limited supply in the very resource which has partially accounted for our high standard of living--good agricultural land close to urban markets.

Our economy is based on a relatively cheap food supply leaving a large portion of our income for the purchase of durable and other goods and services. While the average person in many other nations spends one-half or more of his income for food we average only about 25 per cent, a situation which in part results in our higher level of living.

Technology can, at present, meet the greater demands placed on the smaller land area. But eventually an upper limit may be reached after which the employment of technological devices may no longer maintain our level of living.

Community planning and zoning are some tools which can, if accepted, be utilized to protect agricultural land from urban encroachment in some areas if it is felt that this is important to us. In the final analysis, however, the public must become aware of the problem and must be convinced of the need to solve it.

Purpose of the Study

The object of this study is to determine the distribution of urban-type lands in the Lansing area of Michigan. It aims to ascertain the relation of land uses as influenced by soil types to the suitability of the use in relation to the soils of the area.

It attempts to answer the questions: Is a type of selection occurring which keeps the best land in agriculture? Do people build on soils best suited for building? To what extent are soils developed for urban uses which are not suited to the development? How much influence does urbanization have on the increase of idle land held for speculative purposes awaiting ripening into urban use?

Assuming man is a rational creature and will act wisely if basic information is available, the discussion section of the thesis suggests methods by which soil survey data may be utilized to guide rational urban development. The product could be a balanced environment which recognizes the desirability of maintaining our better soils in agricultural production.

Scope of the Study

Since the problem rests in part on the knowledge of past changes and development trends in the region, a brief history of the area is included. Population trends in the city of Lansing were investigated and discussed. Population estimates based upon the number of electricity customers and the number of newly-constructed dwelling units were made for the area. Agricultural census data on land-use were summarized for comparison with the study data. Available information on the acreage of farmland sub-divided, platted or sold in lots within the study area were presented as evidence of the urbanizing influence at work.

In order to facilitate determination of land uses from aerial photographs and comparison of the information with soil survey maps, it was necessary to construct a photo-projection device. The data thus gathered is presented for the area as a whole and for the portion related to urban uses. The latter receives special analysis. The results are discussed and assuming that it is desirable to dedicate our best agricultural lands, some suggestions for courses of action leading to the preservation of Class I agricultural land in urban-rural fringe areas are made in the light of experiences in other regions of the United States, Germany, and Holland.

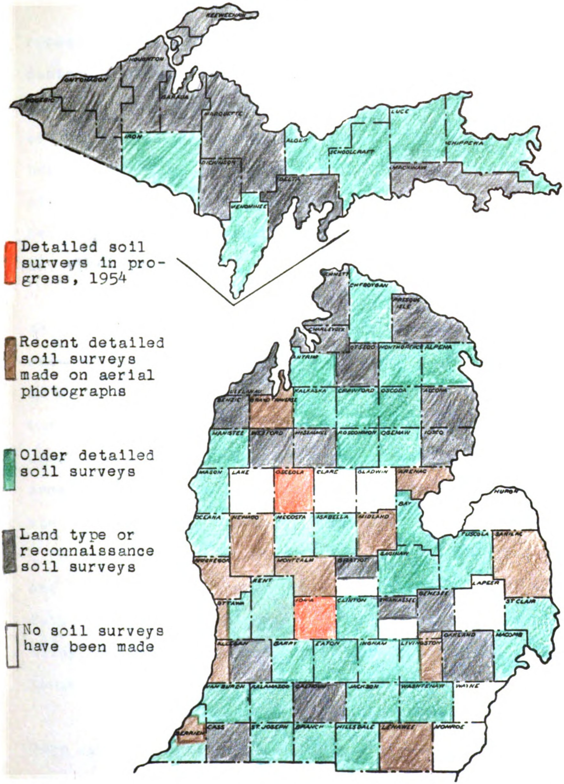
Delineation of the Study Area

If an investigation of the relationship of land classes to urban and other uses is to be conducted, the area chosen must meet several requirements: (1) A rapidly expanding urban agglomeration where the impact of development is strongly in evidence would be desirable. (2) A soil survey of the area should be available. (3) Recent aerial photographs from which land use may be determined are needed.

The population of the Lansing area is one of the most rapidly growing of the state of Michigan. The population section of this study will confirm that the area is well qualified to meet the first criterion. Clinton, Eaton and Ingham counties were engaged almost exclusively in agriculture in 1900, each of them having more than 95% of their areas in farmland. By 1954, however, the area devoted to agriculture had decreased to 89% in Eaton county, 91% in Clinton county, and 80% in Ingham county (1) (2), indicating a shift away from land in farms since 1900.

Detailed soil surveys for many counties of Michigan are available at Michigan State University, but Lansing is one of the few cities for which there are detailed soil surveys for the major portion of the urbanized area (see Figure 1). Clinton, Eaton and Ingham counties are among those counties for which older detailed soil survey maps could be obtained.

Figure 1



Kinds of soil surveys that have been made in Michigan.

Lansing, as the capital city of Michigan, is the repository for most official information, as well as the center of state activities. Here are located the various state offices, department headquarters and district offices of the federal government. Of these organizations, the headquarters for the Agricultural Stabilization and Conservation Commission was of the greatest interest to this study, because most of the aerial photographs covering the state are filed here.

After studying the maps of the three counties of which the Lansing area is a part, it was decided to confine research to a region of approximately 200,000 acres described by a circle having a ten mile radius with the center at the capitol in Lansing. This also includes an area in which the urban impact has not been great and which still remains agriculturally oriented. Included would be most of the area in which persons employed in Lansing dwell.

The entire townships of Delhi, Delta, Dewitt, Lansing and Meridian; the greater parts of the townships of Alaiedon, Bath, Watertown and Windsor; and smaller parts of Eagle, Riley, Olive, Oneida and Victor were encompassed by the ten-mile radius.

An expanse having a longer radius would have included more land primarily agricultural in nature which would not have had particular bearing on this study of urban influence on land use and land classes.

AGRICULTURE AND URBAN EXPANSION

REVIEW OF LITERATURE

Many persons concerned with the future of agriculture assume that the dedication of agricultural land for future generations is in the best interest of the nation. It is well known that good land use is not a problem associated only with contemporary society. Bennett (3) wrote a very interesting chapter on the problems of land use in ancient civilizations. Even the Egyptians could not afford to use their valuable food-producing flood plains for housing developments. Yet as the zenith of each civilization passed, leaving behind a disorganized and over-populated state, new areas of the world provided under-populated virgin lands to be explcited. Whether "new worlds" are still available in terms of food producing space is questionable. Our "new worlds" most probably lie in technological progress but, unless we recognize the importance of the good land of our own food-producing areas, we may literally be forced to the hills on to marginal lands possibly creating a situation which contributed to the demise of previous civilizations.

Among the writers of the Twentieth Century to be alarmed by the magnitude of urban encroachment on agricultural land was Stapleton (4) who estimated the acreages removed from agriculture for urban uses in England. He doubted the thesis that population would eventually stabilize but looked upon periods of slow population increase as breathing spaces in which to study the problem of land utilization and to provide against the perpetuation of more glaring land use errors. One could say that he represents the extremists in the conservation field, for he maintains:

> To my mind, the whole trouble relative to our land surface arises from short view and short-sighted notions as to economics. No matter if it costs ten, twenty or thirty times as much to build an aerodrome or reservoir, a suburb or a city on land of little or no agricultural value as on good land, it is the duty . . . to choose wherever possible the poor land!

He criticizes agricultural researchers for professional snobbishness in compartmentalizing research on problems, the solutions of which, do not lie in the power of one narrow field.

An interesting history of the economic changes in the United States from 1900 to 1950 is written by Allen (5) who describes suburban development in 1900 as follows:

> Each city had its outlying areas, within walking distance of the railroad or trolley lines: . . . And there were many commuters who made a cindery railroad journey to work from suburban towns. But those outlying towns were quite different from what they were to become in the automobile age. For only if one could be met at the station by a horse and carriage . . . or was an exceptionally hardy pedestrian, was it practicable to live more than a mile or so from the railroad or trolley. So the suburbs were small and backed by open country.

Abrams (6), in discussing urban land policies of the world as a whole notes: "Improvement of roads and acceleration of transportation have opened up to residential use areas once considered too far from places of work." He lists considerations which are usually ignored in abortive subdivisions and carefully reviews the problems of increasing competition for land for various uses. He states:

> The flat or gently undulating tract is almost certain to be highly productive farmland and is also the type of land on which a large modern factory with a horizontal layout can best be located. It is also the type of land most easily developed for housing, playfields or an airport.

In the industrialized areas of Massachusetts, Rosman (7) noted that demand for land for uses other than agriculture, primarily residential, industrial or certain recreational uses, curtailed the amount of land used for agriculture. In a later study (8), he observed that urban characteristics had so profoundly influenced the rural scene that one-half of the farms in Massachusetts were part-time operations.

Raup (9) recognized the implications of losses of agricultural land to industry and housing in 1936. Subsequent citations will demonstrate the accuracy of his predictions.

The problem of agricultural competition with industry and housing in Connecticut led McKain and Whitten (10) to say:

> In some areas the demand for rural residential property has raised land values to the point where only the most efficient commercial farmers can afford to stay in business.

Hanlon (11) presents in detail the changes which have occurred since 1935 in agricultural land use and settlement in a section of the Oneida Lake, New York, littoral. Farms have changed in size, management, crop emphasis and relative importance in the area.

> There has been a marked (approximately 40 per cent) increase in population that is accounted for largely by growth of rural, non-farm occupance on the outskirts of four small villages along the recreational shoreline and in the open country.

In an economic land classification of Lewis County, New York, Conklin and Lucas (12) found 26 per cent of all rural households were rural residences only and 22 per cent were part-time and subsistence farmers.

A more recent publication of an economic land classification of farm areas of St. Lawrence County, New York, by Nobe and Conklin (13) found 25 per cent of all rural households were rural residents and 31 per cent were part-time and subsistence farmers. Both Lewis and St. Lawrence Counties are rural counties not near any metropolitan area and Lewis County is the leading dairy county in New York State.

Wohlrab (14) discusses the problem of farm survival in the lignite open pit mining area of Germany and describes how much of the area is being reclaimed for agriculture after mining operations are completed.

Clauson (15) describes the urban expansion problem as not serious, saying:

> The past decrease in farm area due to urban expansion has been offset many times over by the

> increase in output per acre due to higher yields of crops and livestock. . . . From a land use point of view, the most serious deficiencies of modern suburban expansion is the inadequate provision for parks and other recreational areas.

Belser and Schulman (16) write:

> . . . our biggest problem in trying to conserve the traditional economy of the country and build on it a balanced economy of supplemental uses has been that the residential development [which] has taken place . . . on this fragmented pattern has so dismembered the basic soil resources of the country that not only is the primary agricultural activity gone, but also it no longer seems possible to salvage many of the industrial features of the economy that were based on the land.

Bogue (17), in assembling land use data of 147 standard metropolitan areas, estimated that the average rate of conversion of land to non-agricultural use in metropolitan areas as a result of population increase may be expressed by the equation:

$$L = \frac{238\ P}{1000} = .238\ P$$

where

L = Acres of land in farms converted to non-agricultural use

P = The increase in total population of the standard metropolitan area.

He estimates that by 1975, 14 per cent of the agricultural resources of standard metropolitan areas will go out of agricultural production into urban uses but emphasizes that these expressions are more illustrative than predictive and points out that: "The subject of metropolitan agriculture has not been given the research attention it deserves."

In an article on our shrinking farm lands, Adams (18) warns:

> If our present era of plenty does become an era of scarcity, it will not be the farmer who will suffer first. He will continue to eat. Others will have to get along with what is left.

Norton (19) says that urban and related uses have taken over one and one-third million acres of our best soil in each of the past five years. An area equal to one-twentieth of all the productive cropland left in the United States has been removed from agriculture over the past fifteen years. Unfortunately, the land taken out of production is truck, dairy and specialty cropland and not the surplus-producing corn, cotton or wheatland.

In describing the shift to rural living as a new trend underway, Wolfanger (20) writes:

> The motor vehicle and the modern road are luring thousands back to the land each year to live just outside of the town or city or within easy commuting distance from it.
> . . . .
> This migration is destined to become one of the distinguishing features of the Twentieth Century.

Wolfanger points out the problems of degraded highways, pollution, waterfront buildup and the loss of agricultural land to farming and says:

> We know of no practical or economical ways to make large areas of first class farmland to order --land that is level, durable, productive and economically responsive to our present knowledge of crop production.

In another article, Wolfanger (21) emphasizes that reclamation of land is always costly and often sacrifices resources that would yield a higher return on naturally good land. He feels:

> Many of these [urban type] uses could just as well make use of our second or lower grades of farmland. The big problem of these uses is not so much the kind of land as the proper location and arrangement of uses on the land.

Suggitt (22), in pointing out that modern highways consume large acreages of land, says that the greatest land use change resulting from highways will be to render remote farming areas accessible to commuters, industrial development and other non-farm uses. He states:

> With present highway facilities, no farming area within 50 miles of an expanding non-farm employment base is immune from this dispersed, checkerboard, leapfrogging type of development. As highway facilities are improved, and time enroute is reduced, the circumference of city influence upon rural areas will widen.
>
> . . . .
>
> Once farmland is converted to urban and urban-related uses, it is forever lost to agriculture, no matter how badly it may be needed in future years.

Solberg, Strout and Belser (23) in "Planning and Zoning in Rural Areas," says:

> Somehow, and in the long run, a community does not seem to be promoting the fullest use of natural resources when it permits houses to grow on fertile valley farms and the farmers to be pushed onto the less productive hills. It seems that the hills would be more suitable for homesites than the farms.
>
> . . . .
>
> Our problem is to locate, define and protect these areas.

In the discussion which followed the presentation of his paper, Solberg said: "I agree that detailed soil information is necessary before effective agricultural zoning can be done."

In describing the situation in California, and calling for a more rational urbanization of the state's farmland, Gregor (24) states that it is estimated that California is now losing 100,000 to 500,000 acres of productive land annually. He notes that there is no deep social root in California farming. It is an economic enterprise and sale value ends the use of land for agriculture as it converts to other uses. An interesting table is presented that shows "dispersal intensity index" which reveals the degree of fragmentation of agricultural land.

After pointing out that between 1940 and 1954 twenty-five per cent of the agricultural land shifted from agriculture to urban use, while the population doubled in the same period, Gregor predicts that by 1975 a total of fifty-eight per cent of the agricultural land of California will have been taken over by urban uses.

He goes on to say:

> Planning thought on agricultural zoning now seems to favor the even more emphatic step: a state planning agency backed by a state land use inventory, with power to limit sub-division on the best agricultural land, create 'farm protection districts' or to exercise various combinations of these two functions.

A <u>Municipal Journal</u> survey (25) finds that opposition of agriculturalists in England to housing developments has increased. Of the total area of 37,000,000 acres of England and Wales, only 24,300,000 acres are left as food producing land. About 3,400,000 acres, or nine per cent of the area, is now covered by town or other developments. The survey goes on to say:

> An analysis of regional planning reports, new town proposals, housing statistics, land required for armed services, road construction, mineral workings, etc. leads to the conclusion that during the next twenty years some 750,000 acres of land will probably be taken out of agricultural use for various forms of development. This represents the home-produced food for a million and a half people.
>
> If, as seems likely, we lose another 2,000,000 acres of agricultural land in the next sixty years, the outlook leaves no room for complacency.

In a policy statement of the Ministry of Town and Country Planning, it is written:

> One of the main objects of planning policy is to ensure that productive agricultural land is not taken for development where less good land would serve the purpose.
>
> The policy was restated in a later circular: . . . A housing authority should be prepared to incur some additional costs when that will enable it to keep off good agricultural land.
>
> There is too, more than one example of a planning authority proposing development of some distance from a town center in order to preserve better quality agricultural land nearer at hand.

Busfield (26), taking the housing viewpoint, argues:

> Let there be no illusions concerning either food production or housing. Both are essential to the nation's welfare. We must have food to live at all but we must have somewhere to eat and live.

. . . .
> From their point of view, housing authorities wish to procure those plots of land which are relatively easy and economical to develop. They like their sites to be compact and reasonably close to main services. To housing authorities, low cost and speed in completion are most important. Hence, their dislike of small plots, remote sites and sites difficult to develop.

Bourdon (27), in citing the causes of the drift from farming to urban employment, feels that the amenities of urban areas are only of secondary importance in the migration. He lists as major factors the loss of traditional rural living standards and the development of large scale industry offering jobs in urban areas which grow at the expense of the rural population.

The inefficiency of scattered developments and the lack of knowledge as to the effects upon the way of life of present and future generations were discussed by Wilkins (28).

Distribution of Idle Land

Not only does direct urban use remove land from agricultural use but, as Eli and Wehrwein (29) observe, land becomes idle due to indirect causes such as speculation. They cleverly compare premature subdivision with the problems in the agricultural forest fringe. Land is removed from one use and frozen into its future use despite the fact that conditions do not justify that particular use.

A trend contrary to that apparently occurring in urbanized areas is reported in a farm community in Northern Michigan by Whiteside and Krumbach (30). They investigated the changes in land use that took place on four different soil groups and reported that although there was a 7.5 per cent increase in idle or abandoned brushland, there was a 14.5 per cent decrease in idle or abandoned grassland. This resulted in a net decrease of 7.0 per cent in idle or abandoned land.

Wolf (31) estimates that in the foreseeable future, 98.2 per cent of the total area of West Germany under present circumstances will never be building area. This means that only a small area will be used and that the waiting costs of some areas will never be realized.

The term "social fallow" is given by Hartke (32) to the idle and less intensively used land in Northwest Germany in his description of the changes taking place in the nature of social groups occupying the land. Industrially oriented rather than rural oriented people are inhabiting the area.

Aschman (33) describes the same phenomenon as "Dead Land" surrounding the city.

The disposition of "dead land" far removed from urban influences is described by Barlowe (34) who states that third and fourth class land of lowest value for farm use have gone into Pittman Robertson [wildlife] projects, providing an example of land use according to its capabilities.

Urbanization and Assessments

Urbanization affects farming and land utilization in another way. Corty (35) reports in a study of the comparative levels of assessment for farms and rural residences in fifteen New York towns in 1954 that farms were being assessed at 40 per cent of the owners estimate of probable sale value and rural residences were assessed at 25 per cent. He believes that this may be due to the lag between the rate of new rural residences, and failure to reassess farms.

Barlowe and Limberger (36) found a similar situation in Ingham County, Michigan. They established assessment-sales ratios for rural, suburban, urbanized and urban districts and found that: "Rural properties had average assessment ratios of 40.5 compared with 35.2 for the urban properties, 28.6 for properties in urbanized districts and 25.2 for properties in suburban areas."

In another tabulation, they show that: ". . . all six of the townships with samples involving two or more classes of properties had higher average assessment-sales ratios on their rural properties than on their suburban and urbanized properties."

Possible Tools for Guiding Rural-Urban Development

Engelbert (37), in calling for research in the rural-urban areas says:

> Agricultural planning and zoning for the rurban area present an entirely different problem from that for the distinctly rural environment. Unfortunately, this has not been recognized, since our research is lagging far behind. To date, there have been at most, only a few studies which could be classified as dealing with the rurban land use problem.
>
> . . . .
>
> Agricultural economists have been appraising agricultural land uses in terms of crop patterns, production and supply, but have not looked at it from a standpoint of transitions in uses from rural to urban.

Engelbert cites seven major forms of urban dispersal into agricultural areas as follows:

> 1. Graded encroachment
> 2. Urban encirclement of non-urban territory
> 3. Radial penetration
> 4. Diffusion
> 5. Non-contiguous development
> 6. Industrial decentralization
> 7. Planned dispersal.
>
> . . . .
>
> Urban planners on the other hand, have looked at the problem of rurban agriculture almost exclusively from metropolitan considerations. They have developed agricultural zoning primarily as a tool for urban land use.
>
> . . . .
>
> Planners have been reluctant to establish zones because they have no guidance as to types of areas that should be kept exclusively in agriculture.

Smith (38), in describing the process of county planning states: ". . . increased urbanization of the county called for control which the cities could not provide." Existing land uses were frozen in 1945, and subsequently the mechanism of zoning was adopted to produce changes in rural land use which would cause the fewest maladjustments.

In order to cope with the increasing urbanization, planners were becoming more interested in methods of subdivision control as described by Adams (39). He emphasizes however, that the various jurisdictions of an area must coordinate and standardize subdivision regulations. Conflict and confusion usually result if some jurisdiction feels it is not as adequately protected as municipalities nearby. He suggests the county as the governmental unit which should take the lead in establishing subdivision control standards.

The possibilities of agricultural zoning to assist in rational development of an area is described by Gilkey (40) who points out that it is not a cure-all for the problems of rural communities. She emphasizes that agricultural districts should be so written as to be dynamic and flexible so that it may accommodate the changing patterns of the community.

Solberg (41) in his rather complete bulletin on Rural Zoning, states that the full potential of the rural zoning technique for guiding the growth and protecting the agricultural community has not been realized. He reviewed the many types of zoning used in the United States, their legal foundation, and how they may be applicable to individual problem areas.

In Germany, Muthman (42) felt that as proposals and direction for improving the agricultural structure of the country are realized, economic planning and building development must be coordinated with the agricultural structure.

The implementation of these goals rest upon the former Reich laws governing residential development which are still the most important laws of land planning in all the West German states.

Mocine (43) in a discussion of rural zoning writes:

> Although county and city planners have made some valiant attempts to meet this problem, [protecting Class I agricultural land] their efforts have so far not proved too successful.
>
> . . . .
>
> Zoning has proven a weak weapon, however, to withstand the onslaught of the land developer armed with a fat checkbook. . . . Only when people understand that a comprehensive plan for future development makes provision for a well balanced economy will they support an adequate zoning plan and back up the legislative body in resisting requests for zoning changes.

Recent Research on Land Utilization

Although considerable material has been written about urbanization and its encroachment upon agricultural land, practically no specific research has been done to determine the extent of the problem or its relation to our best farm lands.

Fairchild (44), in 1950, in his study of the Lansing region, related agriculture to natural land types with particular emphasis on changes in the agricultural scene. He found that land use differed among selected natural land types in per cent of total land devoted to farming, per cent of farmland under cultivation and per cent of each kind of crop grown on cultivated land. Perhaps most interesting is his theoretical explanation of the action a person would take faced with alternatives of full-time farming, part-time farming or full-time off-the-farm work.

An example of a possible mode of investigation if implemented on a more detailed scale is Humphrey's thesis (45). Projected trends in land use based on present land use policy are presented and compared with proposed trends of land use based on natural land characteristics. It is interesting to note how much present use is out of harmony with natural land characteristics.

Moore (46), dealing directly with the effect of sub-urbanization on land use for selected segments of the Lansing area, pointed out that less than seven per cent of the land owned by full-time farmers was idle in contrast to forty-five per cent of the land owned by rural residents. He also presents data on cropland, pasture, crops grown, and animal production carried by full-time and part-time farmers.

Moore and Barlowe (47), in a revision of the thesis data, emphasize the very interesting fact that over forty per cent of the rural residents owned one to one and nine tenths acres of land, and that less than eleven per cent of rural residents owned thirty or more acres of land. They point out that:

> The farms occupied by the part-time farmer group were generally smaller than those held by full-time operators.
>
> . . . .
>
> Neither the size of farm or the proximity to sub-urban developments appear to have had much effect upon the use of land for crops and pasture.

Thaung (48), in a thesis similar to that of Fairchild, correlated the distribution of land types and farm land uses. He found that kinds of crops and methods of farming have close relationship with slope-soil-drainage complexes. He bemoans the fact that social and economic factors have led to the abandonment of some farms and fruit orchards which occupy productive farm lands.

In his study of the relationships of land character to zoning ordinance use-classes of thirty-four Michigan towns, Duke (49) states:

> Many of the townships investigated have created so-called agricultural districts, but in each case, various non-agricultural uses are permitted in addition to agriculture. However, almost 30 percent (93,719 acres) of Class I and Class II land has been zoned 'away' from agriculture even if those districts are considered as truly agricultural in nature.
>
> Approximately 54 percent (424,052 acres) of the total area of the thirty-four townships has been included in such 'agricultural' districts. Almost 29 percent of this amount is Class IV and Class V agricultural land. This is especially significant in view of the fact that about 39 percent of the non-agricultural districts (which embrace 237,858 acres) consists of Class I and Class II land.
>
> The implications of the results then, are two-fold: (1) Much good agricultural land is not adequately protected against the encroachment of non-agricultural uses and (2) many townships have drafted zoning ordinances without giving due consideration to the character of their lands and their suitability for certain uses.
>
> . . . .
>
> . . . not a single acre in the 34 townships, all of which have zoning ordinances, has been zoned exclusively for agriculture.

Honzatko (50), studied the expansion and urban uses and the absorption of farmland in Macomb County, Michigan.

He calculated residential space requirements from the demand for new single and multiple family housing and from lot size requirements stipulated in present zoning ordinances. Industrial and commercial land requirements were also calculated and the following conclusions were reached:

> 1. The past expansion of urban use in Macomb County has resulted in the absorption of about 65 square miles of farmland.
> 2. The rate of farmland absorption will increase, however, for by 1980, an additional 47 square miles will be in urban use.
> 3. Approximately 30 square miles of highly productive farmland will be absorbed into urban use by 1980 with an additional 15 square miles left in isolated tracts.

One of the few published works relating soil types to urban land use is that of Ritchie and Swanson (51). In a study of four towns in Hartford County, Connecticut they found over ten per cent of the rural area mapped was devoted to urban uses. About 60 per cent of the urban uses were on good terrace soils. Unfortunately, soils were not classified according to their agricultural merit in this pilot-type study.

Some of the problems of carrying out development without a basic knowledge of soils of the area to be developed is described by Dale (52). In addition to the problem of overflowing septic tanks and flooded basements, he exemplifies:

> In Fairfax County, [Virginia] the Board of Education acquired a tract of land for a new school building without having a proper knowledge of the soil conditions. After the school was started, they

> found that the soil was unstable. It cost the county more than $200,000 to stabilize the footing of the building. A later soil survey showed that the building could have been located a few hundred yards away without the extra cost of abnormally large, reinforced concrete footings.

He describes the progress that Fairfax County has made in directing development with the aid of soil surveys, financed in part by county funds and how the county eventually hired a full-time soil scientist to interpret the soil survey information for the many agencies, organizations and individuals requesting information.

Tax assessors use the soil survey in Fairfax County as a base for assessment of the 50 per cent of the county which is still in farmland. Idle land held for speculation is assessed according to the soil type and location. Dale points out: "Some county officials claim that Fairfax county government has already saved many times the cost of the survey on public structures alone. In addition, the savings and convenience to citizens of the county have been enormous."

Walter Blucher (53) said that information obtained from a soil survey map aided him in selecting a site to recommend to an industry seeking a location in Ohio. Largely on the basis of soil survey information which showed soil conditions favorable for heavy manufacturing, the company has negotiated to purchase the site and will locate its plant there.

Soil Survey for Planning in Germany and Holland

While in Germany under the auspices of a Fulbright Scholarship in the 1956-57 academic year, the author was fortunate to obtain permission to do research in the libraries of the Institut fuer Raumforschung und Raumordnung in Bad Godesberg, at the Neidersaechsisches Amt fuer Landesplannung und Statistik in Hannover, and at the Institut fuer Bodenkunde at Bonn University in Bonn. The personal acquaintances with leading professionals in Germany and Holland gave the author many extraordinary opportunities to familiarize himself with their accomplishments.

The following section will relate some of the contributions of German and Dutch professional people and agencies in the field of planning in rural-urban areas.

Soil Surveys for Urban Developments in Germany.

Hecker (54), who was among those attempting to provide basic data needed for planning,felt that more consideration should be given to the natural conditions of the soil. "What is needed is data on the properties of the soil and their best utilization. Agriculture and city planning of the future need as a foundation, the soil map."

Stremme (55) believed the project must be divided into geological and soil conditions. A map representing both would have the weakness that it presents too many different aspects that do not belong together.

Hecker and Mueckenhausen (56) describe the methods and goals of the German soil survey under the program of the Third Reich and observe that soil once was considered a factor that technology had to overcome. Building lot prices paid by developers could never be rentable even on the best soils in purely agricultural production. Speculation pulled agricultural land and farms into its path. The object of planning in pre-war Germany was to reduce this and bring harmony to the landscape. The soil map was an absolute necessity as a basis in attempting to protect good agricultural land from the encroachment of industrial and residential uses but it is recognized that sometimes even the best soils must be sacrificed for society.

A booklet of the Association of Land Planners in the Rheinland (57), summarizes the results of 25 years of planning in the Rheinland. It describes the various activities of the central planning commission to which the local agencies are responsible. The association report contains maps and data on the natural landscape of the area with special reference to agricultural and forest economies. A water-relationship map provides information on precipitation, ground water and pollution. Included are population change maps, industrial, transportation and traffic flow maps and maps of soil productivity in the crop and pasture land areas. The soil maps are used for tax purposes which are based on the natural productivity of the soil, the location and the local climate.

Roesch and Kurandt (73) describe the German Reich Soil Value Survey and explain that its goal is to determine the agricultural value of each piece of soil, to aid in the proper division of taxation, to aid in improving the agricultural credit structure, and as a basis for plans for best soil use.

The survey encompasses: 1. the exact characteristics of the soil according to its properties. 2. the determination of the yielding ability on a natural basis (soil, climate and lay of the land). 3. the proximity to markets, transportation, etc. will be taken into consideration by the taxing authorities.

Landowners have the right of appeal and review by the courts, in case of change in soil value, due to installation of drainage, irrigation, change in soil cropping system or if he feels the taxing authorities are unjust.

The entire nation serves as a basis for division into the various classes of soil values. Each class has an exact description and identity according to two use-types --cropland or pasture. Value numbers give a representation of the value of the land with 100 being the most productive soils and 0 being the worst. These numbers express the differences of soils in pure yield under normal conditions.

The main division is according to soil texture, and a subdivision denotes development stages representing those properties that are mainly due to genetic factors (climate, vegetation, slope, ground water, parent material, and type of use). There are seven such levels with 1 being the best. In addition, values are guided by type or origin of the soil or whether it is glacial, alluvial, loessial, residual, or lithosol in character.

Soil texture mapping as a basis for systematic preparation for urban development is the subject of a small book by Mueller (59) who describes the loss of agricultural land for highway, rail, resevoir, military, industrial and residential uses. Statistics on actual loss of land to various types of development are given and Mueller estimates that one acre is required to support each person on average German soil. Between 1835 and 1935, space necessary for food production was lost to development which would have supported 4,141,000 persons although technology increased yields 50 per cent in the same period.

Mueller feels that the reclamation of land cannot replace the loss due to population increase. Therefore,it is necessary to consider productivity of the soil when it is requisitioned for technology. The goal of planning should be to protect and improve the present agricultural land.

He feels that a land inventory is the most important basis for general or specific planning. The soil is a living body--its genesis due to relief, vegetation and other factors which influence soil formation and the soil type reflect these factors. A soil map gives the expert a picture of the character and the origin of the landscape.

The solution of the problem of planning lies in a good soil map from which a building area map is compiled, after taking into consideration other factors such as economy of the area, water supply and transportation.

A ground water map is essential to avoid problems of water in cellars, pollution damage and other inconveniences.

An amelioration map provides general recommendations needed for good agricultural land use, such as fertilizer rates, irrigation, drainage, stone removal and other recommendations.

The planning map, a compilation of all previous investigations and maps, attempts to harmonize the landscape with the socio-ecological factors of the area.

If large districts are to be made into industrial or housing complexes, on the basis of sound economics, the best soils must be preserved for agriculture. If industry wishes to move into an area of good soils, it will do so, but then the relatively poorer of the good soils should be used for development.

Gerdes (60) points out that only through visionary regional planning and exact regional analysis can the tremendous problem of postwar industrial and housing construction in Germany be overcome. The recognition of agricultural areas within the plans should be seen as ideal open area--nature areas that supplement city parks and forests, and place agriculture in social and economic balance in a double role--production and consumption of products.

Mueckenhausen and Mueller (61), in a demonstration study for which the city of Bottrop (Westphalia) served as model, point out that early soil surveys used for planning purposes usually had only one soil map. Planners had to accept the observations of the soil surveyor and adapt the map to meet their needs. This limited the use of soil survey maps largely to agricultural (farm) planning. In the immediate pre-war years, it was recognized that more soil information must be obtained or at least the information available must be presented in a different manner to be useful to the regional planner.

In the report compiled for the city of Bottrop, they include the following: description of purpose, method and general information on the geomorphological character, geologic situation, climate and soil types.

Three maps were compiled to depict the information needed for planning in the area.

The soil map presents information regarding the depth of various soil textures, water relationships, humus content, underlying rock formations, and the slope characteristics. Soil water relationships are differentiated according to depth of water table and surface permeability.

The water and building map relates information for the areas of low soil permeability. Large areas of soil textures having deep water tables that naturally provide a very good soil for development are shown. Landfills are depicted in a special category, depending on the water table depth and their ability to withstand building weights.

The building land characteristics given for two to three story houses are divided into ten classes, represented by different colors and symbols on the map, according to their suitability for building.

A map showing the best agricultural uses for the soil types is also included. This permits the expression of various factors inherent in the natural character of the soil and sets forth their suitability for agricultural, pasture, or forest uses.

Mueckenhausen (62) explained the mechanics of conserving land for agriculture that was being temporarily exploited for industry (mining). A layer 10 to 15 feet thick consisting of topsoil of loessal origin, an underlying calcareous loess (15.20% CaCo3) and a substratum which consisted of a buried degraded chernozem, were stripped off by steamshovels, loaded into trucks or mining cars, and transported to storage piles. The next layer, usually consisting of a Miocene clay or clayey fine sand, varying in thickness, was also removed from the original mining area and spread over some nearby lowland areas. This was covered with a six foot layer of loess and topsoil to produce an area of improved farmland.

The coal was then removed and, in the next stage, the clay material was dumped into the area where the coal had been, reducing the problem of transporting the clay matter. As mining progressed, the original mantle was spread over the clay and the land returned to agriculture. Within three years the loess would recover its full pre-mining productivity.

To compensate for the removal of the coal and to regulate the water table, small areas were not reclaimed or filled, but remained as lake or pond-like bodies of water.

Thus the surface of the land lost little of its value for agriculture, and in some cases, actually gained in value. The costs of this operation were added to the sale price of the coal.

Wensel (63) explained that the role of the Neidersachische Amt fuer Landesplanung und Statistik is to guide development by providing base information to local planning agencies. It acts as a clearing house for the local agencies and coordinates their activities. He described the typical county plan as containing the following information: A short physical description of the area, the major goals of the plan, data on drainageways, contours, soil textures, natural productivity of the soil, soil types, geologic map, climate, plant cover, population (changes and structure) types of towns in the area, industry, age of buildings, unemployment, types of employment, tax structure, ground water, watersheds, water supply, electricity and gas, agricultural and forest population, size of farms, soil utilization (yields, animal population, development) forest organization, (types of trees and production) fishing, handicraft, transportation types, surface and mineral deposits, trade, transportation density, cultural and historical development, and finally, the master plan.

Dittrich (64) observes that much of German industry is located on the best soils but, that resources other than soils (i.e. coal deposits), determined the original location of the industrial plant. He questions, however, whether the planner concerned with decentralization should not also concern himself with the question of protection of good agricultural land.

Pounds (65) notes that in the Ruhr the most highly urbanized area is the Hellweg which is also the most fertile. Within the 'inner' Ruhr about half of the area remains under the plow even today and in some districts the proportion is higher than this.

Planning in the Netherlands

Van Eck (66) related that although spatial organization and not soil is the major factor in location of towns in Holland's land reclaimed from the sea, the sandy, boulder clay and some of the peat soils are zoned for forestry. Ninety per cent of the reclaimed land is quite uniform over large expanses and is extremely fertile, and there are no poor soils in many areas where communities exist.

The reclaimed northeast polder was not only a state undertaking but agricultural holdings remain the property of the government and are rented to the farmers so that inheritance cannot subdivide the farms into uneconomic units. Property in towns and villages is available for private purchase for residential, commercial or industrial purposes.

Polder agricultural land areas have recently combined into districts to investigate the problem of the growing urban complexes which release each year thousands of vacationers, many of whom wish to come to the polders for their recreation (67). The districts will try to avoid making the polders recreation areas of the cities by strategically locating road networks, well-landscaped bicycle paths, modern lodgings, play gardens, swimming pools, and camping places along the perimeters of the polders where the soil may be poor. Plans are to be drafted and carried out by the towns concerned, coordinating through the National Planning Headquarters in The Hague.

Old cities in Holland were not originally planned but today's expansion of these cities definitely is.

A publication of the provincial government of the state of Overijessil notes that in 1947 only 18 per cent of the towns of the state had plans, while in 1957, 81 per cent had plans (68).

DESCRIPTION OF THE STUDY AREA

A Brief History of Lansing

Were it not for the arbitrary establishment of the state capitol in Lansing, the present metropolis might have been little more than a small farm community, as Darling (69) indicates:

> Economically, there was no reason whatever for a city to be planned and built on the site of Lansing. It did not have such natural advantages as the waterway at Grand Rapids, the . . . black loam farm land of Kalamazoo or the obvious transportation crossroads of Jackson and Marshall.

The establishment of the new state capitol brought an influx of settlers to Lansing. Most were farmers. They purchased high-lying, oak-forested land away from the malaria-infested tamarack swamps. The land was cleared and the timber brought to the mills which were rapidly appearing along the two rivers. Lumbering diminished in importance after the forests were depleted and the Lansing region's main products were mainly agricultural for some time.

Lansing incorporated as a city in 1859, with slightly over 3,000 inhabitants, but it was far from realizing the full potential in its resources. The big bend of the Grand River was destined to become the city's industrial center. Here, where early speculators saw waterpower possibilities, are now situated the industrial plants of the city.

In 1900, with 16,000 inhabitants, the future growth and development pattern was already set. Michigan Agricultural College dominated development in the eastern portion of the area. Industry was firmly entrenched on the banks of the Grand River and in North Lansing. Public buildings and the shopping district made up the center of the city.

It is interesting to note that even then industry located in unpopulated areas: "On August 16th, 1904, the firm of R. E. Olds and Company was formed in Lansing on S. Washington Avenue in a sparsely settled district composed mostly of farmland." (69)

Population

Growth of Urbanized Areas.--The population of Michigan has grown 31.6 per cent between 1930 and 1950. In contrast, the Flint area has grown 9.8 per cent, the Grand Rapids area has increased 9.5 per cent and the Detroit area has grown 26.4 per cent. The Lansing area has grown 35.8 per cent, or at a more rapid rate than the state of Michigan and a much more rapid rate in relation to the other urbanized areas as Table I will indicate. Note that data prior to 1930 are for the cities only, while the 1930 and 1940 figures are for metropolitan districts, and the 1950 figures are for urbanized areas. Prior to 1930, cities kept pace with population growth by annexation. Since then, this method

TABLE I

POPULATION OF SELECTED URBAN AREAS IN MICHIGAN

City	1900	1910	1920	1930[1]	1940[1]	1950[2]
Lansing						
Population						
in city	16,485	31,229	57,327	78,397	78,753	92,129
outside city				20,297	31,603	41,923
total	16,485	31,229	57,327	98,694	110,356	134,052
Per cent change		89.4	83.6	72.2	11.7	21.5
Detroit						
Population						
in city	285,704	465,766	993,678	1,568,662	1,623,452	1,849,568
outside city				536,102	672,415	809,830
total	285,704	465,766	993,678	2,104,764	2,275,867	2,659,398
Per cent change		63.0	113.0	111.8	8.1	16.8
Flint						
Population						
in city	13,103	38,550	91,599	156,492	151,543	165,143
outside city				23,447	37,011	34,488
total	13,103	38,550	91,599	179,939	188,554	197,631
Per cent change		194.0	137.6	96.4	4.8	4.8
Grand Rapids						
Population						
in city	87,565	112,571	137,634	168,592	164,292	176,515
outside city				38,562	45,581	50,302
total	87,565	112,571	137,634	207,154	209,873	226,817
Per cent change		28.0	22.2	50.5	1.3	8.0

[1]Metropolitan districts
[2]Urbanized areas

of growth has declined in favor and metropolitan areas and urbanized areas were devised by the census bureau to present as accurately as possible the picture of an area's growth.

Estimates of Present Population.--Several methods were used to estimate the present population of the Lansing area.

Data on the number of new residential electricity customers for all communities within the Lansing study area were obtained (70), (71), and showed that 11,349 new customers were added between 1950 and 1957. This figure multiplied by an average of 3.2 persons per customer, reveals an increase of about 36,300 persons in the Lansing area. This figure is probably greater than the actual population increase because some of the rural homes which previously were not electrified have become so during this period.

Another technique of about equal validity is to obtain statistics on building permits issued which give an indication of the new homes erected. These data show that 9875 new dwelling permits were issued during the 1950 to 1957 period for the townships reporting within the study area. When this number is multiplied by 3.2 persons per household, the average number per household of Ingham County as established by the 1950 census, it would indicate an increase of at least 31,600 persons in the Lansing area. This number would be conservative because not all townships reported such information.

From these researches it is apparent particularly, from the first two techniques mentioned, that space for 10,000 to 11,500 new dwelling units had to be provided in the Lansing area during the 1950 to 1957 period.

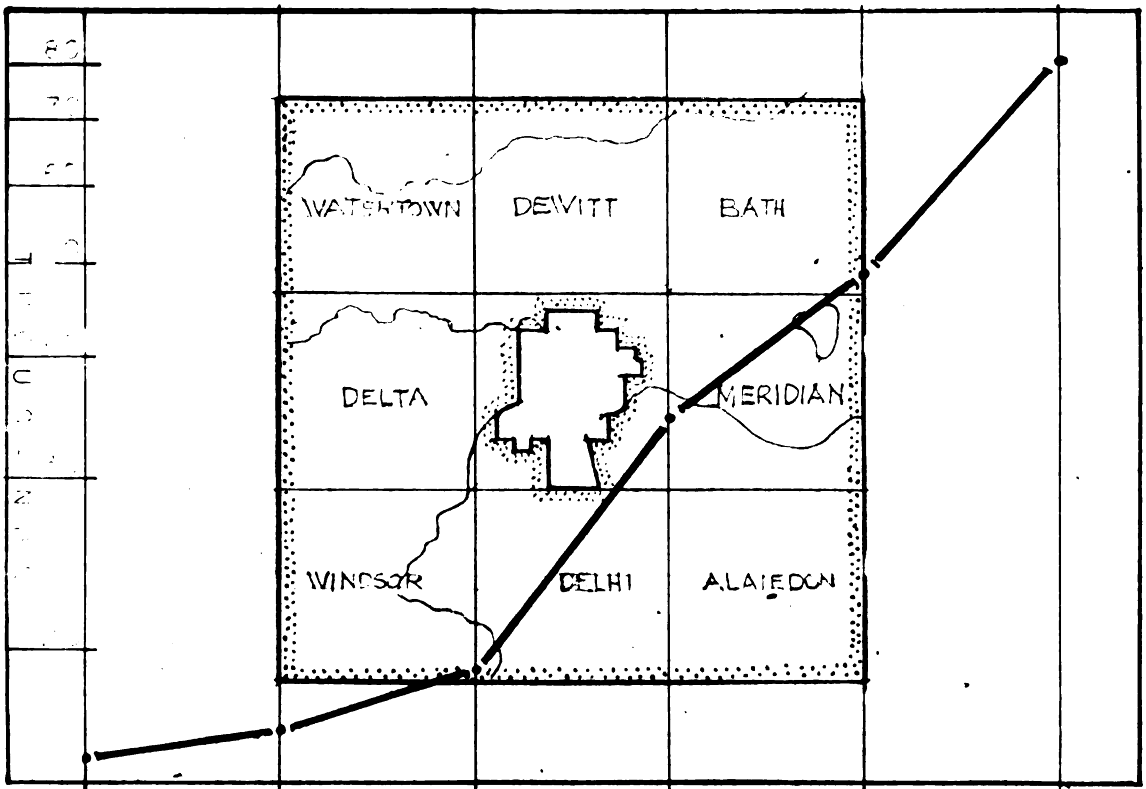
Implication of Suburban Sprawl.--The drift to the suburbs of the cities, although accentuated in recent years, is not entirely new to urban development. In the past, cities grew along the trolley lines, and people built at the terminals of the lines. Then inter-urban trains spread the population to near-by towns. Today modern highways and the use of automobiles have helped make the suburbs the bed-rooms of the cities. Business and industry have either followed or led the people to reduce costs, secure additional space or to provide services needed.

Suburban sprawl together with demands that industry, transportation networks and airfields place upon the land area actually create a situation that is more serious in terms of space requirements than statistics show. A rapid change in land-uses frequently involves a reaction in terms of strained public facilities such as streets, highways, schools and sewage disposal systems and often disrupts not only tax income structures, but also the sociological patterns of the area.

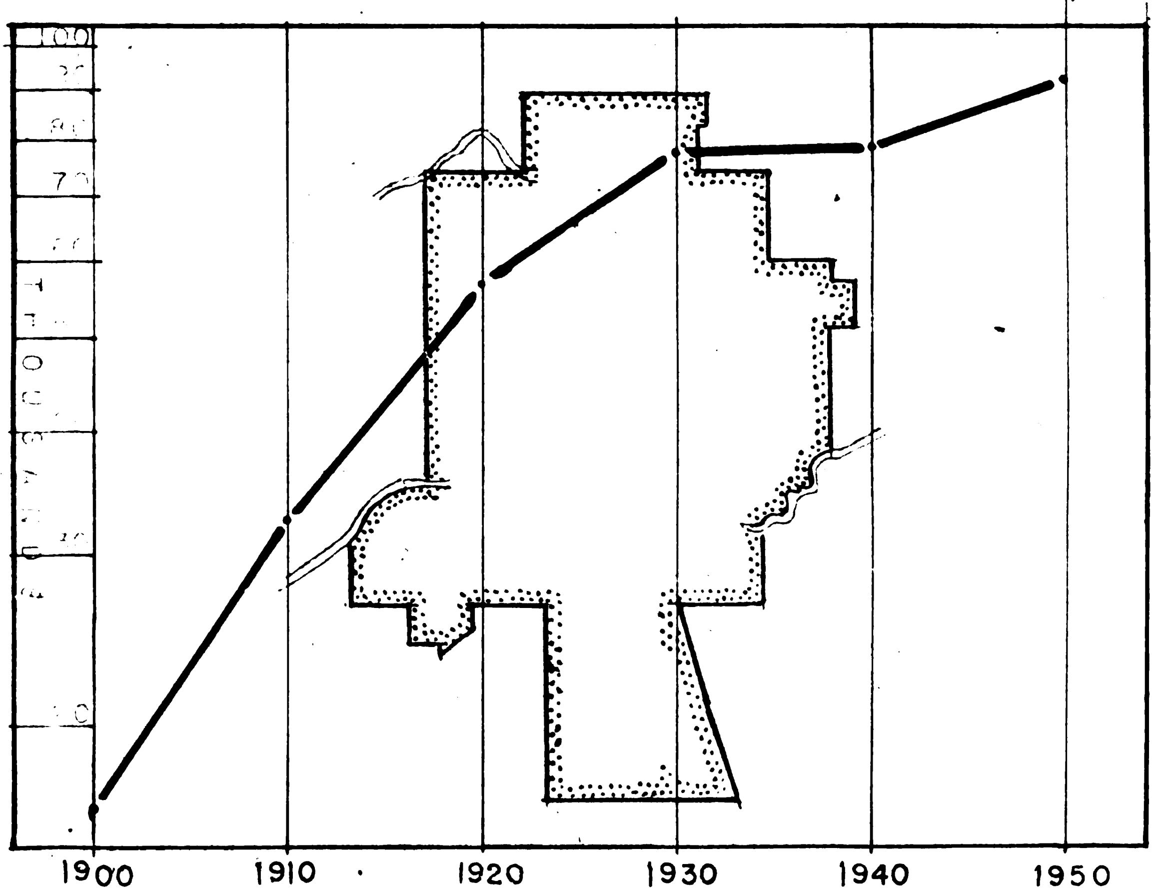
Generally, in the urban areas of the United States, the unincorporated areas outside the cities are growing at a much faster rate than the cities themselves. In the past, the cities have annexed the built-up areas but this method of growth has declined in favor since 1930. The graphs on the next page will show the different rates of growth between the city of Lansing and the remainder of the study area indicating the shift to a more rural environment. What this means in terms of agricultural land removed from farming and used instead for human activity developments will be discussed in a later section. (See also Table II)

How many of the estimated 223 to 240 million people who will be living in the United States will live in the Lansing urbanized area is difficult to determine (72). A great deal depends on the economics of the area and its role in relation to the remainder of the nation. One can safely say that the area will share to some extent the growth expected in the rest of the country. One thing is certain, if the population increases, people will require space in which to live. How well this space is allocated and the effect it will have on our best agricultural soils may be suggested by what has happened in the past. In the following sections the question of the relationship of urban and suburban development to land character will be more closely examined.

POPULATION



STUDY AREA EXCLUDING CITY



CITY OF LANSING

Figure 2

TABLE II

POPULATION OF SELECTED TOWNSHIPS IN THE STUDY AREA

Township or City	1900	1910	1920	1930	1940	1950
Alaiedon	1,172	955	896	1,011	1,132	1,486
Bath	1,065	1,021	872	1,033	1,626	2,804
Delhi	1,467	1,412	1,729	4,512	6,723	10,077
Delta	1,383	1,224	1,255	1,921	2,618	4,131
Dewitt (including Dewittville)	1,236	1,305	1,627	2,545	3,210	4,896
East Lansing	--	802	1,889	4,389	5,839	20,325
Grand Ledge	2,161	2,893	3,043	3,572	3,899	4,506
Lansing (city)	16,485	31,229	57,327	78,397	78,753	92,129
Lansing (township)	1,353	1,760	2,815	8,518	14,274	17,627
Meridian	1,625	1,392	1,513	2,878	4,767	9,108
Watertown	1,334	1,211	1,071	1,196	1,219	1,585
Windsor	1,497	1,347	1,334	1,798	2,114	2,628

Geographic Description of the Region

The study area included parts of the three counties, Clinton, Eaton and Ingham, which are located in the south-central portion of the lower peninsula of Michigan. (Figure 3)

Physiography

These counties are in the upland division of Michigan, physiographically featured by a broad glaciated plain rising two hundred to six hundred feet above the Lakes Erie, Huron, and Michigan. The relief as a whole is smooth or gently undulating, representative of glacially influenced landscape, with till plains, ground moraines, and outwash plains and some kettle-kame topography. Rounded hills with short slopes, stretches of undulating landscape with pitted sandy plains, short drainage basins and swamps and lakes of various sizes, characterize the surface pattern. Streams are not numerous and dissection has not progressed to any extent. The landscape reflects the constructional action of glaciers.

The major rivers of the region are the Grand River, the Red Cedar River and the Looking Glass River. Pine Lake (Lake Lansing) and Park Lake are the major lakes. Grand River traverses the study area from its southern boundary north to Lansing, then westward to the map boundary. The Red Cedar River flows westward to join the Grand in Lansing. Across the northern portion of the study area, the Looking

Glass River flows in a west-southwesterly direction. Pine Lake is the largest body of water in Ingham County, covering approximately 450 acres and is a little over a mile in length. It has been quite important as a recreational area for the inhabitants of this region. Park Lake, which is somewhat smaller, has also been developed for recreation. None of these bodies of water is used for navigational purposes.

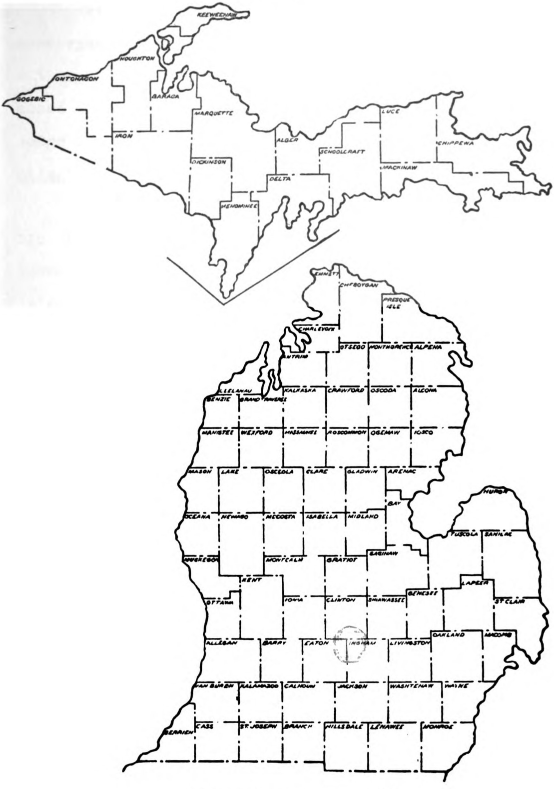
Lansing is served by the New York Central, Grand Trunk and Chesapeake and Ohio railroads.

There are a number of major highway linking Lansing to the other large cities of Michigan. The most important of these are: U.S. highway number 16, the main arterial connecting Lansing to Detroit and Grand Rapids; U.S. highway number 27 which goes north through St. Johns and south through Charlotte; Michigan highway number 78 connecting Lansing to Flint; and U.S. highway 127 which is the main road to Jackson.

<u>Natural Vegetation</u>.--The greatest part of the area was originally covered with deciduous trees. Dry upland portions supported an oak-hickory climax with white oak as the predominant species. A maple-beech forest climax considerably interspersed with black cherry, basswood and ash, was found on heavier soils. Occasional stands of white pine were found on very sandy soils.

The poorly-drained lowland mineral soils were sparsely forested with elm, ash and red maple.

FIGURE 3



LOCATION OF STUDY AREA

Willow, tamarack, aspen and red maple were the dominant species found on the drier parts of the muck soils although some marshes maintained leatherleaf and spagnum moss. The wettest portion of the muck soils sustained marsh sedge and tall grasses. (73).

Climate.

Rather cold winters and mild summers are characteristic of the climate in the study region. The mean winter temperature is 24.2° F and the average summer temperature is 68.6° F. The mean annual temperature is 46.9° F.

Precipitation, including melted snow, normally amounts to 31.43 inches each year. Rainfall is fairly evenly distributed throughout the year. Humidity is relatively high and evaporation is moderately low.

The prevailing westerly winds seldom attain a velocity high enough to be destructive.

Broad Land Divisions.

To present a clearer understanding of the general land character of the region, a description of the broad land divisions as outlined by Whiteside, Schneider and Cook (74) follows.

Level to Rolling Soils Developed from Limey Loams.--The western two-thirds of the study area comprises this land type. The dominant soil series in this division are Miami and Conover. Limey loam glacial till is the parent material of the soils in this land division, in which most of the study area lies. The drainage varies from good to imperfect, with poorly-drained areas found in depressions and in natural drainageways. The topography is level to rolling, with occasional local steep slopes. "The soils are deep, relatively high in fertility and durable under cultivation except on the steeper slopes."

<u>Rolling to Steeply Sloping Well-drained Loamy Sands and Sandy Loams</u>.--The eastern corner of the study area falls within this land type. Boyer, Bellefontaine, Spinks and Hillsdale are the principle soil series in this land division.

Extremely rough terrain with swamps, marshes and lakes in basin-like depressions characterize this land division. Gravels, loose coarse sands and sandy loams comprise the substratum. Mechanical agriculture is not well adapted to this land type, and soil erosion has depreciated much of the land value in the steeper cultivated slopes. In some cases, farms have been abandoned on the sandy soils having steep slopes. "Many hilly areas are unsuitable for farming and are best used for forestry and recreation." (74).

<u>Organic Soils, Mucks and Peats</u>.--A rather large organic soils area lies northeast of the city of Lansing, and other smaller tracts are scattered throughout the remainder of the study area. This land division is "largely occupied by muck or peat in sufficiently large bodies to be delineated on the soil association map." (74).

MATERIALS AND METHODS

Aerial Photographs and Land Use Identification

Rural and agricultural features appearing on aerial photographs are readily distinguished from one another, according to H.T.U. Smith (75). Each type of land use, whether for grassland, orchard, woodland or crop cultivation is readily apparent. It is even possible for the discerning observer to distinguish various standing crops from one another.

Characteristic features for towns and cities are also readily observed from the photographs. Smith states: "The identification of most of these features presents no special problems, and requires only a degree of familiarity with the urban environment."

Costello (76), on the same subject, states that most judgments are easily made and errors are usually confined to the land uses that have the least distinct characteristics for identification.

Methods.--Land-use information was transferred from the air photographs of scale four inches to one mile, to index sheets which covered the study area having the scale of one inch to approximately one and five tenths miles. This was done by first determining the land use from the air photographs, then outlining the corresponding region on the index sheet and finally labelling the area according to its land use category.

Land uses which could readily be identified from aerial photographs included cropland, pasture, idle land, woodland, swamp, housing, industry, commercial uses, roads, railroads, airports, recreational areas and cemeteries (77). For the purposes of this study the uses were categorized as follows:

Agriculture - Land obviously in forage or row crops, not including small gardens.

Woodland - Land in woods including the land in which more than 50 per cent is in tree cover and such areas in swamp, including grass-type swamp.

Idle Land - Land having spots of brushy-type growth, including brushy pastures, or land from which no crops have been harvested for several seasons.

Urban Land - Land directly influenced by cultural developments including housing, commercial areas, farmsteads, cemeteries, streets, roads, parking lots, airports, and recreational areas. Areas presently utilized for recreational purposes are included because in this region they are closely linked to the urban area and any change in their use would be toward housing or industry rather than to agriculture, as described by Whyte Jr. (78).

Construction of Photo-Projector

To facilitate the transfer of land use information to the acetate overlay sheets for analysis, it was found necessary to design and build an inexpensive device for projecting an enlarged image on the surface of a drafting table (79).

Basically, the projector constructed was a system composed of a light source to produce the image, a reflecting surface to rectify the image, and a lens or group of lenses to magnify or reduce the image. (See Figure 4).

The projector was constructed in the following fashion: A wooden box was used for the base, the dimensions of which were 15" x 12" x 8". These dimensions could vary, with the exception of the height, which was eight inches and had the correct height for a lens of about 9" focal length. For a shorter focal length, the height of the box could have been reduced.

A good quality mirror, as free from imperfections as possible, was used. It was mounted on a piece of ½" plywood fastened to a wooden block, the upper surface of which was at a forty-five degree angle to the front of the box. A single wood screw held the block to the bottom of the box thus permitting the mirror to be swung slightly to align the image. Upon adjustment of the mirror, the screw was tightened to hold it firmly in position.

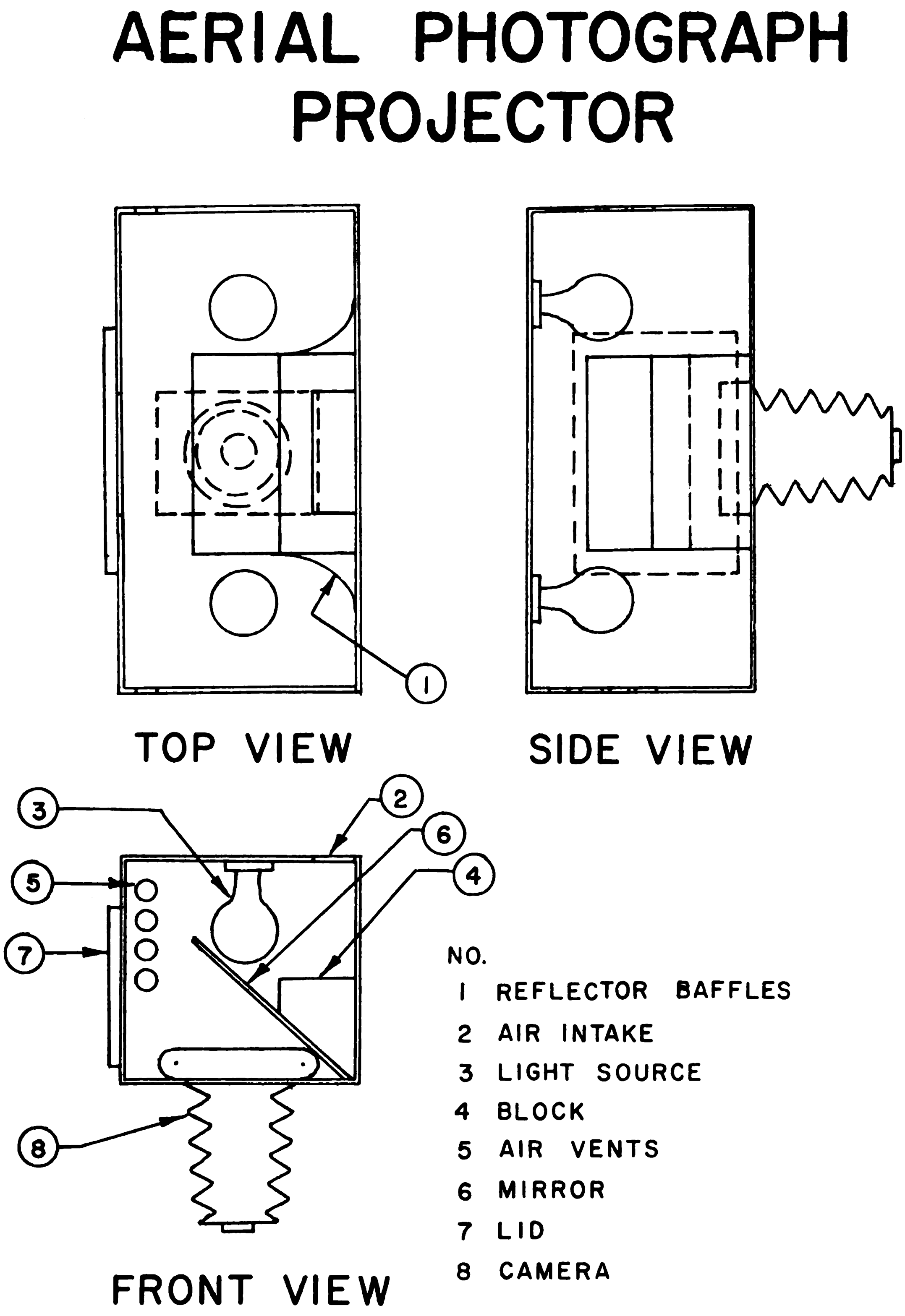


Figure 4. Aerial Photograph Projector.

Two one-hundred watt lamps were used as the source of light. The sockets were wired in parallel with a cord extending out through the ventilating slot. A through-cord switch was installed a foot from the box.

The width of the box would have to be altered depending on the size and type of sockets used in order to bring the lamp filaments into line with the center of the picture to be projected. Air space around the lamps protected the wood from excessive heat. A slit-like opening along the back and holes in each end of the box provide ventilation.

The rear of the box had a rectangular opening, rabbeted or provided with wooden strips to receive the glass upon which the photograph to be reproduced was placed. The glass was merely placed in the recess and could be removed for cleaning or changing a lamp.

The rear of the box had a hinged lid to cover the glass and was attached by metal hinges. The underside of the lid was covered with black cloth to prevent light leakage.

The lens is the most important part of the projector, for the sharpness of the image depends upon its performance. An astigmat of F 4.5 speed or greater and a focal length of eight inches or more is most satisfactory. Such a lens may be procured from another projector or from an old bellows-type view camera if the latter is available. By removing its back, it was possible to build the entire camera into the projection box. This at the same time, provided a very satisfactory method of focusing the image simply by moving the camera on its rail. The aperture could be changed to provide the desired brightness or sharpness of image.

It is necessary that the reproduction be done in a darkroom. Any small room having a single window can easily be made into a darkroom simply by applying several coats of black paint to a standard window shade and masking shut the sides of the drawn shade so that light leakage is at a minimum.

The finished projector should be mounted on a stable rig or to a wall above the drafting table so that it may be moved up and down to produce the desired scale. All parts of the projector, rig and drafting table must be firm, for any movement of the components will be reflected in a change of scale of the projected image.

Technique of Projector Utilization

The aerial photograph index sheet containing the outlined information to be reproduced to the new scale was inserted between the glass and the lid. The base map was placed on the drafting table under the projector. The projector was moved up or down until the image was brought into focus. The projected image would be either smaller or larger than the base map, but by raising or lowering the projector and moving the lens on its rails at each position, gradually, an image was produced which corresponded with the lines of the base map. Only the center of the image was reproduced on the base map so that the distortion which was found at the perimeter of the image was avoided as much as possible. The degree of distortion could be determined by observing the coincidence of image to physical characteristics of the base map, such as roads, rivers and rail lines. Distortions due to photography (75), such as tilt, could be corrected by tilting the drafting table. By using this apparatus and these techniques, reproductions of the information outlined of considerable accuracy could be drawn to the new scale, thus substituting for the time-consuming grid-transfer method.

Methods of Data Accumulation

The Land Use Map.--Three separate parts comprised the land-use map, one for each county. The soil survey maps of each county were used as the base upon which the land-use information was superimposed for analysis. Physical features such as roads, highways, railroads, streams and lakes were traced from each soil survey map onto semi-transparent acetate paper, thus providing exactly the same scale and the same features as present on the soil survey maps.

The acetate sheets were then used as a base upon which were projected the land-use characteristics of the area in question. Heavy plain white paper was placed on the drafting table to serve as a surface to reflect the image from the projector. In this way, the land uses outlined could be transferred directly to the acetate map. Errors due to photography could be corrected as detailed previously.

After the acetate land-use map was completed, the entire map was again checked for possible errors in location, areas, or interpretation against the original air photographs at the Agricultural Stabilization and Conservation Commission office. Any errors were corrected before the land use map was considered complete.

Determination of Land Use of Soil Type Acreage.--The next phase of the research required that the land use data be superimposed upon the soil survey maps and the acreage of each soil type for each land use be determined. This was to be accomplished by counting the area using a grid.

Drafting a counting grid was attempted but the resulting degree of accuracy was not sufficient for this study. Graph paper having 256 squares per inch, was taken to an engineering laboratory where the paper was photographically enlarged, to produce a diapositive having the scale of 1/62500 inches. The transparent diapositive could then be overlaid on a section of the soil survey map, and the 256 squares of counting grid would exactly correspond to the section, with each square representing two and one-half acres.

In order to determine the acreages, it was necessary to devise a simplified light table. A large flat safety-glass plate was purchased. This was placed upon two desk-high side supports. A desk lamp, shining upward from under the glass, served as light source.

Finally then, the squares could be counted. First the soil survey map was laid on the glass surface, this was overlaid by the semi-transparent acetate land-use map which was firmly affixed to the perimiter of the soil survey map. The labelled soil types, their boundaries and colors as well as land use features delineated on the acetate were clearly visible. The transparent counting grid could then be placed over the section, the acreages of which were to be determined.

Every township within the study area was thus analyzed by counting the squares of each soil type for each land use on a section-by-section basis. Each section was counted twice and the total more closely approaching 640 acres was used.

<u>Analysis of the Data</u>.--The following arithmetic manipulations were carried out on the raw data obtained by counting the squares:

1. Each soil type for each land-use type was totaled.
2. For each township, the total number of acres of the soil types in each of the four land-use categories was calculated.
3. The sum of these totals was checked against the final sum of the land-use totals of the individual

sections for each township. This served as a cross-check against arithmetic errors.

4. The acreages of each soil type for each land-use from all the townships were totaled. The final totals were then summarized according to their land use and their soil classes.
5. The percentage of each class of soil in each land-use was calculated.
6. The total acreage of each class for the entire study area was also determined.
7. The percentage of acreage for each land-use category was determined for the study area.

PRESENTATION OF THE DATA

Establishment of Land Classes

Thirty-nine soil types were included in the study area. To simplify the data on distribution of the various land uses in relation to the soil types, this study adopted the six land classes which Duke and Schneider (49), organized for Southern Michigan. They were classified on the following bases: Class I was best suited for agricultural use with Class V the least suited. Classes II, III, and IV were gradations in between. Class VI was set up as a special category to include those lands that could not be placed in a particular class on the basis of soil type alone. The soils of this class, which consist only of organic soils, would have to be examined in the field in order to classify them because such characteristics as drainage, depth, underlying materials, etc. influence their value.

Soil Types of the Area

A brief description of the main soil types of the area as detailed in the soil surveys of Clinton, Eaton, and Ingham Counties will permit a better understanding of the data which is presented in this part of the study.

Class I Soils

Miami Loam.--Miami loam is developed on the well-drained, smooth and nearly level to gently rolling glacial tills. The plow soil in a dry condition is a grayish-brown mellow fine-granular loam which grades into a pale yellow, more gritty sub-surface. The plow soil contains a medium supply of organic matter, is slightly to strongly acid and is considered to be medium to high in fertility. The sub-soil tends to be sticky when wet and hard when dry with a comparatively high moisture content.

Conover Loam.--The top four to six inches of Conover loam consist of dark grayish-brown mellow loam of silt loam developed under conditions of imperfect drainage. Below this is a pale yellow, friable, gritty loam which grades into a calcareous clay or clay-loam substratum. The land is nearly level or gently sloping, occupying plains, shallow swales or basin-like valleys. The soil has a medium content of humus and is nearly neutral in reaction. Although Conover soils are high in fertility, tile drainage is usually necessary for high agricultural yields. Slow water percolation suggests caution in developing the soil for urban uses.

Brookston Loam.--Brookston loam occupies flat basin land, valleys and depressions which are or were originally wet and swampy. The surface of six to ten inches is a very dark gray or nearly black color and is rich in organic matter. Below this is a gray or yellowish-gray clayey layer which grades into a plastic or sticky clay. Brookston loam is high in natural fertility with a nearly neutral reaction. Drainage constitutes the main problem in the use of land for crops and should be a factor retarding its development for urban uses.

Class II Soils

Hillsdale Sandy Loam.--This soil is developed on rolling or moderately hilly well-drained land. The plow layer consists of a grayish-brown sandy loam or light loam underlain by a layer of pale yellow, friable, sandy loam which becomes a friable sandy clay loam with a pervious variable sandy clay substratum. The content of humus is low and the soil reaction is medium to strongly acid with a fair natural fertility. Soils of this type do not offer particular problems to urban development.

Class III Soils

Bellefontaine Sandy Loam.--Bellefontaine Sandy Loam is developed in knolly or hilly topography. Six to seven inches at the surface are grayish-brown, friable or loosely coherent sandy loam or fine loamy sand which grades into a pale yellow sandy loam. This is underlain by a reddish-brown sandy or coarse gravelly substratum which contains enough clay to form a coherent mass. The soil is of medium fertility with a medium or strongly acid reaction. It contains only a medium supply of organic matter. This type of soil seems well-suited for individual home sites and developments.

Fox Sandy Loam.--The plow soil of Fox sandy loam is loose brownish-gray sandy loam containing a moderate to small amount of organic matter. The subsoil is a reddish-yellow mixture of sand and gravel with some clay which is sticky when wet and brittle when dry. Below this lies unconsolidated loose beds of sand and gravel. Fox sandy loam occurs on narrow, rounded gravelly ridges. It is not as productive as Brookston, Conover, or Miami soils, and seems well-suited to non-agricultural uses.

Class IV Soils

Coloma Loamy Sand.--This soil occurs on hummocky or hilly areas having smooth slopes, broad swales and shallow pit-like depressions. The plow soil is light gray loamy sand of loose consistency. A small amount of clay is found in the subsurface but it does not bind it into a solid mass. The substratum is primarily composed of sand with lenses of clay and some gravel possible. Coloma loam has a low level of fertility and is strongly acid in the plow horizon. The soil is pervious throughout, suggesting excellent adaptation to uses requiring this characteristic.

Genesee Fine Sandy Loam.--Genesee fine sandy loam usually occurs as alluvial deposits so situated that they are well drained. The soil does not have distinct horizons but the surface is usually a brown mellow loam. This is underlain by moist sandy loam or sandy clay. The soil is of high natural fertility but because it usually lies along stream banks that are occasionally subject to floods, its use should be limited by this fact.

Oshtemo Loamy Sand.--The cultivated surface soil of Oshtemo loamy sand is usually a light grayish-brown, loosely coherent loamy sand or sandy loam. This material is usually underlain, at a depth of 15 to 30 inches by a light reddish-brown clayey layer, thinner and less compact than that underlying Fox soils. The soil is acid in the surface layer and has low to medium productivity. It occurs on level outwash-type material. Its low average moisture and high permeability limit its agricultural use and are advantageous to housing development.

Class VI Soils

Carlisle Muck.--Carlisle muck occurs in areas that were formerly swamps or wet drainageways. It is characterized by a dark brown or black coarse to fine granular surface. The organic matter becomes finer in texture at a depth of a few inches, and is hard and horny when dry, but pasty when wet. At a depth of 12 to 20 inches, the material becomes coarser and more peaty. It is medium acid or alkaline in reaction. Drainage is required for agricultural utilization of the soil.

Rifle Peat.--The surface soil of Rifle peat is granular, woody, loamy and dark brown to nearly black in color. Below a depth of 6 or 8 inches, it is not very decomposed and the material is coarse in texture with either a fibrous or woody spongelike mass. It is usually acid or neutral in reaction. The undecomposed nature of the peat attests to a rather high water table under natural conditions. Drainage is necessary for agricultural utilization.

Distribution of Soil Types in each Land Class by Uses

Tables III through VII show the distribution of the soil types which make up each land class and their distribution according to land uses.

TABLE III

DISTRIBUTION OF SOIL TYPES IN EACH LAND CLASS FOR THE TOTAL STUDY AREA

Class I		Class II	
Soil Type	Acres	Soil Type	Acres
Brookston clay loam	227	Bronson loam	2,729
Brookston loam	7,107	Brady loam	3,246
Conover loam	36,604	Fox loam	909
Conover silt loam	67	Gilford loam	2,027
Hillsdale loam	1,799	Hillsdale sandy loam	18,933
Miami loam	57,223	Maumee loam	1,249
Miami silt loam	1,696	Parma loam	98
Total	104,723	Total	29,191

Class III		Class IV	
Soil Type	Acres	Soil Type	Acres
Berrien fine sandy loam	462	Berrien loamy fine sand	997
Bellefontaine sandy loam	6,309	Bellefontaine loamy sand	2,173
Brady sandy loam	3,447	Brookston-Washtenaw cmpx.	4,019
Fox sandy loam	5,241	Coloma loamy fine sand	624
Griffin clay loam	18	Coloma loamy sand	2,039
Griffin loam	2,271	Genesee fine sandy loam	2,252
Gilford sandy loam	505	Granby loamy sand	277
		Griffin sandy loam	192
		Oshtemo loamy sand	3,641
		Ottawa loamy fine sand	807
		Wallkill loam	2,160
		Washtenaw loam	2,298
Total	18,253	Total	21,479

Class V		Class VI	
Soil Type	Acres	Soil Type	Acres
Greenwood peat	116	Carlisle muck	9,856
Kerston muck	969	Houghton muck	982
Plainfield sand	418	Rifle peat	12,244
Total	1,503	Total	23,082

TABLE IV

DISTRIBUTION OF SOIL TYPES IN EACH LAND CLASS
FOR AGRICULTURAL LAND IN THE STUDY AREA

Class I Soil Type	Acres	Class II Soil Type	Acres
Brookston clay loam	144	Bronson loam	2,161
Brookston loam	4,243	Brady loam	2,375
Conover loam	24,085	Fox loam	523
Conover silt loam	58	Gilford loam	1,297
Hillsdale loam	1,118	Hillsdale sandy loam	10,800
Miami loam	41,821	Maumee loam	614
Miami silt loam	1,521	Parma loam	35
Total	72,990	Total	17,805

Class III Soil Type	Acres	Class IV Soil Type	Acres
	--	Berrien loamy fine sand	431
Berrien fine sandy loam	315	Bellefontaine loamy sand	939
Bellefontaine sandy loam	4,329	Brookston-Washtenaw cmpx.	3,282
Brady sandy loam	1,650	Coloma loamy fine sand	452
Fox sandy loam	3,393	Coloma loamy sand	1,029
Griffin clay loam	--	Genesee fine sandy loam	473
Griffin loam	413	Granby loamy sand	63
Gilford sandy loam	226	Griffin sandy loam	90
		Oshtemo loamy sand	1,868
		Ottawa loamy fine sand	589
		Wallkill loam	1,194
		Washtenaw loam	1,590
Total	10,326	Total	12,000

Class V Soil Type	Acres	Class VI Soil Type	Acres
Greenwood peat	5	Carlisle muck	4,985
Kerston muck	344	Houghton muck	327
Plainfield sand	175	Rifle peat	5,642
Total	524	Total	10,954

TABLE V

DISTRIBUTION OF SOIL TYPES IN EACH LAND CLASS FOR WOODLAND IN THE STUDY AREA

Class I		Class II	
Soil Type	Acres	Soil Type	Acres
Brookston clay loam	81	Bronson loam	238
Brookston loam	838	Brady loam	489
Conover loam	2,445	Fox loam	78
Conover silt loam	7	Gilford loam	424
Hillsdale loam	187	Hillsdale sandy loam	1,292
Miami loam	2,624	Maumee loam	204
Miami silt loam	73	Parma loam	13
Total	6,255	Total	2,738

Class III		Class IV	
Soil Type	Acres	Soil Type	Acres
Berrien fine sandy loam	15	Berrien loamy fine sand	131
Bellefontaine sandy loam	412	Bellefontaine loamy sand	213
Brady sandy loam	403	Brookston-Washtenaw cmpx.	335
Fox sandy loam	340	Coloma loamy fine sand	52
Griffin clay loam	6	Coloma loamy sand	193
Griffin loam	945	Genesee fine sandy loam	639
Gilford sandy loam	25	Granby loamy sand	22
		Griffin sandy loam	50
		Oshtemo loamy sand	193
		Ottawa loamy fine sand	44
		Wallkill loam	235
		Washtenaw loam	135
Total	2,146	Total	2,242

Class V		Class VI	
Soil Type	Acres	Soil Type	Acres
Greenwood peat	93	Carlisle muck	1,787
Kerston muck	295	Houghton muck	349
Plainfield sand	31	Rifle peat	3,240
Total	419	Total	5,376

TABLE VI

DISTRIBUTION OF SOIL TYPES IN EACH LAND CLASS FOR IDLE LAND IN THE STUDY AREA

Class I Soil Type	Acres	Class II Soil Type	Acres
Brookston clay loam	--	Bronson loam	131
Brookston loam	1,013	Brady loam	280
Conover loam	2,939	Fox loam	83
Hillsdale loam	244	Gilford loam	279
Miami loam	3,012	Hillsdale sandy loam	2,967
Miami silt loam	26	Maumee loam	361
		Parma loam	--
Total	7,234	Total	4,101

Class III Soil Type	Acres	Class IV Soil Type	Acres
Berrien fine sandy loam	83	Berrien loamy fine sand	146
Bellefontaine sandy loam	836	Bellefontaine loamy sand	661
Brady sandy loam	835	Brookston-Washtenaw cmpx.	276
Fox sandy loam	551	Coloma loamy fine sand	61
Griffin clay loam	12	Coloma loamy sand	304
Griffin loam	726	Genesee fine sandy loam	462
Gilford sandy loam	145	Granby loamy sand	139
		Griffin sandy loam	47
		Oshtemo loamy sand	625
		Ottawa loamy fine sand	43
		Wallkill loam	438
		Washtenaw loam	257
Total	3,188	Total	3,459

Class V Soil Type	Acres	Class VI Soil Type	Acres
Greenwood peat	3	Carlisle muck	2,703
Kerston muck	283	Houghton muck	268
Plainfield sand	138	Rifle peat	2,936
Total	424	Total	5,907

TABLE VII

DISTRIBUTION OF SOIL TYPES IN EACH LAND CLASS
FOR URBAN LAND IN THE STUDY AREA

Class I Soil Type	Acres	Class II Soil Type	Acres
Brookston clay loam	2	Bronson loam	199
Brookston loam	1,013	Brady loam	102
Conover loam	7,135	Fox loam	225
Conover silt loam	2	Gilford loam	27
Hillsdale loam	250	Hillsdale sandy loam	3,874
Miami loam	9,766	Maumee loam	70
Miami silt loam	76	Parma loam	50
Total	18,244	Total	4,547

Class III Soil Type	Acres	Class IV Soil Type	Acres
Berrien fine sandy loam	49	Berrien loamy fine sand	289
Bellefontaine sandy loam	732	Bellefontaine loamy sand	360
Brady sandy loam	559	Brookston-Washtenaw cmpx.	126
Fox sandy loam	957	Coloma loamy fine sand	59
Griffin clay loam	--	Coloma loamy sand	513
Griffin loam	187	Genesee fine sandy loam	678
Gilford sandy loam	109	Granby loamy sand	53
		Griffin sandy loam	5
		Oshtemo loamy sand	955
		Ottawa loamy fine sand	131
		Wallkill loam	293
		Washtenaw loam	316
Total	2,593	Total	3,778

Class V Soil Type	Acres	Class VI Soil Type	Acres
Greenwood peat	15	Carlisle muck	381
Kerston muck	47	Houghton muck	38
Plainfield sand	74	Rifle peat	426
Total	136	Total	845

TABLE VIII

DISTRIBUTION OF LAND USES IN TOTAL STUDY AREA

Land Use	Total Acreage	Per cent of Total
Agriculture	124,599	62.9
Woods	19,176	9.7
Idle	24,313	12.2
Urban	30,143	15.2
Total	198,231	100.0

<u>Land Uses in the Lansing Area</u>.--The area within a ten mile radius of the capitol building in Lansing is still dominated by agriculture while only slightly more than one-seventh of the area is in urban usage, as Table VIII indicates. The pattern of urban usage can be observed by examining the appendix map illustrating the land use pattern of the study area. Slightly less than one-eighth of the area is idle. Note the idle acreage concentration around the urban agglomerations.

Since about 85 per cent of the area within ten miles of the capitol is not in urban use, the question arises if it would not be possible to build in those areas which are best suited for development, perhaps utilizing some of the 20 per cent of the land that is in Classes III and IV for homesites.

TABLE IX

DISTRIBUTION OF LAND CLASSES IN TOTAL STUDY AREA

Land Class	Acres	Per Cent
Class I	104,723	52.8
Class II	29,191	14.7
Class III	18,253	9.2
Class IV	21,479	10.8
Class V	1,503	0.8
Class VI	23,082	11.7
Total	198,231	100.0

Land Class Distribution in the Lansing Area.--Table IX shows the distribution of all the land classes in the total study area. Over 50 per cent of the area consists of three Class I soil types. They are: Miami loam - 28.8 per cent, Conover loam - 18.5 per cent, and Brookston loam - 3.6 per cent. These soils make up 96.4 per cent of the Class I soils. Almost two-thirds of the Class II soils consist of Hillsdale sandy loam which makes up 9.6 per cent of the total study area.

Class III is dominated by two soil types: Bellefontaine sandy loam - 34.6 per cent and Fox sandy loam - 28.7 per cent. Together they comprise 5.8 per cent of the study area.

Almost two-thirds of the Class IV soils are comprised of five soil types: Coloma loamy sand, Griffin sandy loam, Oshtemo loamy sand, Washtenaw loam and Brookston-Washtenaw complex. These make up 7.1 per cent of the total study area. Carlisle muck and Rifle peat comprise 95.8 per cent of the Class VI soils. For soil types within classes see Table IV.

TABLE X

DISTRIBUTION OF AGRICULTURAL LAND
IN EACH LAND CLASS IN TOTAL STUDY AREA

Land Class	Acres	Per Cent
Class I	72,990	58.6
Class II	17,805	14.3
Class III	10,326	8.3
Class IV	12,000	9.6
Class V	524	0.4
Class VI	10,954	8.8
Total	124,599	100.0

Agricultural Land.--Class I and II soils are by far the most important agricultural soils of the area. Although 67.5 per cent of the total study area is in Class I and II soils, 72.9 per cent of the land used for agriculture is in Land Classes I and II (compare Tables X and IX). Conversely, a smaller percentage of soils in Classes III to VI are used for agriculture than the percentage of these classes which exist in the total study area indicating that they are less desirable for agricultural usage, as one would expect. Organic soils require drainage before they can be developed for agriculture, therefore a smaller proportion is used for agriculture than the proportion of organic soils existing in the study area.

TABLE XI

DISTRIBUTION OF WOODLAND IN EACH LAND CLASS
IN TOTAL STUDY AREA

Land Class	Acres	Per cent
Class I	6,255	32.6
Class II	2,738	14.3
Class III	2,146	11.2
Class IV	2,242	11.7
Class V	419	2.2
Class VI	5,376	28.0
Total	19,176	100.0

Wooded Land.--Nearly half of the woodland of the study area is on Class I and Class II lands and, although, less than 10 per cent of the study area is in woodland, that portion which is on Class I and Class II land is not allowing for most efficient utilization of the good soils. Some of this could probably be cleared for agricultural development. Most of the 28 per cent of woodland that is on Class VI land is on swampy soils which are difficult to improve.

TABLE XII

DISTRIBUTION OF IDLE LAND IN EACH LAND CLASS
IN TOTAL STUDY AREA

Land Class	Acres	Per cent
Class I	7,234	29.8
Class II	4,101	16.9
Class III	3,188	13.1
Class IV	3,459	14.2
Class V	424	1.7
Class VI	5,907	24.3
Total	24,313	100.0

Idle Land.--The distribution of idle land (see Table above) in each land class is somewhat similar to the apportionment of land classes in woodland (see Table XIII). Although more Class I and Class II land is idle than is in woodland, approximately the same percentage of idle land is in these two classes as is in woods under the same classes.

A rather high percentage of Class VI land is idle, reflecting the difficulty in developing it for agriculture. These soils would probably be most efficiently used as wildlife refuges and as recreational areas.

TABLE XIII

DISTRIBUTION OF URBAN LAND
IN EACH LAND CLASS IN TOTAL STUDY AREA

Land Class	Acres	Per Cent
Class I	18,244	60.5
Class II	4,547	15.1
Class III	2,593	8.6
Class IV	3,778	12.5
Class V	136	0.5
Class VI	845	2.8
Total	30,143	100.0

Urban Land.--Over 60 per cent of the urban land in the study area is Class I soil, while for the entire study area, only 53 per cent of all the soils were in Class I. This is to be expected because developers seek out level, well-drained soils of which the greater portion of Class I and Class II land is composed.

About the same percentage of Class II and Class III soils are occupied by urban uses as are in the study region as a whole. However, 12.5 per cent of the land used for urban purposes consists of the sandy, well-drained soils of Class IV, while of the total study area, only 10.8 per cent is Class IV land.

Note that almost 12 per cent of the study area consists of Class VI land, but that less than 3 per cent of the land in urban use is Class VI land. High water tables and difficulty in securing solid footings are major problems in utilizing these soils for building purposes.

Urban and Idle Land in Urbanized Sections.--Statistics thus far presented indicate that those sections under more direct urban influence may have a different land-use pattern than data for the area as a whole shows. This is particularly true in the Urban and Idle use-categories. To investigate further the facts which may be clouded by presenting data for the entire study area, a more select sample was sought.

By graphical methods, it was determined that typical agricultural individual sections of land had about 20 acres devoted to farmsteads and related uses (urban use-category). The trough of the curve representing the number of land sections having a given acreage in urban use was reached at 40 acres. It was felt that this would be a convenient dividing line between land sections under urban impact and those still without apparent urban influence.

The distribution of Urban and Idle land in all individual land sections having more than 40 acres in urban uses was determined and are presented in the tables which follow.

TABLE XIV

DISTRIBUTION OF URBAN LAND IN ALL SECTIONS
HAVING MORE THAN FORTY ACRES IN URBAN USES

Land Class	Acres	Per Cent
Class I	14,634	60.6
Class II	3,761	15.6
Class III	2,039	8.4
Class IV	2,993	12.4
Class V	101	.4
Class VI	618	2.6
Total	24,146	100.0

TABLE XV

DISTRIBUTION OF IDLE LAND IN ALL SECTIONS
HAVING MORE THAN FORTY ACRES IN URBAN USES

Land Class	Acres	Per Cent
Class I	3,943	34.0
Class II	2,057	17.7
Class III	1,540	13.3
Class IV	1,788	15.4
Class V	145	1.3
Class VI	2,121	18.3
Total	11,594	100.0

Distribution of Idle and Urban Land in Urbanized Sections.--The percentage of land in urban use in the various land classes is almost the same for the sections under urban influence as for the study area as a whole [60.6 per cent versus 60.5 per cent]. (See Tables XIV and XIII). This indicates that the patterns of land used for urban purposes in the various land classes are similar whether they are under direct urban influence or not, when considering land class-use distribution.

This is not true for the pattern of land that is idle in the various land classes. Land not in use which is under urban influence has a greater percentage (51.7 per cent) in Land Class I and II than the 46.7 per cent of idle land in the same classes for the area as a whole. (Compare Tables XV and XIII). This is probably due to the fact that some land in the sections under urban influence is being held for speculation and other acreages, belonging to urban-type establishments, is part of the urban parcel although it is idle. Note that a higher percentage (24.3 per cent) of unused land falls into Class VI in the total study area than is in Class VI in the sections under urban influence (18.3 per cent). This is apparently due to the fact that it is less desirable to develop these organic soils than to leave them idle under the given circumstances.

Land Utilization in the Townships

General Relationships

The map on the background of the figure at the top of page 45 will give the reader a picture of the location in relation to one another of the townships that fall within the study area. In addition to the townships shown, several sections of the eastern parts of Oneida Township in Eaton County (directly west of Delta Township) is included within the study boundaries. Also included are several sections of the Clinton County townships of Eagle, Riley, Olive and Victor, north of the townships of Oneida, Watertown, Dewitt and Bath respectively.

The land use map in the appendix presents an illustration of the land use patterns of the area. The township of Lansing is largely urbanized and considerable acreages of Meridian, Delta, Dewitt and Windsor townships are also in urban uses.

Observe that wooded swamps occur along the meanders of the Red Cedar river and along the flood plain of Sycamore Creek in the townships of Lansing, Delhi and Alaiedon. A similar pattern prevails along portions of the Red Cedar River in Meridian Township and along the Grand River in Windsor and Oneida Townships as well as in areas along the Looking Glass River in Clinton County. Large areas of wooded or swampy lowlands occur east of Lake Lansing, in the eastern half of Bath Township and south of Dobie Lake in Alaiedon Township.

Another distinctive pattern occurs in the better drained soils of the more rural areas. Woodlots appear regularly in the centers of sections and seem more related to accessibility than to soil conditions. Generally, woodlots border roads only where drainage conditions are poor.

Areas of idle land surround most of the area in urban use and appear along roads and highways. Some relationship between idle land in urban areas, or where the expectation is that the land will be in urban usage in the future is apparent. In the more rural areas, however, the acreage of idle land is more closely associated with the less accessible woodlots or poorly drained areas than with other characteristics. These areas are probably unimproved pastures which are being allowed to revert to brush and woods.

The following tables will give the distribution of all land uses in each land class for the townships or parts thereof included in the study area. Acreage data from which the percentages were calculated are presented in Tables XXVI through XLV of the appendix.

TABLE XVI

DISTRIBUTION OF LAND USES BY TOWNSHIPS
IN LAND CLASS I

Township	Per cent				Total
	Agriculture	Woods	Idle	Urban	
Alaiedon	80.6	9.1	7.9	2.4	100.0
Bath	78.1	4.1	10.1	7.7	100.0
Delhi	65.3	6.1	13.0	15.6	100.0
Delta	75.5	6.7	6.3	11.5	100.0
Dewitt	76.0	6.5	4.4	13.1	100.0
Eagle	83.5	6.8	6.6	3.1	100.0
Lansing	16.8	1.6	10.9	70.7	100.0
Meridian	53.2	4.8	15.1	26.9	100.0
Olive	86.2	7.4	3.2	3.2	100.0
Oneida	75.1	7.2	4.0	13.7	100.0
Riley	85.7	8.4	3.3	2.6	100.0
Victor	91.3	--	--	8.7	100.0
Watertown	87.2	6.5	1.6	4.7	100.0
Windsor	85.7	6.5	2.9	4.9	100.0

Land Class I Uses by Townships.--Lansing and Meridian townships including their cities are, of course, the areas with the highest percentage of Class I land in urban useage, followed by other developed portions of townships in Delhi, Delta, Dewitt and Oneida (Grand Ledge city). Note that more than 10 per cent of the land Class I areas in Bath, Delhi, Lansing and Meridian townships is idle. Alaiedon, Watertown, Windsor and the remainder of the townships which are at the perimeter of development are, on the other hand, still largely agricultural and have smaller percentages of idle Class I land and higher percentages in agricultural usage.

As expected, Lansing and Meridian have the smallest percentage of Class I land in woodland use while the more rural townships have somewhat larger amounts in that use.

TABLE XVII

DISTRIBUTION OF LAND USES BY TOWNSHIPS IN LAND CLASS II

Township	Per cent				
	Agriculture	Woods	Idle	Urban	Total
Alaiedon	72.4	12.4	10.8	4.8	100.0
Bath	56.4	13.0	23.1	7.5	100.0
Delhi	58.5	8.8	18.2	14.5	100.0
Delta	67.0	15.4	13.0	4.6	100.0
Dewitt	75.7	10.0	5.2	9.1	100.0
Eagle	100.0	--	--	--	100.0
Lansing	24.8	2.6	21.9	50.7	100.0
Meridian	59.6	7.7	16.5	16.2	100.0
Olive	83.6	11.8	2.3	2.3	100.0
Oneida	59.4	7.9	7.1	25.6	100.0
Riley	77.8	21.0	--	1.2	100.0
Victor	56.8	43.2	--	--	100.0
Watertown	76.7	13.4	8.0	1.9	100.0
Windsor	77.5	8.2	7.6	6.7	100.0

Land Class II Uses by Townships.--Class II land use patterns are similar to land Class I. There are somewhat smaller percentages of the soils in urban usage than in Class I and larger percentages of Class II land are idle than in Class I. Compare Tables XVI and XVII. The greater percentage of idle land is also evident in the more rural townships, perhaps reflecting the natural conditions which restrict their potential compared to land Class I soils. The percentage of land in woodland is considerable higher than in land Class I. This is no doubt a result of the fact that the land is less desirable for agriculture.

Tables XXVI through XLV in the appendix present the actual acreage in each townships that is in each use for each land class.

TABLE XVIII

DISTRIBUTION OF LAND USES BY TOWNSHIPS
IN LAND CLASS III

Township	Per Cent				Total
	Agriculture	Woods	Idle	Urban	
Alaiedon	53.8	28.2	16.0	2.0	100.0
Bath	71.7	7.9	14.0	6.4	100.0
Delhi	44.3	13.9	25.2	16.6	100.0
Delta	63.4	10.4	16.0	10.2	100.0
Dewitt	76.5	3.1	5.5	14.9	100.0
Eagle	--	--	--	--	--
Lansing	18.2	10.2	25.3	46.3	100.0
Meridian	55.1	11.1	24.6	9.2	100.0
Olive	70.6	17.8	5.8	5.8	100.0
Oneida	38.4	26.2	14.3	21.1	100.0
Riley	100.0	--	--	--	100.0
Victor	93.0	--	--	7.0	100.0
Watertown	77.4	11.9	6.7	4.0	100.0
Windsor	54.3	15.2	21.3	9.2	100.0

Land Class III Uses by Townships.--The percentage of urban use in land Class III is generally less than is in the same use in the better land classes. A greater percentage of the land is idle, probably being held for speculative purposes, or is not suited for agricultural development when in competition with better lands in the same area.

The amount of land in woods is roughly equivalent to that in land Class II and higher than land Class I. The table above verifies the fact that land Class III is less favorably suited to agriculture and better suited to woods than the higher land classes. The use for agriculture seems to be restricted by the natural limitations of the soils.

TABLE XIX

DISTRIBUTION OF LAND USES BY TOWNSHIPS
IN LAND CLASS IV

Township	Per Cent				Total
	Agriculture	Woods	Idle	Urban	
Alaiedon	67.9	9.7	18.2	4.2	100.0
Bath	67.8	8.9	15.8	7.5	100.0
Delhi	41.4	13.6	28.3	16.7	100.0
Delta	55.2	27.2	15.4	2.2	100.0
Dewitt	77.2	6.3	10.2	6.3	100.0
Eagle	78.6	10.7	10.7	--	100.0
Lansing	16.8	8.0	17.3	57.9	100.0
Meridian	33.8	13.5	24.1	28.6	100.0
Olive	85.3	6.7	4.0	4.0	100.0
Oneida	26.5	16.7	33.3	23.5	100.0
Riley	93.9	6.1	--	--	100.0
Victor	93.4	4.8	--	--	100.0
Watertown	81.1	10.0	6.9	2.0	100.0
Windsor	69.6	5.9	12.1	12.4	100.0

Land Class IV Uses by Townships.--Soils primarily having textures of fine sandy loam, sandy loam, fine sand and sand, comprise land Class IV. They are generally well suited to urban development providing excellent drainage and permeability. These natural factors are reflected in the statistics which show that a greater part of land Class IV is in urban use than is found for the same use in Classes II and III. Generally, however, not as large a portion is in housing as is in urban use in Class I land. Amounts in other uses are somewhat similar to the percentages in land Class III.

TABLE XX

DISTRIBUTION OF LAND USES BY TOWNSHIPS
IN LAND CLASS V

Township	Per Cent				
	Agriculture	Woods	Idle	Urban	Total
Alaiedon	24.5	50.4	24.8	--	100.0
Bath	23.7	12.4	62.2	1.7	100.0
Delhi	53.1	18.5	26.2	2.2	100.0
Delta	24.8	40.9	21.8	12.5	100.0
Dewitt	48.1	26.6	13.9	11.4	100.0
Eagle	--	--	--	--	--
Lansing	2.8	52.2	19.7	25.3	100.0
Meridian	37.2	8.4	41.3	13.1	100.0
Olive	--	100.0	--	--	100.0
Oneida	45.0	30.0	25.0	--	100.0
Riley	--	--	--	--	--
Victor	95.9	--	--	4.1	100.0
Watertown	61.9	25.0	13.1	--	100.0
Windsor	--	--	--	--	--

<u>Land Class V Uses by Townships</u>.--Much of the area in land Class V, which occupies less than 1 per cent of the total study region is predominantly in the categories of woodland or idle. Their agricultural utilization is less than in higher land classes and only Plainfield sand is suitable for building sites without constructional ameliorations, provided it occurs in upland areas. Where there is a pressing need for space, as in the urbanized portions of Lansing, Meridian, Delta and Dewitt townships, soils of this class are utilized for development, their deficiencies being overcome by technology.

TABLE XXI

DISTRIBUTION OF LAND USES BY TOWNSHIPS
IN LAND CLASS VI

Township	Per Cent				Total
	Agriculture	Woods	Idle	Urban	
Alaiedon	29.8	27.5	42.7	--	100.0
Bath	43.4	34.4	21.3	0.9	100.0
Delhi	32.6	19.7	43.1	4.6	100.0
Delta	70.1	18.3	8.2	3.4	100.0
Dewitt	59.6	14.0	21.3	5.1	100.0
Eagle	11.1	5.6	83.3	--	100.0
Lansing	39.0	5.9	40.7	14.4	100.0
Meridian	36.6	29.8	29.2	4.4	100.0
Olive	65.6	32.6	0.9	0.9	100.0
Oneida	65.9	18.8	10.2	5.1	100.0
Riley	--	--	100.0	--	100.0
Victor	28.2	71.8	--	--	100.0
Watertown	50.2	25.0	24.1	0.7	100.0
Windsor	75.4	8.2	14.8	1.6	100.0

Land Class VI Uses by Townships.--Class VI land consists entirely of organic soils. Only in high density development, such as is found in Lansing, is over 10 per cent of this class used for urban purposes. The percentage of these soils that is not used is much higher in most townships than percentages of idle land in other land classes. Significant amounts of this land class have been drained and are being used for agricultural purposes.

In considering the statistics for the townships of Victor, Riley, Olive, Oneida and Eagle, recall that only several individual sections of each of those townships came within the study area boundaries and that the percentage figures are for those individual sections only and not for the entire township.

Agricultural Census Land Use Data for the Lansing Area - 1954

United States Bureau of the Census data for 1954 reflect the degree of urbanization to some extent. While the townships of Alaiedon, Watertown, Eagle and Olive have between 19,000 and 20,000 acres of land in farms, Lansing township has only 1,000 acres and Meridian township has only 7,500 acres of land in farms. The other townships which are under direct urban influence have acreages somewhat in-between (see Tables XXII, XXIII, and XXIV).

Comparisons made between the study data and census statistics should bear in mind that only parts of some of the townships at the perimeter of the study area were included. Areas not in farms, particularly those idle, are not reported in the census data although they might be more than three acres in size. They must meet agricultural census requirements to be enumerated. Only for the rural townships which are almost completely included in the study area (Alaiedon and Watertown) are the statistics similar. Note that the definition of "Lansing City and Adjacent Areas," includes portions of Meridian and Delhi townships and that the land area in farms in the city area is larger than the area in farms in Lansing township and is only 1,200 acres less than the land in farms in Meridian township.

TABLE XXII

DISTRIBUTION OF LAND IN FARMS
FOR SELECTED AREAS OF INGHAM COUNTY-1954 CENSUS OF AGRICULTURE

Township	Acres of Land in Farms	Acres of Cropland	Acres Harvested	Acres of Pasture	Acres of Idle Land	Acres of Woodland	Acres of Other Land
Lansing (city and adjacent area)	6,254	5,118	3,071	1,351	607	313	698
Lansing Twp. (excluding Lansing City)	1,340	1,071	795	163	84	68	119
Meridian Twp. (excluding Lansing City)	7,471	5,649	3,724	1,212	616	496	611
Delhi Twp. (excluding Lansing City)	14,461	10,340	7,373	1,631	895	1,577	1,401
Alaiedon Twp.	20,287	15,273	11,744	1,919	955	2,145	1,932

TABLE XXIII

DISTRIBUTION OF LAND IN FARMS
FOR SELECTED AREAS OF EATON COUNTY-1954 CENSUS OF AGRICULTURE

Township or Town	Acres of Land in Farms	Acres of Cropland	Acres Harvested	Acres of Pasture	Acres of Idle Land	Acres of Woodland	Acres of Other Land
Grand Ledge (city)	136	95	86	2	7	28	9
Oneida Twp. (excluding Grand Ledge)	18,609	13,672	11,498	1,370	449	2,121	1,377
Delta Twp.	17,517	13,228	9,732	2,187	941	1,811	1,473
Dimondale (village)	228	132	79	2	43	20	35
Windsor Twp. (excluding Dimondale)	17,431	12,786	9,612	1,647	1,049	1,499	1,086
Eaton Twp.	19,582	13,477	10,155	2,206	951	2,336	1,878

TABLE XXIV

DISTRIBUTION OF LAND IN FARMS
FOR SELECTED AREAS OF CLINTON COUNTY-1954 CENSUS OF AGRICULTURE

Township	Acres of Land in Farms	Acres of Cropland	Acres Harvested	Acres of Pasture	Acres of Idle Land	Acres of Woodland	Acres of Other Land
Ripley	22,296	16,950	13,767	2,401	523	2,965	1,771
Olive	19,555	14,980	11,201	2,055	898	1,852	2,264
Victor	16,317	10,838	7,711	1,833	1,043	2,004	2,330
Eagle	19,769	14,775	12,143	2,066	362	2,093	2,211
Watertown	20,322	15,846	11,866	2,585	1,129	1,925	2,014
Dewitt (village)	544	437	285	37	83	34	16
Dewitt (remainder of township)	17,527	13,473	10,179	1,991	1,138	1,604	1,776
Bath	16,215	9,665	6,500	1,831	955	3,191	1,127

Farmland Removed from Farm Use by Urbanization in the Lansing Area

The exact number of acres taken out of agricultural production each year would be of great interest to this study because it would indicate how far-reaching the effects of suburban development are in the Lansing region. Unfortunately, only incomplete records of this type of information were available.

Agricultural Stabilization and Conservation Committee Data.--Listing sheets and program records of the Agricultural Stabilization and Conservation Committee of the United States Department of Agriculture were consulted for information relative to the number of acres of agricultural land sub-divided, platted, or sold in lots or to institutions. Unfortunately these records varied a great deal from county to county with the staff in Ingham County scrupulous in their efforts to enter each reason for deletion, presenting rather good data, while the Clinton County staff entered primarily only the fact that the acreage was deleted from the program with only a few notations relative to reasons for the parcels being deleted. The same was found to be true of the Eaton County records, only occasional notations were made as to reasons for withdrawal from the program. Table XXV shows the data recorded from the listing sheets and program records for the period 1950 to 1956, inclusive. A total of 4,790 acres of farmland was reported withdrawn

from the stabilization program in order to be subdivided, platted or sold to institutions, industry or for housing. Of this 3,177 acres were considered cropland. If the 641 acres sold to schools, institutions or factories is disregarded, a total of 4,149 acres was subdivided, platted or sold in lots. Since 9,875 new dwelling permits were issued in towns reporting such data, and these same towns report 4,149 acres retired from agriculture to go into housing and related uses, there would be slightly more than 0.41 acre per new dwelling required. This is rather high considering the size of lots in most subdivisions.

However, it must be remembered that premature subdivision is a phenomenon associated with most land speculation and undoubtedly plays a part in this area. One could therefore,assume that if development is allowed to continue in the present manner, that about 0.41 acre of farmland will drop out of production to be sub-divided or platted for each three persons added to the population of the area with the figure approaching 0.5 acre for each three additional persons if institutional and industrial needs are also included.

In referring to Table XV, please note that the category institution includes acreage sold to schools, governmental units, factories, or for gravel pit operation.

TABLE XXV

AGRICULTURAL LAND REMOVED FROM PRODUCTION
FOR URBAN DEVELOPMENT

City or Town	Farmland	Cropland	Category
Alaiedon	--	--	Institution
	221	152	Platted
	160	125	Subdivided
	381	277	Total
Bath	--	--	Institution
	100	92	Platted
	--	--	Subdivided
	100	92	Total
Delhi	16	16	Institution
	298	185	Platted
	105	66	Subdivided
	419	267	Total
Delta	15	15	Institution
	336	211	Platted
	--	--	Subdivided
	351	226	Total
Dewitt	--	--	Institution
	80	64	Platted
	--	--	Subdivided
	80	64	
Lansing	601	377	Institution
	227	207	Platted
	539	338	Subdivided
	1,367	922	Total
Meridian	10	10	Institution
	366	255	Platted
	1,636	1,064	Subdivided
	2,012	1,329	Total
Windsor	20	--	Institution
	60	--	Platted
	--	--	Subdivided
	80	--	Total
Totals	662	448	Institution
	1,688	1,166	Platted
	2,440	1,593	Subdivided
	4,790	3,177	Total

Evaluation of 3,415 acres which were listed "delete", "idle" or "out of production" for the study area is rather difficult. Some of the acreage belonged to small farms which dropped out of the A.C. and S.C. program. Some of the operators undoubtedly gave up a marginal production to find employment elsewhere, but continued to use the small farmstead as a residence; while others bought small holdings to use solely as residence in the country. Data from Moore and Barlowe (47) pointed out that only 12 per cent of the rural residents in select Okemos and Williamston areas own more than thirty acres of land. Their study bring to light some interesting details on the socio-psychological factors involved in choosing a rural area for residential purposes, and their effects on economic factors such as family income, taxes, agricultural production and land use.

Perhaps more important is the fact that 3,177 or about two-thirds of the 4,790 acres removed from agricultural production, was classified as cropland in the A.C. and S.C. records. There is little doubt that suburbanization has had some influence in this pattern but one must remember that the agricultural picture was clouded by some very special considerations. Including farmers in the social security program may have kept some farmers in production a few additional years in order to become eligible for benefits. The soil bank program may have induced some farmers to place a portion of their acreage into that reserve, thus removing it from production. Price support programs may have permitted some marginal farms to remain in production while the drop in farm prices since the immediate post-war years may have caused others to cease production. However obscure the reasons may be, the fact remains that some acreage is being removed from agricultural production for reasons other than subdivision, platting, or directly related urban influenced factors.

Figure 5. Photograph of Typical Developments in the Study Area.

Figure 5 shows a new development in the foreground, at the perimeter of an older portion of the city of Lansing. The development is located in Lansing Township off Grand River Avenue, between Coolidge Road and Wood Street. The shopping center can be seen to the left center, and East Lansing in the upper left. The golf course in the lower right hand corner is clearly outlined. This is an example of the contiguous spread of the city.

Figure 6. Photograph of Typical Developments in the Study Area.

Figure 6 is a picture of the village of Okemos with the new Indian Hills development in the foreground. This is an example of a development which is being added to a village situated within the direct urban influence zone of Lansing. The urban area in the upper left is East Lansing and Meridian Township.

Figure 7. Photograph of Typical Developments in the Study Area.

Figure 7 is a photograph of the Okemos and Sandhill Roads crossroad. Sandhill Road is horizontal to the reader and on the left side of Okemos Road on Sandhill, one can see new rural residences. In the foreground are several farmsteads. This represents a typical situation of new rural non-farm homes, where a farmer has sold some road frontage to the home builder.

DISCUSSION AND EVALUATION OF THE RESULTS

Most predictions and projections indicate that our population will continue to increase. Additional demand for food seems likely to result, while at the same time, more space will be required for non-agricultural uses. This poses the question of whether our decreasing land area will be able to supply our food needs and whether our standard of living can be maintained under these circumstances. The problem may be sufficiently important to cause us to consider the advisability of preserving our better agricultural lands for agricultural use.

Under present circumstances, with the current surpluses of some agricultural commodities caused in part by our rapid technological advances in food production, it does not seem to be an urgent problem. However, it is also recognized that no community benefits from irrational and haphazard development. It is just as important to discourage building on soils not suited to development because of high water tables or poor soil stability, as to consider dedicating some of our better soils to permanent agricultural use. Nor is the scattered checkerboard development necessarily undesirable, if community and social facilities can be provided,and the development occurs on land particularly well suited to it.

Many of our communities originally developed in areas of excellent agricultural lands because they provided the service centers needed for agricultural enterprises. As industry gained in importance, the urban centers grew and today, where industry is expanding, they are growing rapidly indeed. A shift in emphasis from two or multiple dwelling units to single story single family ranch style units with garages and large lawns require considerably more land than the expansion which occurred in the 1920's.

It may often prove inadvisable or impractical to use small parcels of non-agricultural land for development. At the same time, however, it might be reasonable to consider the need for preserving large tracts of good agricultural land if only to provide areas of open space to supplement parks or to provide fresh produce near the markets.

Research in the area within a ten mile radius of the capital building at Lansing has shown that the dominant agricultural use of the area is being altered by the encroachment of urban uses. It is recognized that space for homes must be available but it may be questioned whether our best agricultural soils must be expended for this use when other soils less well suited for farming might be utilized for these purposes.

The data in this study have shown that urban uses actually seem to seek out Class I land for development. The preference of urban developers for the well-drained sandy soils of Class IV has also been shown as well as the disinclination to use the Class VI organic soils which are developed with considerable difficulty. This pattern does not change appreciably when individual sections of land under intense urban influence are considered.

Concomitant to urban development is the increase in acreage of idle land as is clearly apparent if one examines the Land Use Map of the area. The percentage of Class I land idle occurring in the study area is 52.8 per cent. Of the idle land, 29.8 per cent is in Class I land. Class VI lands on the contrary make up only 11.7 per cent of the study area but of the idle land, 24.3 per cent is in land Class VI. However, if one considers only the individual sections of land under more intense urban influence, a greater percentage of the better class lands are idle than are in those land classes for the entire study area.

This indicates that owners in urbanized sections are more willing to permit good agricultural land to remain idle than the owners in the more rural areas who depend upon their land resources for income. The reverse situation is probably responsible for the fact that a greater percentage of Class VI land is idle in the more rural sections than in the more urbanized areas.

Although less than ten per cent of the study area is in woodland almost one-half of it is on Class I or Class II land indicating that some of the woodlot acreage could be placed in agricultural production if land were to be used in its highest capacity. More than 25 per cent of the woodland occurs in lowland or swampy areas which probably constitutes their best use.

Almost 20 per cent of the area in agricultural use is Class III and IV land and while it may not be possible or perhaps even desirable to remove from agricultural production the small areas of this land some of the larger acreages might be better adapted to urban, woodland or recreational uses than for agriculture.

While many soil surveys have been made in the United States and some have been made to assist in giving direction to urban development, the author knows of no publication similar to the work that has been done in Germany. Special soil maps showing suitability of land for development as well as agriculture are supplemented by specific percolation, permeability, stability and other soil data. It would seem that with our rapid urbanization and continued development that this might become one of the functions of the soil survey. The methods and system of the soil scientists of Germany might well be adapted for use in this country in future soil surveys or at least in interpreting our present soil survey information for urban development.

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LITERATURE CITED

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APPENDIX

ABBREVIATIONS FOR THE SOIL TYPES

Class I

Bc--Brookston clay loam

Br--Brookston loam

Cl--Conover loam

Co--Conover silt loam

Hl--Hillsdale loam

Ml--Miami loam

Ms--Miami silt loam

Class II

Bm--Bronson loam

Bo--Brady loam

Fl--Fox loam

Gd--Gilford loam

Hs--Hillsdale sandy loam

Mm--Maumee loam

Pl--Parma loam

Class III

Bf--Berrien fine sandy loam

Bs--Bellefontaine sandy loam

By--Brady sandy loam

F --Fox sandy loam

Gc--Griffin clay loam

Gl--Griffin loam

Gs--Gilford sandy loam

Class IV

B --Berrien loamy fine sand

Bl--Bellefontaine loamy sand

Bw--Brookston-Washtenaw complex

Cf--Coloma loamy fine sand

Cs--Coloma loamy sand

Gf--Genesee fine sandy loam

Gr--Granby loamy sand

Gy--Griffin sandy loam

Ol--Oshtemo loamy sand

Os--Ottawa loamy fine sand

Wa--Wallkill loam

Wl--Washtenaw loam

Class V

Gp--Greenwood peat

Km--Kerston muck

Ps--Plainfield sand

Class VI

Cm--Carlisle muck

Hm--Houghton muck

Rp--Rifle peat

TABLE XXVI

CLASS I SOIL TYPES
IN AGRICULTURAL USE BY TOWNSHIPS

Township	Acreage							
	Bc	Br	Cl	Co	Hl	Ml	Ms	Total
Alaiedon	--	909	3,830	--	--	2,323	--	6,604
Bath	--	101	240	--	--	3,056	--	3,397
Delhi	--	479	3,382	--	--	2,743	--	6,604
Delta	--	464	4,349	--	811	5,860	--	11,484
Dewitt	29	376	1,360	23	51	6,964	30	8,833
Eagle	--	49	211	--	--	593	--	853
Lansing	--	351	1,325	--	--	517	--	2,193
Meridian	--	475	1,868	--	--	1,007	--	3,350
Olive	32	94	585	--	8	2,950	--	3,669
Oneida	--	95	1,317	--	118	1,422	--	2,952
Riley	16	20	299	--	--	418	108	861
Victor	--	--	8	--	--	13	--	21
Watertown	42	680	2,492	35	17	6,912	1,383	11,561
Windsor	25	150	2,819	--	113	7,043	--	10,150
Total	144	4,243	24,085	58	1,118	41,821	1,521	72,992

TABLE XXVII

CLASS I SOIL TYPES IN WOODLAND BY TOWNSHIPS

Township	Acreage							
	Bo	Br	Cl	Co	Hl	Ml	Ms	Total
Alaiedon	--	152	483	--	--	165	--	800
Bath	--	5	26	--	--	146	--	177
Delhi	--	30	375	--	--	213	--	618
Delta	--	114	442	--	138	322	--	1,016
Dewitt	5	46	180	--	5	508	8	752
Eagle	--	44	14	--	--	12	--	70
Lansing	--	74	79	--	--	51	--	204
Meridian	--	89	189	--	--	27	--	303
Olive	10	21	32	--	--	252	--	315
Oneida	--	20	129	--	32	100	--	281
Riley	17	7	17	--	--	43	--	84
Victor	--	--	--	--	--	--	--	--
Watertown	39	113	193	7	--	441	65	858
Windsor	10	123	288	--	12	344	--	777
Total	81	838	2,445	7	187	2,624	73	6,255

TABLE XXVIII

CLASS I SOIL TYPES IN IDLE LAND BY TOWNSHIPS

Township	Acreage							
	Bc	Br	Cl	Co	Hl	Ml	Ms	Total
Alaiedon	--	122	380	--	--	188	--	690
Bath	--	--	51	--	--	379	10	440
Delhi	--	151	754	--	--	409	--	1,314
Delta	--	25	281	--	204	453	--	963
Dewitt	--	56	95	--	7	358	--	516
Eagle	--	56	8	--	--	4	--	68
Lansing	--	297	622	--	--	496	--	1,415
Meridian	--	232	517	--	--	204	--	953
Olive	--	2	10	--	--	124	--	136
Oneida	--	23	55	--	31	49	--	158
Riley	--	--	11	--	--	22	--	33
Victor	--	--	--	--	--	--	--	--
Watertown	--	46	53	--	--	93	16	208
Windsor	--	3	102	--	2	233	--	340
Total	--	1,013	2,939	--	244	3,012	26	7,234

TABLE XXIX

CLASS I SOIL TYPES IN URBAN USE BY TOWNSHIPS

Township	Acreage							
	Bc	Br	Cl	Co	Hl	Ml	Ms	Total
Alaiedon	--	2	65	--	--	143	--	210
Bath	--	--	23	--	--	310	--	333
Delhi	--	99	789	--	--	684	--	1,572
Delta	--	21	594	--	205	924	--	1,744
Dewitt	2	21	497	2	22	984	--	1,528
Eagle	--	--	12	--	--	20	--	32
Lansing	--	663	3,976	--	--	4,579	--	9,218
Meridian	--	172	752	--	--	772	--	1,696
Olive	--	2	10	--	--	124	--	136
Oneida	--	25	205	--	19	288	--	537
Riley	--	--	10	--	--	6	10	26
Victor	--	--	--	--	--	2	--	2
Watertown	--	6	96	--	--	461	66	629
Windsor	--	2	106	--	4	469	--	581
Total	2	1,013	7,135	2	250	9,766	76	18,244

TABLE XXX

CLASS II SOIL TYPES IN AGRICULTURAL LAND BY TOWNSHIPS

Township	Acreage							
	Bm	Bo	Fl	Gd	Hs	Mm	Pl	Total
Alaiedon	--	--	75	--	1,018	7	--	1,100
Bath	33	170	98	37	569	30	--	937
Delhi	--	--	5	--	2,198	165	--	2,368
Delta	434	494	64	265	567	10	--	1,834
Dewitt	249	416	59	35	726	43	--	1,528
Eagle	33	63	--	--	--	--	--	96
Lansing	--	--	--	--	902	25	--	927
Meridian	--	--	26	--	3,535	173	--	3,734
Olive	101	45	--	--	217	--	--	363
Oneida	74	366	--	97	113	47	35	732
Riley	39	67	--	20	--	--	--	126
Victor	26	13	--	--	3	--	--	42
Watertown	798	507	85	173	422	31	--	2,016
Windsor	374	234	111	670	530	83	--	2,002
Total	2,161	2,375	523	1,297	10,800	614	35	17,805

TABLE XXXI

CLASS II SOIL TYPES IN WOODLAND BY TOWNSHIPS

Township	Acreage							
	Bm	Bo	Fl	Gd	Hs	Mm	Pl	Total
Alaiedon	--	--	--	--	189	--	--	189
Bath	36	54	5	5	103	--	13	216
Delhi	--	--	13	--	215	128	--	356
Delta	46	93	--	193	88	--	--	420
Dewitt	46	98	14	--	33	10	--	201
Eagle	--	--	--	--	--	--	--	--
Lansing	--	--	--	--	97	--	--	97
Meridian	--	--	10	--	433	38	--	481
Olive	5	26	--	--	20	--	--	51
Oneida	--	32	--	42	3	20	--	97
Riley	9	14	--	11	--	--	--	34
Victor	5	11	--	16	--	--	--	32
Watertown	47	158	22	65	53	8	--	353
Windsor	44	3	14	92	58	--	--	211
Total	238	489	78	424	1,292	204	13	2,738

TABLE XXXII

CLASS II SOIL TYPES IN IDLE LAND BY TOWNSHIPS

Township	Acreage							
	Bm	Bo	Fl	Gd	Hs	Mm	Pl	Total
Alaiedon	--	--	5	--	159	--	--	164
Bath	5	80	17	--	281	--	--	383
Delhi	--	--	7	--	433	296	--	736
Delta	32	28	10	68	219	--	--	357
Dewitt	15	57	2	--	31	--	--	105
Eagle	--	--	--	--	--	--	--	--
Lansing	--	--	20	--	795	4	--	819
Meridian	--	--	7	--	979	47	--	1,033
Olive	4	--	--	--	6	--	--	10
Oneida	--	58	--	25	--	4	--	87
Riley	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	--	--	--
Watertown	75	57	15	30	33	--	--	210
Windsor	--	--	--	156	31	10	--	197
Total	131	280	83	279	2,967	361	--	4,101

TABLE XXXIII

CLASS II SOIL TYPES IN URBAN LAND BY TOWNSHIPS

Township	Acreage							
	Bm	Bo	Fl	Gd	Hs	Mm	Pl	Total
Alaiedon	--	--	2	--	64	--	--	66
Bath	2	13	6	--	104	--	--	125
Delhi	--	--	--	--	560	27	--	587
Delta	10	24	6	12	74	--	--	126
Dewitt	18	28	43	--	95	--	--	184
Eagle	--	--	--	--	--	--	--	--
Lansing	--	--	7	--	1,890	--	--	1,897
Meridian	--	--	--	--	978	35	--	1,013
Olive	4	--	--	--	6	--	--	10
Oneida	127	17	105	--	16	--	50	315
Riley	2	--	--	--	--	--	--	2
Victor	--	--	--	--	--	--	--	--
Watertown	22	6	2	--	20	--	--	50
Windsor	14	14	54	15	67	8	--	172
Total	199	102	225	27	3,874	70	50	4,547

TABLE XXXIV

CLASS III SOIL TYPES IN AGRICULTURAL LAND BY TOWNSHIPS

Township	Acreage							Total
	Bf	Bs	By	F	Gc	Gl	Gs	
Alaiedon	--	93	377	69	--	122	--	661
Bath	--	834	--	742	--	--	--	1,576
Delhi	--	171	894	566	--	94	57	1,782
Delta	101	315	--	180	--	65	--	661
Dewitt	--	1,086	--	1,082	--	12	--	2,180
Eagle	--	--	--	--	--	--	--	--
Lansing	--	204	19	20	--	14	56	313
Meridian	--	434	341	246	--	44	113	1,178
Olive	--	147	--	36	--	--	--	183
Oneida	22	35	--	52	--	20	--	129
Riley	--	9	--	15	--	--	--	24
Victor	--	--	--	53	--	--	--	53
Watertown	--	856	19	113	--	--	--	988
Windsor	192	145	--	219	--	42	--	598
Total	315	4,329	1,650	3,393	--	413	226	10,326

TABLE XXXV

CLASS III SOIL TYPES IN WOODLAND BY TOWNSHIPS

Township	Acreage							
	Bf	Bs	By	F	Gc	Gl	Gs	Total
Alaiedon	--	--	60	--	--	287	--	347
Bath	--	97	--	73	2	2	--	174
Delhi	--	2	217	54	--	286	2	561
Delta	3	22	--	7	--	77	--	109
Dewitt	--	55	5	29	--	--	--	89
Eagle	--	--	--	--	--	--	--	--
Lansing	--	6	15	3	--	152	--	176
Meridian	--	22	106	58	--	28	23	237
Olive	--	38	--	8	--	--	--	46
Oneida	--	24	--	20	--	44	--	88
Riley	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	--	--	--
Watertown	--	103	--	34	4	11	--	152
Windsor	12	43	--	54	--	58	--	167
Total	15	412	403	340	6	945	25	2,146

TABLE XXXVI

CLASS III SOIL TYPES IN IDLE LAND BY TOWNSHIPS

Township	Acreage							
	Bf	Bs	By	F	Gc	Gl	Gs	Total
Alaiedon	--	12	85	16	--	84	--	197
Bath	--	237	--	60	12	--	--	309
Delhi	--	91	555	156	--	149	62	1,013
Delta	5	14	--	33	--	115	--	167
Dewitt	--	156	2	--	--	--	--	158
Eagle	--	--	--	--	--	--	--	--
Lansing	--	63	74	77	--	202	19	435
Meridian	--	137	119	143	--	63	64	526
Olive	--	15	--	--	--	--	--	15
Oneida	--	33	--	15	--	--	--	48
Riley	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	--	--	--
Watertown	--	68	--	16	--	2	--	86
Windsor	78	10	--	35	--	111	--	234
Total	83	836	835	551	12	726	145	3,188

TABLE XXXVII

CLASS III SOIL TYPES IN URBAN LAND BY TOWNSHIPS

Township	Acreage							
	Bf	Bs	By	F	Gc	Gl	Gs	Total
Alaiedon	--	7	7	8	--	3	--	25
Bath	--	35	--	105	--	--	--	140
Delhi	--	58	329	253	--	8	18	666
Delta	15	40	--	12	--	39	--	106
Dewitt	--	244	6	174	--	--	--	424
Eagle	--	--	--	--	--	--	--	--
Lansing	--	186	109	300	--	115	83	793
Meridian	--	47	106	26	--	9	8	196
Olive	--	15	--	--	--	--	--	15
Oneida	9	4	--	58	--	--	--	71
Riley	--	--	--	--	--	--	--	--
Victor	--	--	--	4	--	--	--	4
Watertown	--	47	2	2	--	--	--	51
Windsor	25	49	--	15	--	13	--	102
Total	49	732	559	957	--	187	109	2,593

TABLE XXXVIII

CLASS IV SOIL TYPES IN AGRICULTURAL USE BY TOWNSHIPS

Township	Acreage												
	B	Bl	Bw	Cf	Cs	Gf	Gr	Gy	Ol	Os	Wa	Wl	Total
Alaiedon	12	15	--	--	64	--	--	--	120	--	131	49	391
Bath	66	122	1,037	--	81	--	9	4	667	211	78	68	2,343
Delhi	113	60	--	--	24	22	--	--	107	47	246	154	773
Delta	--	10	--	134	--	257	--	--	--	178	--	--	579
Dewitt	59	232	1,018	--	34	36	24	43	425	126	167	402	2,566
Eagle	--	--	5	--	--	--	--	--	--	--	9	67	81
Lansing	22	130	--	--	104	6	--	--	10	--	130	63	465
Meridian	92	126	--	--	682	43	--	--	168	--	158	64	1,333
Olive	18	--	201	--	--	--	20	--	3	--	91	267	600
Oneida	--	--	--	--	--	--	10	--	--	17	--	--	27
Riley	16	21	30	--	--	--	--	15	--	--	4	6	92
Victor	--	--	3	--	--	--	--	--	203	--	6	-	212
Watertown	8	48	988	--	40	--	--	28	130	10	174	450	1,876
Windsor	25	175	--	318	--	109	--	--	35	--	--	--	662
Total	431	939	3,282	452	1,029	473	63	90	1,868	589	1,194	1,590	12,000

TABLE XXXIX

CLASS IV SOIL TYPES IN WOODLAND USE BY TOWNSHIPS

Township	Acreage												
	B	Bl	Bw	Cf	Cs	Gf	Gr	Gy	Ol	Os	Wa	Wl	Total
Alaiedon	--	--	--	--	15	--	--	--	10	--	31	--	56
Bath	7	40	116	--	2	--	22	--	70	35	10	5	307
Delhi	--	83	--	--	2	50	--	--	3	--	80	35	253
Delta	--	--	--	35	--	244	--	--	--	7	--	--	286
Dewitt	13	12	78	--	3	10	--	25	30	2	23	12	208
Eagle	9	--	2	--	--	--	--	--	--	--	--	--	11
Lansing	--	29	--	--	4	130	--	--	35	--	13	9	220
Meridian	100	44	--	--	157	158	--	--	30	--	23	20	532
Olive	--	--	17	--	--	--	--	--	--	--	16	14	47
Oneida	--	--	--	--	2	15	--	--	--	--	--	--	17
Riley	--	--	4	--	--	--	--	--	--	--	2	--	6
Victor	--	--	--	--	--	--	--	--	9	--	2	--	11
Watertown	--	--	118	--	8	--	--	25	6	--	35	40	232
Windsor	2	5	--	17	--	32	--	--	--	--	--	--	56
Total	131	213	335	52	193	639	22	50	193	44	235	135	2,242

TABLE XL

CLASS IV SOIL TYPES IN IDLE LAND BY TOWNSHIPS

Township	Acreage												Total
	B	Bl	Bw	Cf	Cs	Gf	Gr	Gy	Ol	Os	Wa	Wl	
Alaiedon	--	12	--	--	--	--	--	--	55	--	26	12	105
Bath	21	80	142	--	31	9	3	--	178	24	45	15	548
Delhi	43	209	--	--	--	20	--	--	63	8	140	45	528
Delta	--	--	--	5	--	148	--	--	--	9	--	--	162
Dewitt	10	40	82	--	--	--	82	22	61	--	5	37	339
Eagle	--	--	--	--	--	--	--	--	6	--	5	--	11
Lansing	15	48	--	--	48	78	--	--	139	2	86	62	478
Meridian	42	241	--	--	225	177	--	--	114	--	106	46	951
Olive	--	--	6	--	--	--	--	--	4	--	--	18	28
Oneida	--	--	--	--	--	--	34	--	--	--	--	--	34
Riley	--	--	--	--	--	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	--	--	--	--	--	--	--	--
Watertown	--	15	46	--	--	7	20	25	--	--	25	22	160
Windsor	15	16	--	56	--	23	--	--	5	--	--	--	115
Total	146	661	276	61	304	462	139	47	625	43	438	257	3,459

TABLE XLI

CLASS IV SOIL TYPES IN URBAN USE BY TOWNSHIPS

Township	Acreage												
	B	Bl	Bw	Cf	Cs	Gf	Gr	Gy	Ol	Os	Wa	Wl	Total
Alaiedon	2	--	--	--	3	--	--	--	16	--	3	--	24
Bath	--	30	59	--	24	--	4	--	80	60	2	--	259
Delhi	61	90	--	--	4	--	--	--	74	18	48	16	311
Delta	--	--	--	--	--	12	--	--	--	11	--	--	23
Dewitt	--	22	47	--	--	2	32	5	20	16	24	43	211
Eagle	--	--	--	--	--	--	--	--	--	--	--	--	--
Lansing	25	135	--	--	81	517	--	--	452	26	156	205	1,597
Meridian	192	46	--	--	399	126	--	--	283	--	60	26	1,132
Olive	--	--	6	--	--	--	--	--	4	--	--	18	28
Oneida	--	--	--	--	--	7	17	--	--	--	--	--	24
Riley	--	--	--	--	--	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	--	--	--	4	--	--	--	4
Watertown	--	--	14	--	2	3	--	--	20	--	--	8	47
Windsor	9	37	--	59	--	11	--	--	2	--	--	--	118
Total	289	360	126	59	513	678	53	5	955	131	293	316	3,778

TABLE XLII

CLASSES V AND VI SOIL TYPES IN AGRICULTURAL LAND BY TOWNSHIPS

Township	Class V				Class VI			
	Gp	Km	Ps	Total	Cm	Hm	Rp	Total
Alaiedon	--	27	--	27	185	--	43	228
Bath	--	4	53	57	377	125	1,885	2,387
Delhi	--	49	--	49	856	3	77	936
Delta	--	75	--	75	771	--	543	1,314
Dewitt	--	38	38	76	205	107	1,793	2,105
Eagle	--	--	--	--	6	--	--	6
Lansing	5	--	--	5	268	--	241	509
Meridian	--	15	56	71	911	--	608	1,519
Olive	--	--	--	--	47	--	94	141
Oneida	--	18	--	18	303	--	8	311
Riley	--	--	--	--	--	--	--	--
Victor	--	66	28	94	--	17	7	24
Watertown	--	52	--	52	60	75	316	451
Windsor	--	--	--	--	996	--	27	1,023
Total	5	344	175	524	4,985	327	5,642	10,954

TABLE XLIII

CLASSES V AND VI SOIL TYPES IN WOODLAND BY TOWNSHIPS

Township	Class V				Class VI			
	Gp	Km	Ps	Total	Cm	Hm	Rp	Total
Alaiedon	--	55	--	55	168	--	42	210
Bath	--	16	14	30	203	292	1,394	1,889
Delhi	--	17	--	17	464	8	94	566
Delta	--	124	--	124	196	--	147	343
Dewitt	--	30	12	42	71	25	399	495
Eagle	--	--	--	--	3	--	--	3
Lansing	93	--	--	93	25	--	52	77
Meridian	--	11	5	16	369	--	869	1,238
Olive	--	9	--	9	45	--	25	70
Oneida	--	12	--	12	72	--	17	89
Riley	--	--	--	--	--	--	--	--
Victor	--	--	--	--	--	3	58	61
Watertown	--	21	--	21	81	21	123	225
Windsor	--	--	--	--	90	--	20	110
Total	93	295	31	419	1,787	349	3,240	5,376

TABLE XLIV

CLASSES V AND VI SOIL TYPES IN IDLE LAND BY TOWNSHIPS

Township	Class V				Class VI			
	Gp	Km	Ps	Total	Cm	Hm	Rp	Total
Alaiedon	--	27	--	27	244	--	82	326
Bath	--	28	122	150	123	161	889	1,173
Delhi	--	24	--	24	1,086	--	149	1,235
Delta	--	66	--	66	98	--	55	153
Dewitt	--	6	16	22	41	35	677	753
Eagle	--	--	--	--	45	--	--	45
Lansing	3	32	--	35	209	5	318	532
Meridian	--	79	--	79	583	57	572	1,212
Olive	--	--	--	--	--	--	2	2
Oneida	--	10	--	10	39	--	9	48
Riley	--	--	--	--	10	--	--	10
Victor	--	--	--	--	--	--	--	--
Watertown	--	11	--	11	69	10	138	217
Windsor	--	--	--	--	156	--	45	201
Total	3	283	138	424	2,703	268	2,936	5,907

TABLE XLV

CLASSES V AND VI SOIL TYPES IN URBAN LAND BY TOWNSHIPS

Township	Class V				Class VI			
	Gp	Km	Ps	Total	Cm	Hm	Rp	Total
Alaiedon	--	--	--	--	--	--	--	--
Bath	--	--	4	4	5	14	29	48
Delhi	--	2	--	2	131	--	--	131
Delta	--	38	--	38	51	--	12	63
Dewitt	--	--	18	18	27	24	128	179
Eagle	--	--	--	--	--	--	--	--
Lansing	--	7	38	45	65	--	123	188
Meridian	15	--	10	25	76	--	106	182
Olive	--	--	--	--	--	--	2	2
Oneida	--	--	--	--	--	--	24	24
Riley	--	--	--	--	--	--	--	--
Victor	--	--	4	4	--	--	--	--
Watertown	--	--	--	--	4	--	2	6
Windsor	--	--	--	--	22	--	--	22
Total	15	47	74	136	381	38	426	845