CHANGING RURAL LAND USES
IN THE
TORONTO CENTRED REGION COMMUTERSHED
1955 - 1977

By

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ABSTRACT

Rural land uses in the western Toronto Centred Region were studied in order to determine whether trends were in accordance with the stated public policy for the area. Three types of land use were studied, agricultural, recreational and non-farm rural residential. Within the study period, agriculture in the commutershed townships experienced changes in structure as well as decreases in scale. Many acres of the western Toronto Centred Region were under recreational uses, but a large number had access restrictions or financial deterrents to use by the general public. Lot fragmentation and rural residence construction trends indicated a significant increase in the number of land owners and residences, especially in those areas adjacent to metropolitan Toronto. Past land uses were found not to be in accordance with desired land-use patterns and a re-evaluation of policy or a greater intervention in land-use controls is urged.

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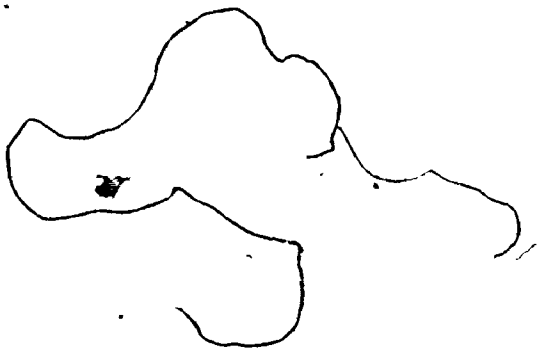

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CHAPTER I

INTRODUCTION

Land-use patterns in the rural areas surrounding large Canadian cities have been changing rapidly in the last decade. Nowhere has this been more evident than in the Toronto area of southern Ontario, where the rapidly growing metropolis and its satellite centres have been spreading onto some of the best agricultural land in Canada.

The ineffficient use of land has been a major problem of unguided urban growth. The premature removal of agricultural land from production for speculative or urban uses, and the private ownership of land ideal for recreational use by the general public have been topics of special concern. The idea that the land surrounding large urban centres should be used in such a way that society as a whole, rather than individuals, benefits, has been a common theme in rural-urban studies and it will be discussed in detail in the review of literature.

The government of Ontario in 1970 published a report entitled Design for Development: The Toronto Centred Region which acknowledged the existence of these land-use problems and outlined a general scheme to guide

urban growth in the 37,760 square kilometres surrounding metropolitan Toronto (Figure 1). The development policy for the rural commutershed, Zone 2, stated that this zone should be retained as much as possible for agriculture, for recreation and open space uses.[1] Therefore, the government has decided that interference in the land market is necessary in order to protect these three types of land use in the urbanizing area surrounding Toronto.

The main hypothesis of this research is that past and present trends in land use and land ownership in this area of the Toronto Centred Region are not in line with the above-stated public policy. Three sub-hypotheses will be examined which correspond to the desired agricultural, recreational and open space policies of the provincial government. These are:

1) Agricultural activity has declined in Zone 2.

2) Provision of recreational space in Zone 2 for use by the general public has been minimal.

3) Lot fragmentation and rural residence construction have been interfering with the preservation of open space in some parts of Zone 2.

The study period begins in 1955 and extends to 1977. The year 1955 was selected as the starting date

[1] Design for Development: The Toronto Centred Region, (Toronto: Ministry of Treasury, Economics and Intergovernmental Affairs, 1970), p.20.

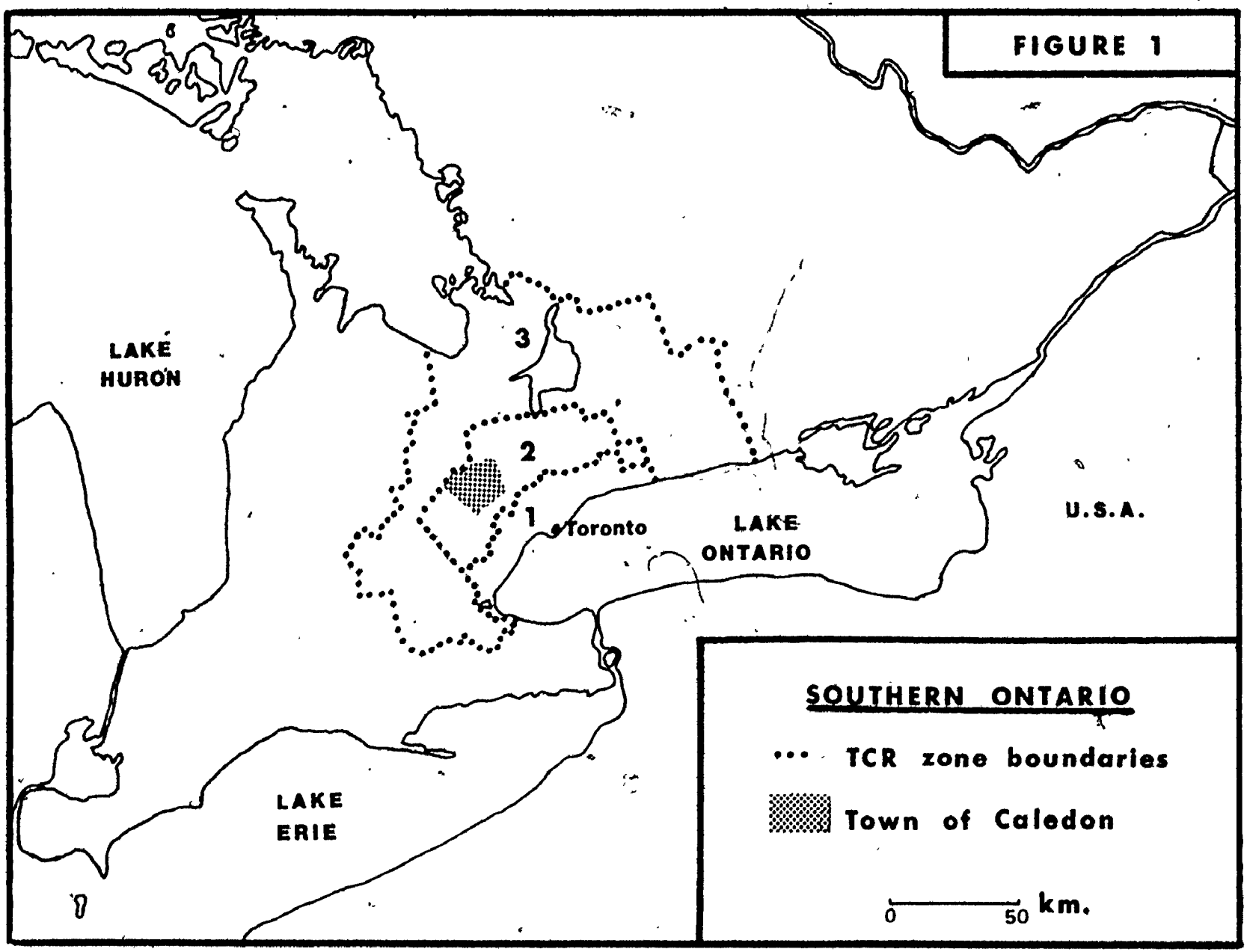


FIGURE 1
LAKE HURON
3
2
1
Toronto
LAKE ONTARIO
U.S.A.
LAKE ERIE
SOUTHERN ONTARIO
TCR zone boundaries
Town of Caledon
0
50
km.

because of the availability of air photo coverage. Empirical data used to test these hypotheses were obtained for the Town of Caledon, the Regional Municipality of Peel and several other Toronto Centred Region townships.[2]

Several minor hypotheses were developed in order to prove or disprove each of the three sub-hypotheses. To determine whether agricultural activity was declining, five minor hypotheses were formulated.

1) Decline in agricultural activity varies spatially among Zone 2 townships.

2) Farmland loss is positively related to urban population growth, rural population growth and non-farm rural residential growth and is negatively related to agricultural land capability.

3) Variables measuring changes in the number of farms, farm population and agricultural land uses can be related to variations in the amount of farmland loss.

4) The ratio of the number of farms to the area of farmland differentiates townships according to the size of their farm units.

5) Areas of Zone 2 which have experienced large losses of farmland would tend to have a high proportion of remaining farmland in non-intensive agricultural uses e.g. pastureland.

[2]The term township is used to refer to all county and regional municipality sub-divisions although some, as a result of regional municipality formation, are actually regional towns or cities.

Five further minor hypotheses were formulated to examine the trends in the provision of recreational space:

1) The ratio of recreational land to total land area varies by township. The total area of recreational land also varies greatly by township.

2) Areas of surplus or deficit recreational space can be identified by the ratio between the local population and the available acreages.

3) The total area of recreational land is insufficient for the population of the growing metropolitan Toronto area.

4) Many recreational sites have access restrictions or financial deterrents which limit their potential use by the general public.

5) Recreational land uses do not exhibit a preference for areas with high recreational capabilities.

The changes in the open space character of Zone 2 were analysed with the use of the following minor hypotheses covering three areas of interest; 1) lot fragmentation, 2) rural non-farm residence construction and 3) growth in the rural non-farm population:

1) The number of individually-owned land parcels has increased significantly by the fragmentation of 100-acre lots:

2) Greater lot fragmentation activity has occurred since 1965.

3) The tendency for a lot to remain stable with regard to the number of parcels it contains decreases through time. Lots with the greatest number of parcels will be the least stable.

4) Lot fragmentation activity varies spatially, with townships nearest to Toronto having the higher rates.

5) Physical, locational and land-use characteristics of a 100-acre lot are related to the number of individually-owned parcels contained in that lot.

6) Spatial variations in the size of parcels exist, with a greater number of small parcels being found near Toronto.

7) The number of residences per 100-acre lot has increased throughout the study period.

8) Spatial variations in residence construction exist, with more homes being built near Toronto.

9) Residence construction has not occurred at the same rate as lot fragmentation but has been accelerating since 1965.

10) The dispersed rural non-farm population has greatly increased in numbers and as a percentage of the total population.

The loss of open space is very important in influencing future land uses as it also affects agricultural activity and the provision of recreational space. The fragmentation of land holdings, in order to create small residential parcels, affects agriculture in two ways. There is an actual loss of farmland to other uses but, more importantly, a loss in efficiency by making farming on the remaining land more difficult. For example, poorly placed severances may interfere with farming operations and also make it more difficult for a farmer to expand his operations by purchasing neighbouring land. Agricultural activity may

also suffer from the juxtaposition of non-compatible land uses such as livestock operations and non-farm residences. The Ontario Agricultural Code of Practice[3] is an attempt to minimize these conflicts.

The fragmentation of land holdings, especially in the more scenic, low agricultural capability areas, makes it more difficult and more expensive for government agencies to purchase land for recreational uses.

The examination of these minor hypotheses will determine whether or not the three sub-hypotheses as well as the main research hypothesis will be accepted or rejected. If the research hypothesis is accepted and land-use trends are found not to be in line with desired policies for the area, planned public policy intervention may be justified.

The thesis is divided into nine chapters. The two chapters following the Introduction provide background information on the research topic and the study area. Chapter II summarizes the relevant literature. The topics covered are 1) land uses around large urban centres, 2) rural land-use planning, 3) declining agricultural activity in urbanizing areas 4) provision of recreational space near large urban centres and 5) the loss of open space in rural areas due to lot fragmentation and rural residence construction.

[3] Agricultural Code of Practice, (Toronto: Ministries of Agriculture and Food, Environment and Housing, 1976).

Chapter III explains why the Town of Caledon was selected as a study area and briefly describes the physical characteristics of the area which affect land uses. The settlement history is summarized and a brief discussion of recent land-use, and recreational land-use planning affecting the Town is included. Chapter IV describes the types of data and methods of collection used in the research. Chapters V, VI, VII and VIII investigate the three sub-hypotheses dealing with agriculture, recreational land uses and the decline in open space. Chapter IX summarizes the major findings and discusses whether the research hypothesis and its sub-hypotheses should be accepted or rejected. The trends in land use are discussed in terms of present land-use planning goals and the provision of future recreational space.

CHAPTER II

REVIEW OF LITERATURE

The review of literature summarizes research reports and government publications related to the research problem. The first two sections provide background material on two topics, land uses around large urban centres and rural land-use planning. The philosophy of land use and methods used to acquire desired patterns of land use are discussed. The last three sections deal specifically with agricultural activity, the provision of recreational space and the decline in open space. The literature reviewed in these sections gave direction to the formulation of the hypotheses.

i. Land Use in Areas Surrounding Large Urban Centres

The concentration of an ever increasing proportion of the population on small areas of land in cities has caused a change in the perception of rural areas surrounding these urban centres. When most of the population lived in rural areas, or in dispersed small settlements, the rural environment was part of day-to-day life but, today, access to the countryside is a critical problem for those desiring to participate in rejuvenating recreational pursuits (Kando (63))[1] or to view a relatively natural environment.

[1]The numbers in brackets refer to the bibliographic entry of that number.

Land adjacent to urban areas is viewed as a scarce, and therefore valuable commodity, but one that owes its inflated value to the existence of the neighbouring city and its large population. Research in rural areas by Biggs (8), Jameson (61) and Punter (107) has indicated that access to nearby countryside is most often restricted to those who can afford to purchase this expensive rural property. Little attention has been given to the needs of the majority of the population or the costs and benefits to society as a whole. However, as Platt (102) pointed out, the decision to provide public open space rests on the perception of need by those having legal authority over the land. Benefits derived from non-development or public ownership must exceed the costs of preventing conversion to other, more profitable, uses. Costs are usually borne locally by the loss of tax revenue if the land is withdrawn from urban or urban-related development but the benefits to users extend over a larger area. A "buck-passing" situation then develops, as municipalities wholeheartedly approve of open space as long as it is situated in their neighbours' jurisdiction.

As van Vuuren (133) pointed out, for society as a whole, an economic optimum land use does not equal a true optimum. In simple terms of numbers served, public recreational space benefits a larger group than that provided by private ownership and development.

The theory and practice of public access to the countryside often differ. The Preliminary Proposals of the Niagara Escarpment Commission (81) have, as one of their major objectives, the need to provide public access to land for recreation. Development control land-use planning is the tool which hopefully will fulfil this goal. However, actual land-use planning, with restrictions on small lot residential development, is often used as a rationalization of present land uses rather than as an instrument to arrange land uses in a more socially-desirable form (Biggs (8), Punter (107)). In addition, those already owning rural land near urban areas are often not overly eager to share this resource for several reasons - some well-justified (Hamilton Spectator (106)). Rural areas are voicing their objections to becoming the back-yard playgrounds for urban populations (Regional Municipality of Peel (109)). Land holders also will often oppose government plans to forbid land development in areas where the protection of a unique natural environment for society as a whole interferes with their perceived rights as property owners (Windsor Star (100)).

In summary, conflicts over the proper use of valuable rural land near large urban centres exist between those who have and those who have not.

ii. Rural Land-Use Planning

Reports published by government ministries concerned with rural land-use planning provide an optimistic view of attaining desired land-use patterns through controls (Design for Development: The Toronto Centred Region (137), Green Paper on Planning for Agriculture (53)), but analyses of planning policies are not as favourable, especially when the land market is seen to be at variance with the objectives of public planning (Martin (71)). Punter (107) claimed that the Toronto Centred Region Zone 2 concept is trying to protect what does not exist, and what land-use controls will actually be protecting, is an elite group of property owners who can afford high land prices. Controls will also tend to increase the investment value of their land holdings. O'Riordan (83) echoed this sentiment.

One consensus has been reached by the many who are discussing, or, who are active in rural land-use planning (Biggs (8), COLUC (28), McLaren (74), Special Committee on Farm Income (123)); that planning for rural areas must be approached from a rural viewpoint to benefit rural dwellers. Rural land uses, such as agriculture, must no longer be viewed simply as a "holding" use until the land is needed for urban development. Biggs specifically criticized the common municipal view of land simply as a tax-generating commodity which leads to what he termed "dollar-planning." Such an outlook was apparent in the 1970 Caledon Official

Plan which zoned large areas as suitable for estate residential development, which coincided with several large landholders' applications for sub-division (Punter (107)).

Wallace (136) viewed the need for rural land-use planning as the inevitable result of poor urban planning and deteriorating urban environments which would encourage people to look towards outlying areas for cheaper land, privacy and recreation. He saw the need for policy integration to ensure socially, rather than economically effective allocation processes for these valuable lands.

A major problem of rural land-use planning is the need to accommodate many different and sometimes conflicting uses. Pearson and Dhams (99) listed the numerous roles that a region, such as the Regional Municipality of York just north of Toronto, must supply. Among these are specialised food products, building materials, public and private recreation, disposal sites, drainage basin control not to mention a reserve for dispersed or concentrated urban development. Found and Morley (45) also recognized the complexity of the rural area and the problems caused by over-generalization in policy making.

Despite these multiple use possibilities, McLaren (74) stressed the need for a perspective approach to planning in which all land uses are evaluated with respect to their supportive, neutral or detrimental relationship to one preferred land use.

Two schools of thought exist concerning the best way to ensure controls over land use within a large area. One, supported by Biggs (8), by Rodd (111) and, partially, by the Conservation Council of Ontario (29) and by the Regional Municipality of Peel (32), urges stronger upper level government policy formation, especially implementation through legislation to ensure a more uniform achievement of desired land-use goals. Girt (49) also supported strong upper level government action, but at the regional rather than provincial level. The problem is, in Ontario at least, there is no effective level of government to fill the space between provincial and county levels.

The Government of Ontario expresses a contrary viewpoint to Biggs and the other sources cited above, presented in the Strategy for Ontario Foodland Report (125) and the Green Paper on Planning for Agriculture (53). The government places primary responsibility for land-use planning with the numerous local governments, subject to loosely-worded provincial guidelines. The government does not anticipate problems and in its Toronto Centred Region Program Statement (28) stated that development in the TCR since 1971 had been consistent with provincial policies.

It would appear that land-use planning in Ontario during the seventies has not progressed very far except for the fact that local municipalities must now conceal their tax-generating developments under an Official Plan.

iii. Agricultural Activity in Urbanizing Regions

Five topics related to agricultural land uses in urbanizing areas were examined. These were 1) farmland loss in urbanizing areas, 2) farmland loss related to population growth, 3) farmland loss related to land capability, 4) farm size trends in urbanizing areas and 5) the role of hobby farms in urbanizing areas.

Gierman (48), Nelson and Nicholson (80) and Noble (85) documented actual declines in farmland acreages in some parts of Ontario affected by urban growth pressures. However, Bryant (14) and Punter (107) would argue that decreases in agricultural activity are as much the result of changes within agriculture as urban influences, and, in some instances, pre-date intense development pressures.

The provincial Green Paper on Planning for Agriculture (53) attributed the decrease in agricultural activity in the rural-urban boundary zone to land speculation, land fragmentation, conflicting land uses, competition for land and uncertain agricultural prospects in areas where urban uses outnumber rural uses. Several authors discussed in detail the conflicts of land use which lead to decreased agricultural activity, for example Brown (13) and McLaren (74). Maas and Reeds (68) discussed the re-location of farmers in the Toronto Centred Region as a response to urban pressures. Rodd (110) stated that the cost/price squeeze, which is greatly affected by land values and taxes in the

rural-urban boundary, was forcing farmers to increase their productivity or to sell to non-farm users.

Although there was general agreement that the amount of agricultural land has decresed, some felt that this trend is reversible. McKay (73) claimed that a number of hobby farmers in the Town of Caledon are merely custodians of agricultural land which will be needed for production in the future. The Strategy for Ontario Foodland report (125) also claimed that urban fringe lands were not being permanently removed from agriculture but would be retrievable in the future when demand warranted increased acreages.

Studies by Chapman and Putnam (24), Crerar (33) and Pearson (93) related farmland losses directly to urban population growth. Girt (49) found that the least stable rural uses were associated with easy accessibility to urban areas. Van der Linde (132) was unable to obtain a significant correlation between farmland loss and the increase in the non-farm rural population but attributed his difficulties to his sampling methodology. Punter (107) attributed the largest proportion of idle farmland to residential uses which were forced, under severance controls, to be situated on 10-acre or 25-acre parcels.

The Ontario Population Trends report (88) using data from the 1976 census, reported a shift in population from central urban areas to outlying townships, especially in the Toronto area. Future research will perhaps be able

to relate these population shifts to even greater farmland losses.

Studies by Brookbank (11), Found and Morley (45), Greaves (52), Michie and Found (79) and Troughton (130) have discovered that rural residential construction, especially the large estate type, was common on poor agricultural land. However, accessibility to urban centres appeared to be a key factor in some areas and all of the above studies found evidence of this criterion pushing residential development onto better agricultural land immediately adjacent to urban boundaries. Greaves (52) and Rodd (111) in particular, found significant amounts of "suburban" residential development on good farmland. Girt (49) found greater instabilities of land use in areas with poorer agricultural soils.

The general trend in farm size in Canada is towards fewer, larger farms (Centre for Resources Development (23), Federal Task Force on Agriculture (44)). However, the former report found that the smallest increases in farm size were occurring in townships around Toronto, except where development or investment companies were consolidating their holdings and renting them to farmers until development occurred. Goldsmith and Copf (50) also found that farm size tended to increase as distance to a large urban centre increased.

Small farms were found to be closely associated with hobby farming practiced by many commuters in the rural-urban

boundary zone by McKay (73), Punter (107) and Troughton (130). "Equine agriculture" was a common type of hobby farm in both the Toronto and London areas of Ontario. These small farms also tended to have a small annual income from sales of agricultural products. Fuller and Mage (45) discussed the under-utilization of farmland and resources by these part-time operators whose major income sources were not agricultural.

In summary, both the scale and type of agricultural activity may be affected by the presence of a large urban centre in the area.

iv. Provision of Recreational Space

The literature discussing the provision of recreational space near urban areas is closely related to the general public versus private land-use controversy discussed in the first section of this chapter. The growing demand for outdoor recreational opportunities has beem well-documented by Brooks (12), Clawson (27), Laplante (66), Loomer (67) and Pearson (96). They attributed increased demand to growing populations, rising incomes, greater amounts of leisure time and greater mobility. Kando (63) was the only author to question the notion of greater leisure time. Hendee (55) specifically related increased interest in outdoor recreation to increased urbanization levels in North America.

Pearson (95) questioned the adequacy and distribution of present and future recreational space in Canada, especially in Ontario, as the nation moves towards an 80% urbanization level. The Conservation Council of Ontario (29), as early as 1960, discussed the lack of any sizable park on Lake Ontario between St. Catharines and Oshawa.

Clawson (27) discussed the problems of land acquisition for public use in the future as demand for recreational space increases, costs of land rise and competition for space intensifies. He advocated a ratio of 30 acres of parkland per 1,000 people. Like Clawson, Pearson (96) felt the need for land banking around urban areas to ensure future recreational land supplies and remarked that in Canada, only the National Capital Commission of Ottawa had embarked on such a programme. However, he felt that the 10 acres per 1,000 people ratio, a standard developed in 1923 and commonly used more than fifty years later by planners, was an outdated one given increased participation in outdoor recreation, but suggested an increase to only 15 acres per 1,000 people.

The high costs of land acquisitions were illustrated by Punter (107) who claimed that the Government of Ontario paid six times the 1945 price and twice the 1969 price in 1971 when it purchased 506 acres in Caledon, about 48

kilometres from Toronto.

David (35) found that public bodies are often slow to follow trends and preferences of society expressed in the private market. Barbichon (5) discussed two stages in recreational developments in France, the first where rural people offered opportunities to urban dwellers and the second, where urban dwellers purchased and developed rural areas themselves. Public interests then were forced to operate in an highly competitive recreational land market.

The inherent characteristics of an area are important in determining recreational uses. The Special Committee on Farm Income report (123) recommended that poorer recreational land near urban centres be developed for public recreational use. Loomer (67) argued that this land should be reserved for such use as they then become multiple use areas, e.g. recreation, forestry, wildlife sanctuary, drainage basin control, etc. while most private ownership is geared towards only one type of use.

Gierman (47), however, found only a low correlation between better quality recreational land and the land actually developed for recreational use in the Ottawa-Hull region. Despite locational advantages, Wolfe (138) found a recreational "bridge" extending up to 50 kilometres from Toronto where recreational developments were minimal. This situation has persisted since Wolfe's study in 1955; the

Outdoor Recreation Opportunity Quotient (19) of the Quebec City to Windsor axis showed that the Toronto Umland had one of the lowest potentials in the entire corridor. Today's preferences in outdoor recreation are largely for water-based activities and this area does not have any large inland water bodies (ARDA Land Capability Classification for Outdoor Recreation (18), Ontario Recreation Survey (128).

The Government of Ontario and various regional agencies within the province have started to deal with the problem of providing recreational space near urban areas. The Niagara Escarpment Commission (81) proposed to establish a framework for recreational developments which would increase public access, integrate compatible uses and minimize environmental impacts. The Ontario Provincial Parks Council (89) is currently developing its policies on open space near urban areas, but those such as Pearson (96) feel that this concern has come too late. Another question is whether these studies and recommendations will actually be translated into action through a willingness to pay for the large and expensive acreages needed (Wallace (136)).

v. Decline in Open Space Character of Rural Areas

The literature discussing the problems caused by the fragmentation of large rural holdings is closely related to that discussing the decline in agricultural activity related to urban growth pressures. Punter (107) claimed

that the fragmentation of property was the best indicator of the extent and impact of exurban development. The fragmentation processes preceding development were seen to drive up land prices, increase the number of owners which local administrators have to deal with and make future large land assemblies more costly and difficult. This latter point was echoed by Troughton (130). Martin (71) also pointed out that fragmented land holdings lead to higher land prices for bona fide developers.

The rural residence construction which usually accompanies land fragmentation in urban fringe areas is an evident transition of land from open space to urban uses. Russwurm (117) stated that country residential development was the fastest growing segment of the population in Canada's metropolitan areas during the last decade.

The proliferation of immovable structures (residences) in some of the more scenic parts of an urban fringe area tends permanently to remove valuable land from future recreational use (Michie and Found (79). Found and Morley (45) in fact viewed rural residence construction as an expression of private recreational activity and of the desire to own rural property. Thus the choice of living site was much more than simply a choice of living space. The construction of rural residences on better agricultural land within easy commuting distance to Toronto, documentrd

by Greaves (52) and Wiltshire (137) was also seen to be a misuse of land and a transformation of rural land.

Punter (107) believed that the problems of lot fragmentation and rural residence construction do not lie in the number of small lots being created but in their location on either potentially-valuable recreational land or on actually valuable agricultural land. Punter's study near Toronto, showed that exurbanites had a marked preference for sites for their houses in the true countryside rather than adjacent to existing hamlets. The Regional Municipality of Peel (32) and McLaren (74) both expressed the opinion that rural residential development is non-supportive in either agricultural or recreational land-use areas.

The problem which then confronts planners is how to accommodate the growing demand for residential sites within policy frameworks geared towards agricultural, recreational and open space policies.

CHAPTER III

THE TOWN OF CALEDON

The Town of Caledon in the Regional Municipality of Peel was selected as a study area because it possessed many locational and physical characteristics judged necessary for the investigation of the research hypothesis.

First of all, the Town of Caledon is situated in Zone 2, the commutershed of the Toronto Centred Region (Figure 1, page 3). As its northern boundary is less than 80 kilomentres from downtown Toronto, it offers rural residential sites for commuters. The Town is also located to the northwest of metropolitan Toronto in the area experiencing the most intensive growth pressures.[1]

The Town is required to, and is in the process of, drafting an Official Plan. An examination of proposed land-use designations would indicate the manner in which local government officials plan to counteract development trends.

The varied landscapes of the Town, including flat, well-drained plains, rolling morainic slopes and the Niagara Escarpment offer environments suitable for uses such as

[1] Design for Development: The Toronto Centred Region, (Toronto: Ministry of Treasury, Economics and Intergovernmental Affairs, 1970), p.2.

agriculture, rural residential estates and outdoor recreation.

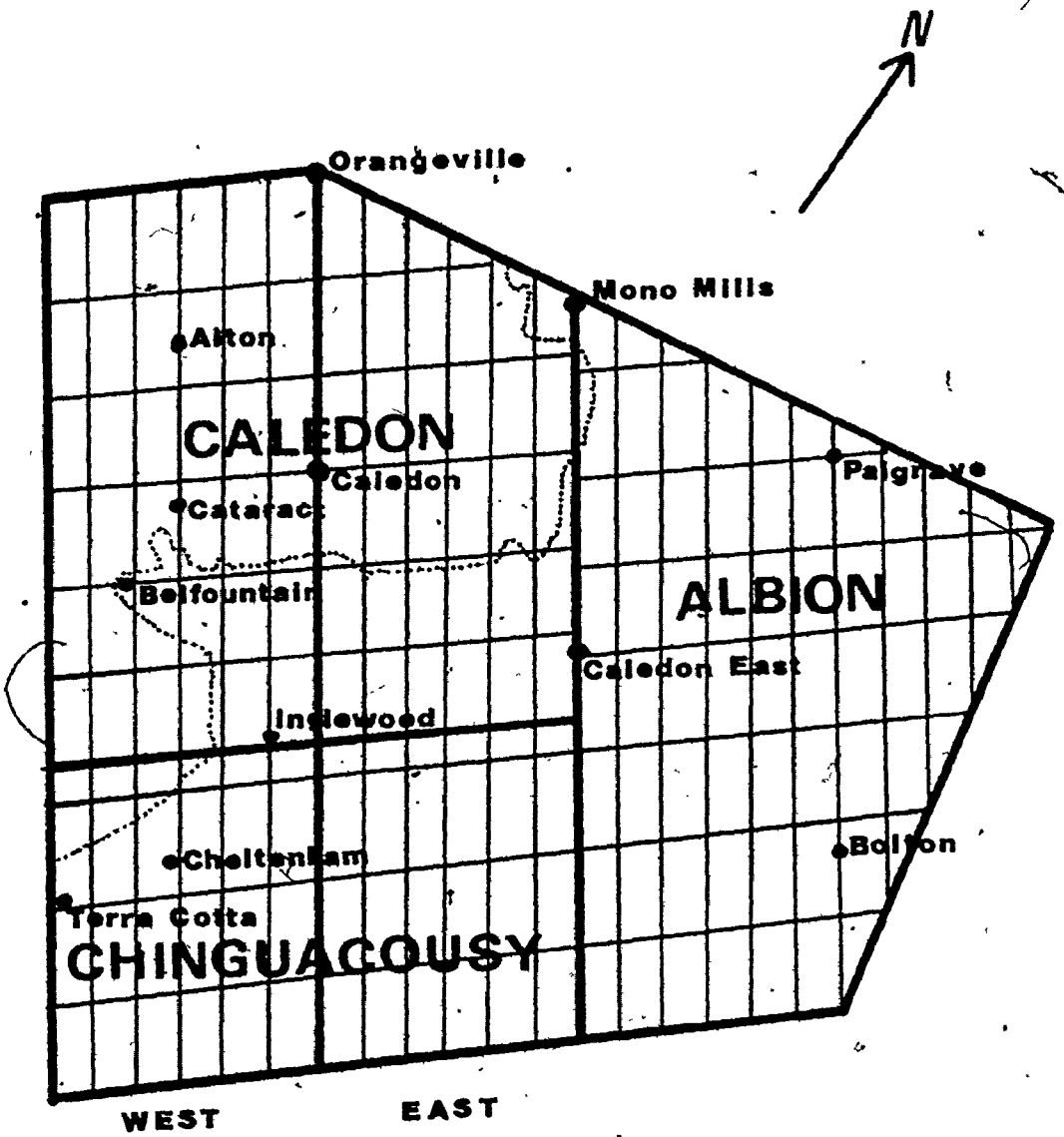
In addition to this scenic landscape, the designation of Zone 2 as a recreational area, and the location of the Town relative to metropolitan Toronto, make it a prime area for future public recreational developments. The proximity to Toronto would allow urban residents to visit the area for one-day recreational outings, which comprise the majority of recreational excursions. Currently, land assembly programmes for the Forks of the Credit Provincial Park near Belfountain are under way in the Town.[2]

i. Location and Physical Characteristics

The Town of Caledon is the most northerly municipal sub-division of the Regional Municipality of Peel, which was created on January 1st, 1974 by the internal reorganization of municipal boundaries in the County of Peel. It is located approximately 40 kilometres to the northwest of downtown Toronto and covers approximately 700 square kilometres. It is bordered by the Regional Municipality of Halton and Wellington County on the west, Dufferin and Simcoe Counties on the north, the Regional Municipality of York on the east and the City of Brampton on the south. Figure 2 illustrates

[2] Ontario Provincial Parks Statistics, (Toronto: Ministry of Natural Resources, 1976).

FIGURE 2



THE TOWN OF CALEDON

..... Niagara Escarpment

concession lines

0 10 km.

the three former townships (Albion, Caledon and northern Chinguacousy) which were amalgamated to form the Town.

There are several distinct landscapes in the Town. Four physiographic regions described by Chapman and Putnam[3] are found; the Guelph drumlin field, the Oak Ridges moraine, the South Slope and the Niagara Escarpment.

In the northwest corner is the Guelph drumlin field, a sloping plain 310 to 430 metres above sea level on which are found widely-spaced, loamy, calcareous till drumlins separated by alluvial deposits.

The knob and basin relief of the Oak Ridges interlobate moraine lies in the northwestern corner of the Town about 310 metres above sea level. This moraine divides the north and south flowing waters of the area. The sandy, gravelly soils of the moraine cause runoff to drain vertically, rather than horizontally, resulting in a lack of surface water in this part of the Town.

The South Slope is the southern slope of the interlobate moraine and rises from a height of approximately 125 metres to 310 metres above sea level from south to north. The clay plain has little relief, making it an ideal agricultural area.

[3]L.G. Chapman and D.F. Putnam, The Physiography of Southern Ontario, (Toronto, University of Toronto Press, 1973) pp. 217-92.

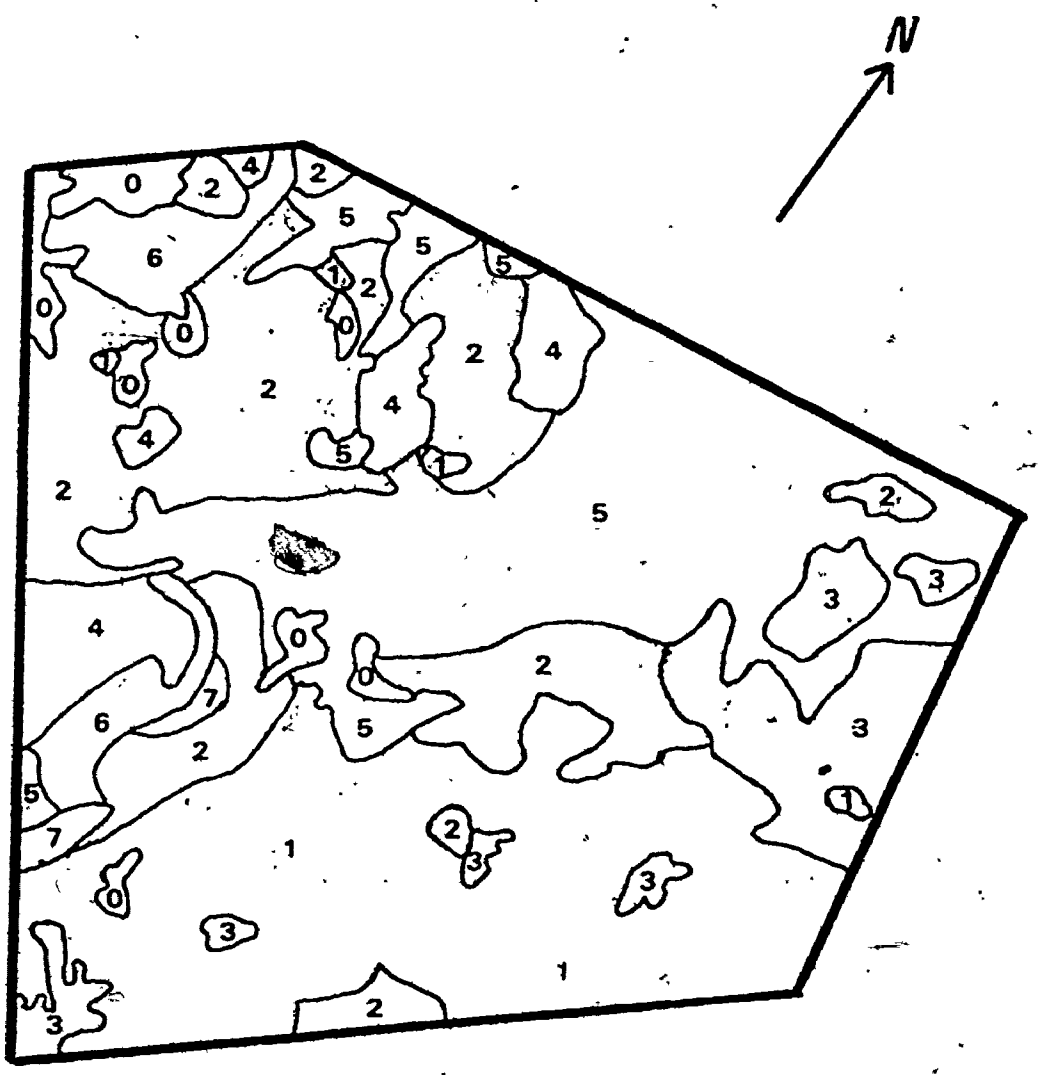
The Niagara Escarpment separates the northwestern Guelph drumlin field from the rest of the Town. It rises from approximately 450 metres to 490 metres above sea level, but over much of its length in the Town, it is partly buried by hummocky, bouldery morainic ridges and deposits of sand and gravel.

The surficial deposits of the physiographic regions vary and so do the soils which have developed on them. In the northern areas, soils of the Pontypool, Caledon and Dumfries catenas have developed on the poorly-sorted and well-sorted outwash deposits and the coarse, stony tills. On the southern plain, soils of the Woburn and Oneida catenas have developed on medium and heavy-textured limestone and shaley tills derived from the underlying Paleozoic bedrock. Along the Escarpment, shallow soils such as those of the Lockport catena, have developed on the bedrock parent material.

The forest vegetation varies according to the drainage characteristics of the soils. Oaks, sugar maples, beeches, pines and spruces are found mainly on the well-drained soils, soft maples and elms on imperfectly drained soils and ash and cedar stands on the poorly drained soils.

The varying physical characteristics of the Town are summarized in the ARDA soil capability for agriculture map, Figure 3. The variations in soil capability reflect

FIGURE 3



SOIL CAPABILITY FOR AGRICULTURE

1 2 3 crop soils

6 7 little to no value

4 5 pasture soils

0 organic soils

0 10 km.

source: CLI map no. 30M & 40P

variations in relief, water regimes, parent material, vegetation and climate. In this graphic presentation, a single value is used to denote areas with a mixture of soil classes. For example, an area with 60% class 6 soils and 40% class 4 soils would be considered a class 6 soil are: (6 x 6/10) + (4 x 4/10) = 5.2. The class ranges are shown in Table 1 with the potential for general agriculture of each class.

ii. Settlement History of Peel and Caledon[4]

By 1802, the area which was to become the Town of Caledon had been included in the Home Administrative District of British North America but the land itself was not opened for settlement until 1818 when it was purchased as part of the Mississauge Second Purchase. By 1825, 16,055 acres in Peel had been patented but only 7,203 were occupied by settlers. Unoccupied land was scarce in the south but common in Caledon until a wave of European immigration between 1826 and 1835 opened the area for settlement. In 1849, Peel, together with York and Ontario, formed one large county but by 1866 Peel had become a separate county.

The economic development of this part of Ontario, like many others, was related to changes in agriculture.

[4]Settlement History of Peel, (Brampton, Ont.: Regional Municipality of Peel Planning Department, 1977).

Table 1: Soil Capability for Agriculture Classification

class	range of values	agricultural capability
1	0 - 1	no significant limitations in use for crops
2	1.1 - 2	moderate limitations that restrict the range of crops or require moderate conservation practices
3	2.1 - 3	moderately severe limitations that restrict the range of crops or require severe conservation practices
4	3.1 - 4	severe limitations that restrict the range of crops
5	4.1 - 5	very severe limitations that restrict the capability of producing perennial forage crops
6	5.1 - 6	capable only of producing some forage crops and improvement practices are not feasible
7	6.1 - 7	no capability for arable culture or permanent pasture

The development of a railway system in the 1850's through Brampton just to the south, relieved the dependency on local mills for the processing of the major commodity, wheat. Close economic ties with Toronto continued through this century and caused the decline of the many small hamlets settled as local service centres in the early part of the century. The proximity to Toronto also prevented the development of a large regional centre.

Through the early 1900's, the trends in agriculture, such as the emergence of dairying and vegetable growing areas, reflected the needs of the growing urban population. Post World War II suburban growth greatly altered the character of the County, but to a lesser degree in Caledon which had only a 64% growth rate between 1946 and 1960, while Brampton and Mississauga had 367% and 603% growth levels respectively.

Growth in the last decade, especially in southern Chinguacousy, has involved planned community developments such as Bramalea and Meadowvale. Proposals for restructuring the local government to deal with increased urbanization levels date back to the mid-sixties and on January 1st, 1974 the Regional Municipality of Peel was created.

In 1951, 16% of Peel's labour force was engaged in agriculture but by 1971 this percentage had dropped to 1.9%. In the future, the Town of Caledon will become the main

agricultural area of Peel as developments such as the South Peel Sewer and Water Scheme allocate urban uses to a large part of the southern sector of the municipality. Dairying and beef production will remain important agricultural activities in the Town, although the growth in the number of hobby farms and lenient severance regulations in the past, have created the potential for conflicts between agriculture and other uses.

iii. Land-Use Planning

The future pattern of land uses in the Town of Caledon will be the result of provincial, regional and municipal policies and priorities in land-use controls. The Town has been included in recent broad-based planning concepts e.g. MTARTS[5], the Toronto Centred Region[6], COLUC[7] and the forthcoming Official Plan of the Regional Municipality of Peel.

[5]Metropolitan Toronto and Region Transportation Study, (Toronto: Department of Transport, 1966).

[6]op. cit.

[7]COLUC Task Force, Report to the Advisory Committee on Urban and Regional Planning of the Central Ontario Lakeshore Urban Complex, (Toronto: Ministry of Treasury, Economics and Intergovernmental Affairs, 1974).

The increase in the number of individually-owned properties through severances and registered plans of subdivision since the end of World War II has led to increasingly stricter controls on land sales. These controls are well-documented by Punter[8] for the former township of Caledon.

The varying restrictions governing parcel creation and the varying strictness in the application of zoning by-laws among the many communities affected by urban growth pressures forced the Ontario government to amend the Planning and Development Act in 1973. This Act forces municipalities to adopt a more orderly and planned approach to development. Under the Act, each municipality is obliged to prepare an Official Plan which reflects provincial policies for development while dealing with local problems and concerns. The province has provided only general guidelines for development; ultimate responsibility over land use and land-use change remains in the hands of the municipalities.

The Town of Caledon, as part of the Regional Municipality of Peel, has been obliged to prepare a plan in line with the goals specified for the Zone 2 commutershed of the Toronto Centred Region and the more formalized COLUC report.

[8] J. Punter, The Impact of Exurban Development on Land and Landscape in the Toronto Centred Region 1954 - 1971, (unpublished PhD. thesis, Department of Geography, York University, 1974), appendix.

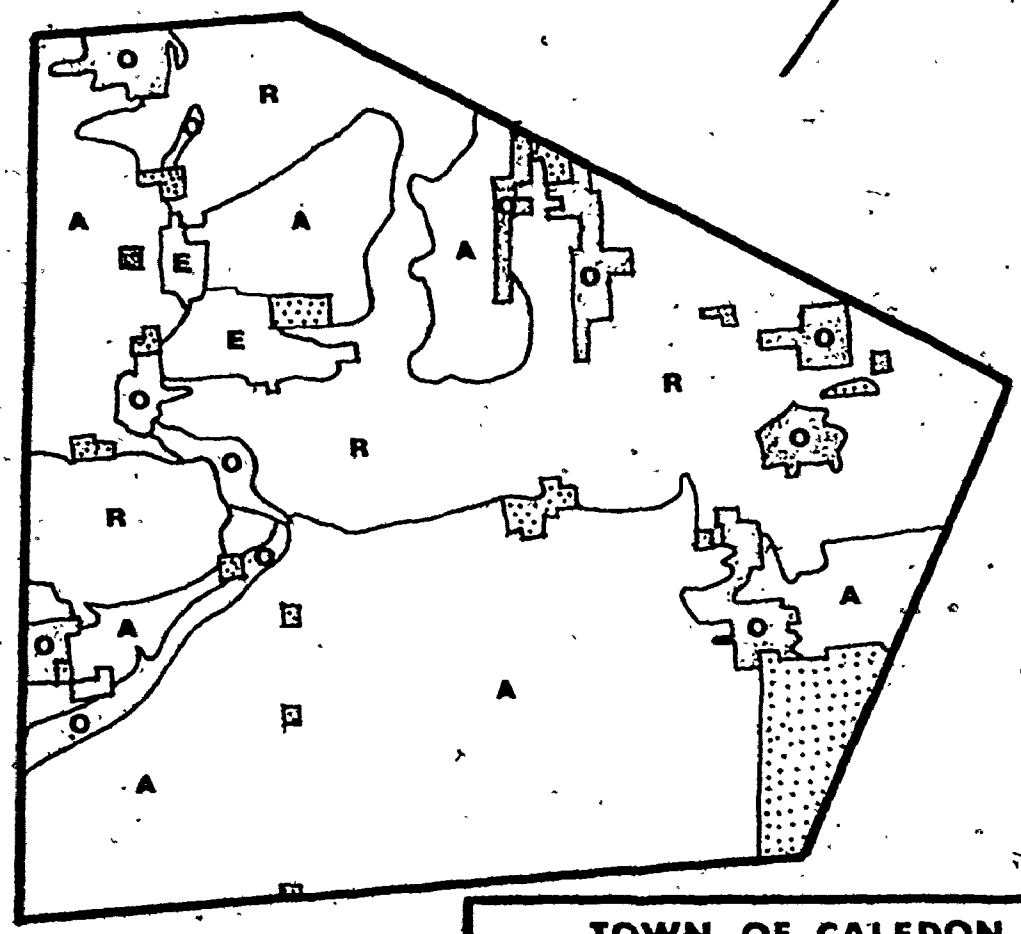
In addition, much of the Town is included in the Niagara Escarpment Planning and Development Area and, on completion of the Niagara Escarpment Commission's Official Plan, the Town's land-use designations and controls must be adjusted where necessary to conform with those of the Escarpment Plan.[9]

Several reports have been published by the Regional Municipality of Peel documenting areas of research leading to the preparation of the Regional Official Plan which will be compiled once Brampton, Caledon and Mississauga have completed their local plans. These reports are not in total agreement as to future mature-state population levels in the Town of Caledon which will be reached some time after the year 2000. Predictions range from 48,000 to 60,000 or even higher depending on the growth rates of the more urbanized parts of the Regional Municipality. The 60,000 population estimate was used as the basis for land-use planning in the Town.

On December 3rd, 1975, the Caledon Official Plan Steering Committee presented the Draft Official Plan to the Town Council and in April 1978 the Official Plan which guides growth to 1988 was produced. The major land-use designations are shown in Figure 4. The major problem

[9] Official Plan of the Town of Caledon Planning Area, (Regional Municipality of Peel, Ont: Town of Caledon Planning Department, 1978), p. 76.

FIGURE 4



TOWN OF CALEDON
LAND-USE PLAN

- A agriculture
- E extractive
- O open space
- R rural
- settlement

0 10 km

source: Town of Caledon Official Plan

which had to be overcome was the accommodation of several land uses i.e. agriculture, recreation desired by the provincial government while accommodating the anticipated 37,205 new residents.[10]

The plan guarantees the continued existence of agriculture on the better soils in the south and north-west with very limited non-farm residential construction permitted. Open space areas are to be formed by the hazard lands along waterways and the existing park facilities. Proposals for parkland in the Town suggest a ratio of two hectares (4.94 acres) per 1,000 people in settlement areas and four hectares (9.88 acres) per 1,000 people throughout the Town.[11] These figures appear to be based on the 1923 standard discussed in the previous chapter (page 19) and do not take into account the recreational space demands of the more populated areas of Brampton, Mississauga or Toronto.

The Toronto Centred Region plan stated that population growth in rural areas should be limited to[12] existing settlements but the proposed population distributions for 1988 show an increase of only 5,500 in the

[10] Official Plan of the Town of Caledon Planning Area, (Regional Municipality of Peel: Town of Caledon Planning Department, 1978), p. 17.

[11] Ibid., p. 62.

[12] op. cit. p. 21.

settlement areas with an increase of nearly 16,000 in the agricultural and rural area.[13] The plan itself suggests that the Toronto Centred Region concept of limited growth encourages the continued dependence of Zone 2 communities on Toronto.

A large part of the Town has been zoned as rural areas with possibilities for rural estate residential development (minimum lot size to be one hectare = 2.47 acres created under registered plan of subdivision) or country estate residential (minimum lot size to be four hectares = 9.88 acres created under registered plan of subdivision). Individual severed lots have a minimum size restriction of 11 hectares or 27.17 acres. In both agricultural and rural areas, no more than three consents per original land holding are permitted and this is retroactive.[14] The large lot designations in the past have been criticized (see review of literature) as being elitest and the new restrictions seem to continue this trend. The designation of large areas of land as being suitable for estate development has also been criticized as a political move to placate large land owners and a financial move to ensure areas of residential tax revenue without the problems of re-zoning,

[13] Official Plan of the Town of Caledon Planning Area, p. 17.

[14] Ibid., pp. 23 - 37.

Re-zoning is a possibility though, even within the planning period. If a private interest desires to develop land designated as major open space, and if no public body is able or willing to purchase the property, the land may be re-zoned to permit development.[15] In a time of public spending restraint, this option could have serious effects on the maintenance of large areas of open space.

In summary, the land use in the Town will depend on the interpretation and enforcement of these policies by zoning administrators, the Land Division Committee and the Committee of Adjustment especially as growth pressures increase in the future as Brampton and Mississauga approach their mature state populations.

iv. Recreational Land-Use Planning

During the 1970's, there has been a growing concern over the lack of outdoor recreational opportunities in the highly urbanized areas of southern Ontario. The high cost of land in these parts of the province make the provision of recreational space, i.e. parkland a provincial responsibility, as local municipalities do not have the financial resources to assemble the large tracts of land needed for non-intensive recreation, and commercial interests are more

[15] Official Plan of the Town of Caledon Planning Area, p. 38.

concerned with higher revenue-generating uses than with becoming involved in long term recreational developments.

The current imbalance of recreational space in Ontario is well illustrated by parkland and reserve parkland statistics published by the Ministry of Natural Resources (Table 2). Although provincial land holdings tripled between 1966 and 1976, in 1976, 82% of the parkland and 87% of the reserve land was concentrated in the northern districts. Only 0.06% of the parkland and 2.98% of the reserve land was in the highly urbanized Central District. Within this district, which contains such population centres as Toronto, Oshawa, Kitchener-Waterloo, Hamilton and St. Catharines, nearly three-quarters of the reserve land was in the most northern Huronia sub-district. In contrast, the southern districts during 1976 had 76% of the total number of park visitors.

This discrepancy has been recognized by the Ministry of Natural Resources.[16] The adequacy of present and future land holdings for a growing population is currently being analyzed as part of a long term 25-year plan. There are no plans for future land acquisitions until this Master Plan is completed, sometime within the next two years. The need for more recreational land adjacent to southern

[16] Interview with Gordon Rogers, Ministry of Natural Resources, April 1978.

Table 2: Distribution of Recreational Land in Ontario: Provincial Parkland[17]

northern districts	% visitors	% reserve	% parkland
North Central	6.60	23.30	15.61
North Eastern	9.00	11.92	5.29
North Western	4.20	27.75	0.20
Northern	4.20	23.77	60.06
TOTAL	24.00	86.74	81.16

southern districts	% visitors	% reserve	% parkland
Algonquin	14.40	7.25	18.27
Central	20.90	2.28	0.06
Eastern	13.80	1.32	0.26
South Western	26.90	2.39	0.25
TOTAL	76.00	13.24	18.84

[17] Ontario Provincial Parks - Statistics 1976, (Toronto: Ministry of Natural Resources, 1977). Statistics 1977, (Toronto: Ministry of Natural Resources 1977).

Ontario's population centres is viewed as a serious problem, but recent severe land acquisition budget cuts[18] preclude further major land purchases similar to those of the early '70's. One alternative will be to sell northern reserve land to increase southern Ontario land acquisition budgets.

The major problem is the high cost of the lands which are most needed. The location of these lands in the hinterlands of large cities tends to increase their value and recreational uses have to compete with higher revenue producing uses. Budget restrictions could even interfere with the purchase of land deemed essential for the preservation of the Niagara Escarpment. Also, the large number of potential sellers in the south tends to increase the overall price of a major land purchase.

In the future, in areas of high land prices, emphasis will be placed on avoiding outright purchase of land, and instead, user rights will be leased and easements used in order to satisfy the goal of providing more recreational space without incurring large financial costs.

The Ministry of Natural Resources to some degree works with the Conservation Authorities in providing recreational space, but they, as autonomous bodies, view their roles differently with not all giving the same priority to outdoor recreation.

[18] Annual Reports 1973 - 1977. (Toronto: Ministry of of Natural Resources, 1973 - 1977).

The Metropolitan Toronto and Region Conservation Authority is currently reviewing its land-use policies and has identified certain lands, some on the Niagara Escarpment, which are suitable for acquisition. Some of their existing recreational sites were found to be inadequate for the number of users during the summer of 1976 but no major developments of new sites are anticipated. As with the provincial government, the need to increase the number of water-based recreational opportunities near large urban centres is the most important problem presently facing regional recreational planners.[19]

No provincial parkland has been developed within the Town of Caledon but a large reserve is located near Belfountain which will become the Forks of the Credit Park. At present, non-intensive use is permitted but only very rudimentary facilities exist. The Master Plan for this park is tentatively scheduled for completion within five years and actual site development within seven years.

[19]Metropolitan Toronto and Region Conservation Authority, personal letter, November 20, 1977.

CHAPTER IV

DATA COLLECTION

Data used in the analysis of rural land uses in the Town of Caledon between 1955 and 1977 were gathered by the author and also were obtained from secondary sources. Data used to study agriculture and recreational facilities were gathered from a wider area than the Town. Census enumeration areas within the Town did not provide a good framework for the study of spatial variations. In the agricultural analysis, 16 townships representing Zone 2 of the Toronto Centred Region were studied. Census data from 1956 and 1971 provided information on agricultural land uses. In the recreational analysis, 13 townships representing a cross-section of Zones 1, 2 and 3 were used in order to determine if, at present, Zone 2 townships are a major supplier of recreational space. Data were obtained from the TORPS[1] study initiated in 1974. Additional parkland information was obtained from an interview with a provincial recreational planner and statistics provided by the Metropolitan Toronto and Region Conservation Authority.

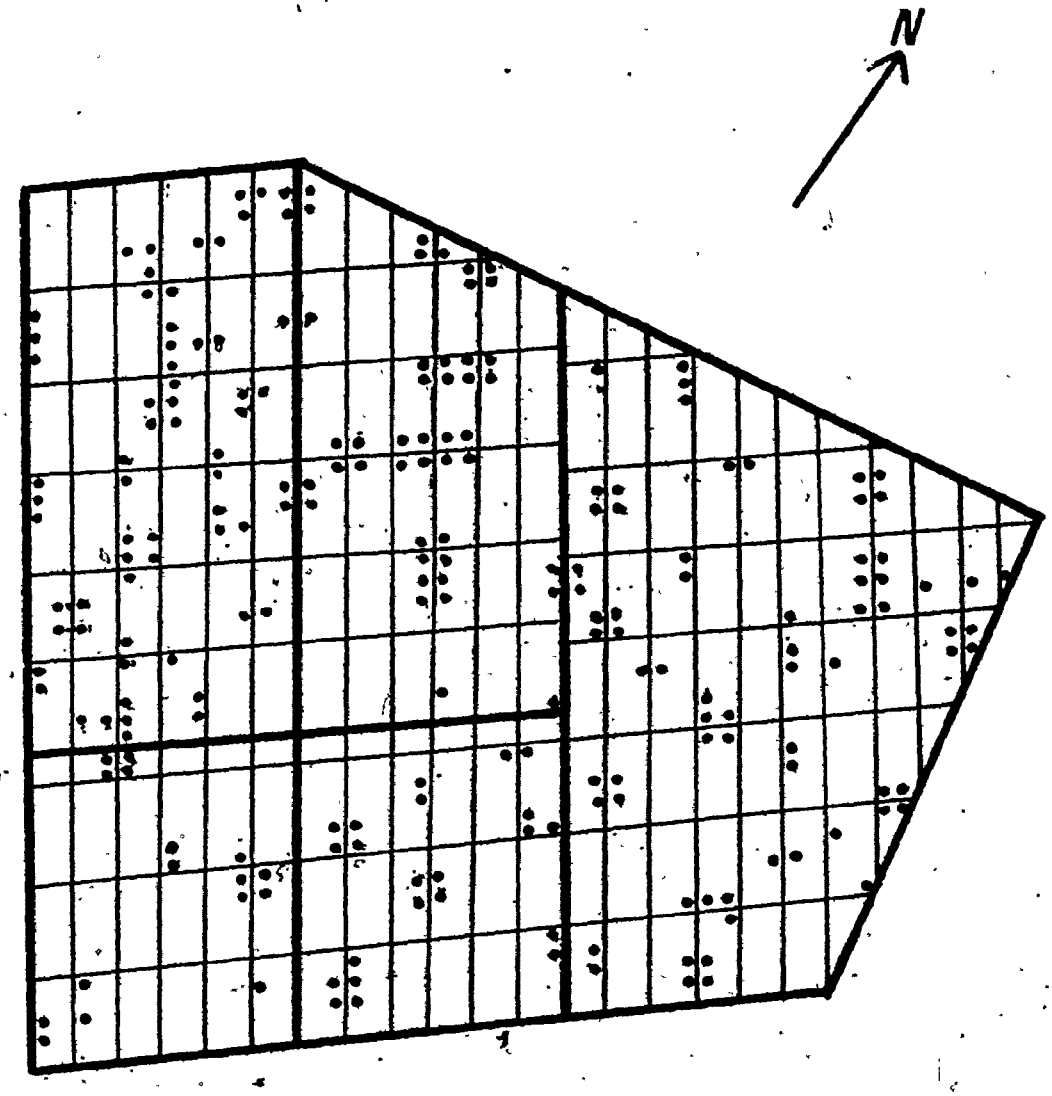
[1] Tourism and Outdoor Recreation Planning Study Committee, Ontario Recreation Survey: Tourism and Recreation Planning Study - Progress Report No. 2, (Toronto, 1974).

A set of sample 100-acre lots was selected from the Town of Caledon for the land fragmentation and residence construction analysis. Lots included were those contained within 70 random UTM one kilometre square grids on 1:50,000 topographic maps. This produced an areal coverage of 218 lots in 70 clusters. This method was used in order to produce a study area containing many contiguous lots so that the effects of neighbouring land uses could be examined in relation to the land-use change of a particular lot (Figure 6).

Field research in 1977 recorded types of land use and the number of residences on each sample lot. Analysis of 1955, 1964, 1969 and 1976 air photographs provided similar data for previous years. An analysis of 1976 assessment rolls and land registry documents provided information on the number of owners, their place of residence and the assessed value of all land holdings from 1955 onwards. Information concerning land sales was also recorded including seller, purchaser, date of sale and the acreage of the land transfer.

Several land classifications describing physical characteristics and planning areas were examined. These were the Canada Land Inventory's Land Capability series

FIGURE 5



TOWN OF CALEDON
SAMPLE LOTS

0 10 km

maps for Agriculture[2] and Recreation[3], the Niagara Escarpment Planning Area maps[4] and the Town of Caledon Draft and Official Plans.[5]

[2]Canada Land Inventory, Soil Capability for Agriculture, Maps 30M and 40P.

[3]Canada Land Inventory, Land Capability for Outdoor Recreation. Maps 30M and 40P.

[4]Niagara Escarpment Study: Conservation and Recreation Report, L. Gertler, chairman, (Toronto: Treasury Department, Regional Development Branch, 1968).

[5]Official Plan of the Town of Caledon Planning Area, op. cit.

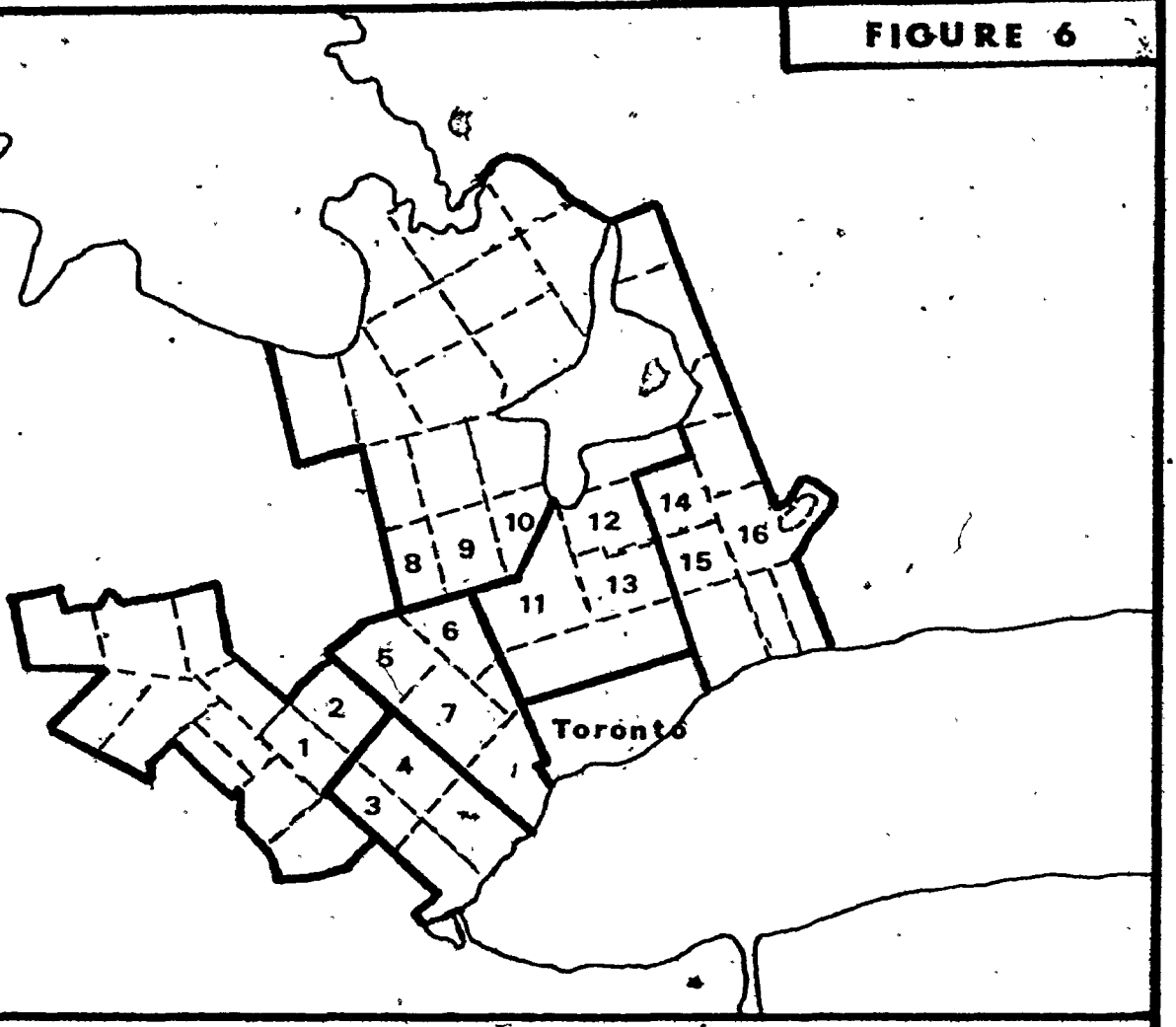
CHAPTER V

ANALYSIS OF AGRICULTURAL ACTIVITY

An analysis of the variations in agricultural land use among Zone 2 townships was undertaken using published census data from 1956 and 1971. Zone 2 of the Toronto Centred Region covers 16 townships but regional municipality formation after 1971 changed several boundaries and so the two areas are not identical (Figure 6). For this reason, the 1976 census could not be used as the census sub-divisions were not comparable to those of previous census reports. In addition, all data from this latest census were not yet available at the sub-division level of aggregation. A more major difficulty, however, was the fact that the definition of a census farm had been changed. The new criteria eliminated a number of farms which had previously been included in the agricultural enumeration.

A common measure of agricultural activity is the proportion of the total land area in agricultural use, i.e. the land area of all census farms. During the past 25 years, in some parts of Ontario, the area of farmland has decreased in size in conjunction with urban growth pressures on the land, but in others, agricultural activity has declined because of the inherent low productivity of

FIGURE 6



TOWNSHIPS USED IN AGRICULTURAL ANALYSIS

——— county line

---- township line

Wellington Co.
1 Eramosa
2 Erin

Halton Co.
3 Nassagawaya
4 Esquesing

Peel Co.
5 Caledon
6 Albion
7 Chinguacousy

Simcoe Co.
8 Adjala
9 Tecumseth
10 Gwillim. W.

York Co.
11 Gwillim. E.
12 King
13 Whitchurch

Ontario Co.
14 Scott
15 Uxbridge
16 Reach

the land. Some townships have remained areas of relatively strong agricultural activity.

Eight types of data were gathered from the census reports and a Canada Land Inventory capability report.[1] They measured farm population, number of farms, area of farmland, size of farms, land use on farms, horse and pony populations, economic class of farms with regard to the value of products sold and agricultural capability. The land use variables measured the amounts of improved land and woodlots as percentages of total farmland area. The improved category was further sub-divided into cropland and pastureland. In total, 22 variables were produced measuring the level of agricultural activity in 1971 and the degree of change between 1956 and 1971 for each of the 16 townships. These variables are listed in Table 3.

The decreases in farmland, the variable DELAND, are listed in Table 4. The use of percentages rather than absolute acreages made later comparisons among different sized townships more meaningful.

All townships had a smaller proportion of their total land area in agriculture by 1971. By this date, there was a greater range in the percentage of farmland

[1] Canada Land Inventory Land Capability for Agriculture, op. cit.

Table 3: Variables Used in the Agricultural Analysis

variable name	explanation	expected relationship to dependent var.
DELAND	Percentage decrease in the amount of farmland between 1956 and 1971	dependent variable
FARMPOP	Farm population as a percentage of total rural population in 1971	negative
FARMPOPC	Change in the percentage of farm population between 1956 and 1971	negative
LANDCAP	Percentage of total area classified as class 1 to 3 agricultural soils	negative
NOFARMC	Percentage decrease in the number of farms since 1956	positive
FARMLAND	Percentage of total land classified as farmland in 1971.	negative
FARMSIZE	Average farm size in acres in 1971	negative
FARSIZCH	Change in average farm size between 1956 and 1971	negative
SMFARM	Percentage of total farms 1 to 69 acres in size	positive
MEDFARM	Percentage of total farms 70 to 239 acres in size	positive
LARFARM	Percentage of total farms 240 acres or larger in size	negative
EQUINECH	Change in the number of horses and ponies between 1956 and 1971	positive

Table 3: continued

variable name	explanation	expected relationship to dependent var.
RATIOCH[2]	Ratio of shift of farms from medium size class to large or small size class	negative
IMPROLAN	Percentage of total farmland classified as improved in 1971	negative
PASTURE	Percentage of total farmland classified as improved pastureland in 1971	positive
WOODLOT	Percentage of total farmland classified as woodlots in 1971	positive
CROPLAND	Percentage of total farmland classified as cropland in 1971	negative
IMPROCH	Change in the percentage of improved land between 1956 and 1971	negative
PASTURCH	Change in the percentage of pastureland between 1956 and 1971	positive
WOODCH	Change in the percentage of woodlots between 1956 and 1971	positive
CROPCH	Change in the percentage of cropland between 1956 and 1971	negative
NONCOCH	Change in the percentage of total farms which had sales less than $2400 (non-commercial farms)	positive

[2]Between 1956 and 1971 the medium size class of farms declined in proportion in all townships. This variable measures whether the small or large class grew the most at the expense of the medium class.

Table 4: Farmland Loss 1956 to 1971

township	% farmland 1956	% farmland 1971	% change
Nassagawaya	79.24	40.45	38.79
Whitchurch	84.67	52.85	31.82
Uxbridge	68.83	41.49	27.34
Erin	86.87	59.67	27.20
Adjala	83.20	57.06	26.14
Caledon	74.37	49.68	24.69
King	82.44	59.27	23.17
Albion	74.12	54.68	19.44
Esquesing	81.73	63.69	18.04
Gwillimbury E.	69.60	53.48	16.12
Chinguacousy	94.23	79.04	15.19
Eramosa	85.87	73.85	12.02
Tecumseth	89.36	77.90	11.46
Gwillimbury W.	81.94	71.75	10.19
Scott	82.92	74.15	8.77
Reach	76.06	67.54	8.52

Table 5: Pearson Correlation Coefficients

	LANDCAP	NONURBAN	RURALRES	URBAN
DELAND r=	-.25	-.06	.07	.66
s=	(.203)	(.417)	(.408)	(.007)

among the townships; 79% to 40% in 1971 compared to 94% to 69% in 1956. Therefore, decreases were not uniform over Zone 2. Four townships, Whitchurch, Erin, Adjala and King had relatively high percentages of farmland in 1956 and also large decreases between 1956 and 1971.

A Pearson product-moment correlation analysis was performed to determine whether population growth (i.e. urban growth pressures) or a small proportion of good agricultural soils was related to the variations in the amounts of farmland lost. The growth in the rural, rural non-farm, urban populations and the percentage of class 1 to 3 soils for each township were correlated separately with each respective DELAND variable. The correlation coefficients are shown in Table 5 (page 53).

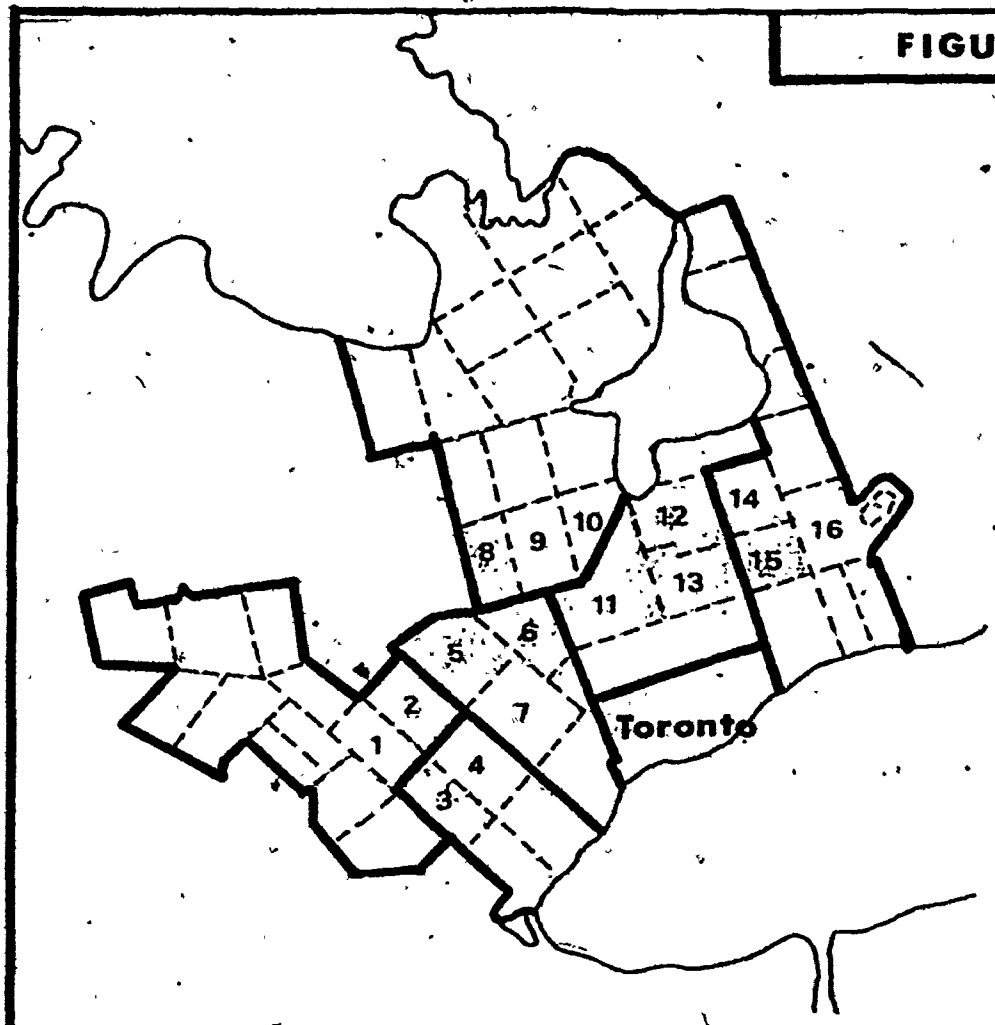
Only the growth in the urban population was correlated significantly with the percentage decrease in agricultural land with a coefficient of 0.66. Although the relationship between the growth in the rural non-farm population and farmland loss was positive, the strength of the relationship was very weak. Rural population growth, which includes farm, hamlet, and non-farm residential populations, was, unexpectedly, negatively-related to farmland loss. Growth in this population group is affected by the decrease in the number of farm and hamlet residents as well as the increase in the non-farm residential population. Therefore, areas of low rural population growth

could be areas where large decreases in the farm and hamlet populations counteracted increases in the rural non-farm residential population, producing low overall growth figures and a negative relationship. However the poor RURALRES/DELAND correlation disproves this theory.

The correlation between farmland loss and the land capability was insignificant but areas with larger agricultural land losses did tend to be areas having a smaller percentage of good agricultural soils.

The townships with relatively large losses of farmland did not represent a distinct geographic area, such as an arc around metropolitan Toronto (Figure 7). As locational or land capability variables were not able to explain the variations in farmland loss, other variables describing agricultural activity were used. A stepwise multiple regression analysis was used to determine over all townships which of the 21 variables listed in Table 3 could explain the largest amount of variation. Initially the variables were tested to determine which were intercorrelated. A Pearson product moment correlation analysis produced significant correlation coefficients for 11 pairs of variables. These are shown in Table 6 with a short interpretation of each relationship. Many correlations were expected e.g. average farm size in 1971 was negatively correlated to the percentage of small farms.

FIGURE 7



FARMLAND LOSS

$\tilde{x}$ = 19.9a.

above average	below average
2 Erin	1 Eramosa
3 Nassagaweya	4 Esquesing
5 Caledon	6 Albion
8 Adjala	7 Chinguacousy
11 King	9 Tecumseth
13 Whitchurch	10 Gwillimbury W.
15 Uxbridge	12 Gwillimbury E.
	14 Scott
	16 Reach

Table 6: Significantly Correlated Agricultural Land-Use Variables

variables	interpretation	r
DELAND FARMLAND	Greater percentage of farmland in 1971 associated with small decreases in the percentage of farmland between 1956 and1971	-0.83
DELAND NONCOCH	Larger decreases in farmland associated with a larger percentage of non-commercial farms	0.88
LANDCAP CROPCH	Larger percentage of good soils associated with increases in the percentage of cropland	0.76
FARMLAND NONCOCH	Larger percentage of farmland associated with a smaller percentage of non-commercial farms	-0.92
FARMSIZE SMFARM	Larger average farm size associated with a smaller percentage of small farms	-0.85
FARSIZE LARFARM	Larger average farm size accociated with a larger percentage of large farms	0.88
SMFARM MEDFARM	Larger percentage of small farms associated with a smaller percentage of medium farms	-0.94
SMFARM EQUINECH	Larger percentage of small farms associated with increases in the horse and pony population	0.69
IMPROLAN WOODLOT	Larger percentage of improved land associated with a smaller percentage of woodlots	-0.77
IMPROLAN CROPLAND	Larger percentage of improved land associated with a larger percentage of cropland	0.92
IMPROCH PASTURECH	Increases in the percentage of improved land associated with increases in the percentage of pastureland	0.73

Other relationships included a negative correlation between the percentage of farms in the non-commercial class and the area of farmland in 1971 and a positive relationship between the percentage of small-sized farms and increases in the horse and pony population. A small loss of farmland was associated with a small percentage of small-sized farms. These three relationships all suggest that areas experiencing high levels of farmland loss are characterized by a number of small, part-time hobby farms.

The 16 townships were roughly divided into two groups representing areas of above and below average farmland loss between 1956 and 1971 (Figure 7, page 56). The means of each variable were compared, but the criterion used in the group creation was not sufficiently rigid to allow statistical testing. However, the townships forming Group 1, representing areas with above average farmland loss, consistently had mean values expected of an area with a greater amount of agricultural change (Table 7). For example, these townships tended to have a smaller percentage of their population classified as farm in 1971, a smaller proportion of class 1 to 3 agricultural soils, decreases in average farm size during the study period and a large percentage of land under pasture, a non-intensive agricultural use. These values also supported the relationships listed in Table 3.

Table 7: Groups of Townships with Above and Below Average Farmland Loss - Mean Values of Variables

Group 1: townships with above average farmland loss
Group 2: townships with below average farmland loss

variable	Group 1	Group 2
DELAND	28.45%	13.30%
FARMPOP	21.40%	25.60%
FARMPOPC	-35.00%	-25.60%
LANDCAP	57.80%	70.90%
NOFARMC	-31.70%	-19.80%
FARMLAND	51.50%	68.50%
FARSIZCH	-7.00 acres	4.00 acres
SMFARM	36.00%	30.60%
RATICH	0.20	0.90
IMPROLAN	71.30%	77.40%
PASTURE	15.90%	13.30%
IMPROCH	1.50%	0.50%
WOODCH	-2.70%	-2.30%
EQUINECH	241.00 horses	83.00 horses

Table 8: Multiple Regression Coefficients - Agricultural Analysis

variable	B	r	mul. r	r^2	r^2 change
NOFARMC	.70	.54	.54	.29	.29
FARSIZCH	-.49	-.41	.97	.94	.66
FARMPOPC	-.07	.05	.97	.95	.01
PASTURE	.89	.22	.98	.96	.01
LANDCAP	-.03	-.25	.98	.97	.01
WOODCH	-1.90	-.40	.98	.97	.00
IMPROLAN	.44	-.45	.99	.99	.02
IMPROCH	-.83	.10	.99	.99	.00
FARMPOP	.89	-.43	.99	.99	.00
SMFARM	.10	.28	.99	.99	.00

y intercept = -49.50

The general form of a multiple regression equation is:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + e$$

where Y = the dependent variable
a = the y intercept
X_i = the independent variables
b_i = the coefficients indicating the amount of change in the independent variables associated with a unit change in the dependent variable
e = the error term

The ten variables which were not significantly intercorrelated were used in the stepwise multiple regression analysis and they are listed in Table 8 (page 59). Two variables, the percentage change in the number of farms since 1956 (NOFARMC) and the change in average farm size (FARSIZCH) together explained 97% of the variation in the dependent variable. The predictive equation showing the relationship between these two variables and DELAND was:

$$Y = - 49.5 + 0.70 \text{ (NOFARMC)} - 0.49 \text{ (FARSIZCH)} + k$$

where k = the contribution of non-significant variables and the error factor

The coefficients are shown in Table 8. The overall F statistic was significant at 0.000 and the Durbin-Watson statistic indicated that there was no significant auto-correlation of residuals.

The equation predicted that areas with large percentage decreases in the number of farms since 1956 and decreases in average farm size would be areas with large decreases in the percentage of farmland. This indicates that changes in the structure of agriculture varied among Zone 2 townships, as well as the scale of agricultural activity. In 5 of the 16 townships (Adjala, Erin, Esquesing, Nassagawaya and Uxbridge), the decreases in the amounts of farmland exceeded the decreases in the number of farms and so the remaining farm units were forced to reduce their size. This could occur when 50 acres of a 100-acre holding is sold to other uses and the remaining acreage is divided into two small hobby farms. These types of structural changes differ from the Canadian trend where farm sizes are increasing on a reduced land base.

Of the 10 independent variables used, only three were not associated with the dependent variable in the expected manner. The percentage of farm population in 1971 and the percentage of improved land were positively related to the amount of farmland lost while the change in the percentage of woodland was negatively related. Areas with high levels of farmland loss did not have small farm populations by 1971, perhaps due to the fact that there were relatively more, smaller farms in these areas. The large farmland losses associated with a large percentage of improved land in 1971

indicate that these losses have removed unimproved land. This is supported by the fact that high levels of farmland loss were associated with decreases in the percentage of woodland. an unimproved agricultural use.

The failure of many of the original variables to explain any significant variation in DELAND is not obvious. Eleven variables were not entered in the final regression; their high correlations with the remaining variables ensured that no explanation would be lost if they were not included. The simple coefficients (r) in Table 8 show that no variables had a strong independent relationship to DELAND, but the two variables, NOFARMC and FARSIZCH, appear to complement each other almost perfectly i.e. the variation that NOFARMC does not explain, FARSIZCH does. If these variables were not included, the contribution of the remaining eight variables could be determined more clearly. without the "swamping" effect of NOFARMC and FARSIZCH. The consistent differences between the mean values of the township groups with above or below farmland loss (Table 7) support the theory that the variables are related to variations in farmland loss.

Another possibility is that when the variables were intercorrelated, the wrong variables were chosen to represent each group. By trial and error, the combination of variables which contributes the greatest amount of variation

could be reached.

In conclusion, the agricultural analysis showed that all Zone 2 townships experienced farmland loss between 1956 and 1971; losses ranged from 38.79% in Nassagawaya to 8.52% in Reach. Variations in farmland loss were significantly correlated with urban population growth in each township but not to rural population growth or agricultural land capability. High levels of farmland loss were associated with large decreases in the number of farms since 1956 and decreases in average farm size between 1956 and 1971. Townships which experienced decreases in average farm size were those whose ratios of farmland to farms in 1956 and 1971 indicated that the rate of farmland loss exceeded the rate of decrease in the number of farms. Remaining agricultural land then became fragmented into smaller holdings. An analysis of the intercorrelated variables showed that farms in areas of high farmland loss were more likely to be in the non-commercial class and would have increased the number of horses and ponies during the study period. These are characteristics often associated with part-time hobby farms. The results of the analysis supported the findings of Punter[3] that changes in agriculture in urbanizing areas are as much changes in the structure of agriculture as the scale of activity.

[3]J. Punter, op. cit., p. 320.

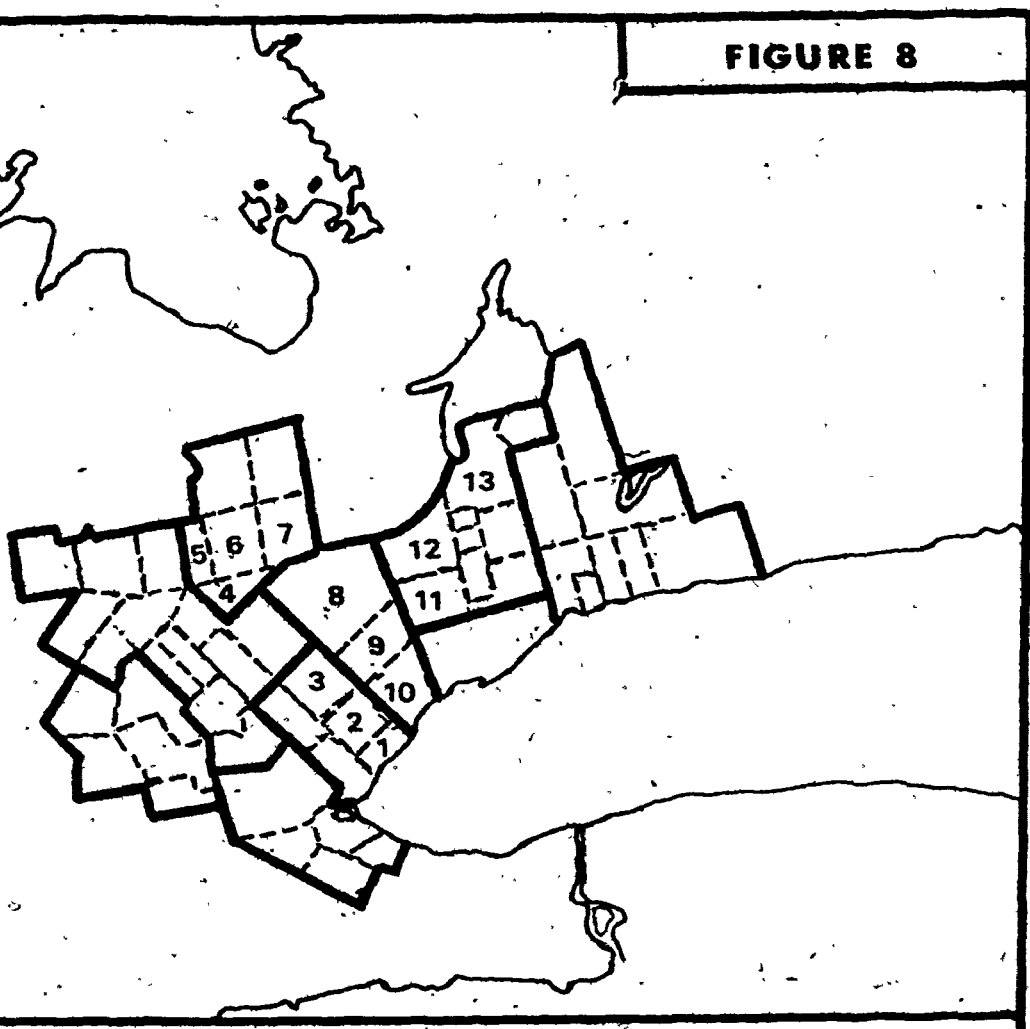
CHAPTER VI

ANALYSIS OF RECREATIONAL SPACE

The inventory of recreational space in the Town of Caledon and other western Toronto Centred Region townships used data compiled from the Ontario Ministry of Natural Resources' TORPS survey. All types of land uses dealing directly and indirectly with outdoor recreation and sports were listed e.g. parks, playing fields, motel accommodation, etc. Information included the exact location of each site, the jurisdiction of each land owner, user restrictions, user capacity and the facilities available. Thirteen townships, which represented Zones 1, 2 and 3 of the Toronto Centred Region, were selected for the analysis (Figure 8). Table 9 lists the townships, their TCR zone, the percentage of their total land area devoted to recreational uses and the absolute acreages of recreational land.

In 1977, there were 51,518 acres of recreational land in these 13 townships. At 10 acres per 1,000 people, this land could supply recreational space for 5,151,780 people, or at 15 acres per 1,000 people, for 3,451,693 people. Six townships, Oakville, Milton, Mono Vaughan, Brampton and Caledon had relatively large proportions of

FIGURE 8



TOWNSHIPS USED IN RECREATIONAL ANALYSIS

county line
township line

Halton
1 Oakville
2 Milton
3 Halton Hills

Dufferin
4 Garafraxa East
5 East Luther
6 Amaranth
7 Mono

Peel
8 Caledon
9 Brampton
10 Mississauga

York
11 Vaughan
12 King
13 Gwillimbury East

Table 9: Recreational Space in Sample Townships

township	zone	rec. land (acres)	% total area	pop. 1976
Amaranth	3	1,376.8	2.10	2,358
Brampton	1	4,087.0	6.79	103.459
Caledon	2	11,363.7	6.49	22,434
East Luther	3	79.9	0.21	860
Garafraxa E.	3	192.8	0.48	11.546
Gwillimbury E.	2	2,250.0	3.71	10,635
Halton Hills	2	2,619.4	3.95	34.477
King	2	2,949.7	3.52	14.030
Milton	2	10,423.4	12.36	20,756
Mississauga	1	2,921.7	4.32	250.017
Mono	3	5,212.7	7.23	3,780
Oakville	1	3,111.4	13.45	68.950
Vaughan	2	4.929.3	7.24	17,782

land in recreational uses and the largest absolute acreages of recreational land. The Town of Caledon had more than twice the acreage of all but one other area, Milton.

Table 10 shows the distribution of acreages according to which type of jurisdiction provided the land. All those townships mentioned above had high percentages of public recreational land. Townships with low federal, provincial or regional recreational space also tended to have low municipal contributions. Sites in these townships were provided mainly by commercial enterprises, with the exception of King, which had a high institutional component. There was no apparent relationship between the size of the local population and the jurisdiction of the majority of the recreational land. Both small and large population areas had high and low levels of public and commercial facilities.

It was not the intent of this analysis to produce any sort of supply-demand index that would have to incorporate the effects of distance, alternate opportunities, and site attractiveness. A simple tabulation of acreages and the 1976 population for each township indicated areas of relatively high or low recreational space with regard to potential demand.

Areas with large populations, as expected, had the lowest per capita acreages. The ratios ranged from less than one person per acre in Mono Township, Dufferin County

Table 10: Jurisdiction of Recreational Land - Percentages[1]

township	fed.	prov.	reg.	mun.	comm.	priv.	insti.
Amaranth	-	0.03	99.97	-	-	-	-
Brampton	-	-	49.99	23.65	21.45	4.82	-
Caledon	-	14.64	52.50	0.38	18.16	10.91	3.41
East Luther	-	-	28.91	4.13	62.58	4.38	-
Garafraxa E.	-	-	70.54	19.92	-	0.20	9.34
Gwillimbury E.	-	-	34.71	1.20	55.64	8.31	0.13
Halton Hills	-	-	62.18	2.41	22.12	4.20	5.34
King	-	-	21.92	4.29	21.02	0.62	53.72
Milton	-	0.24	39.56	1.58	12.96	44.22	1.44
Mississauga	1.57	3.78	24.27	20.56	49.47	0.34	-
Mono	-	44.76	21.58	-	19.49	6.46	7.73
Oakville	0.01	61.71	3.67	10.79	16.71	3.79	3.21
Vaughan	-	0.47	77.44	0.62	20.25	0.57	0.65

[1]Tourism and Outdoor Recreation Planning Study Committee, Ontario Recreation Survey: Tourism and Outdoor Recreation Planning Study, Progress Report No. 2, (Toronto, 1974).

(Zone 3) to 86 people per acre in Mississauga, Regional Municipality of Peel (Zone 1). The Town of Caledon was tied for second rank with only two people per acre.

What these figures do not show is the effect of the large urban population of metropolitan Toronto, or for that matter, Hamilton, Guelph or Kitchener-Waterloo whose people could easily use these sites for one-day recreational outings. The combined population of the 13 townships in 1976 was only 551,084 but the total population of the counties outlined in Figure 8 was 4,030,968 with over 90% classified as urban. Admittedly, these areas would supply additional recreational space but the total acreage needed to supply metropolitan Toronto alone would be 31,864, or 21,243 acres, depending which space standard was utilized.

The 51,518 acres apparently meet the recreational space requirements of this heavily-urbanized part of Ontario. Pearson stated that a recreational space deficit already existed in Southern Ontario but he based his calculations solely on provincial park acreages and did not consider other sectors which supply recreational opportunities[2].

However, this approach might be more accurate. The acreages of the TORPS survey must be analysed more carefully

[2]N.B. Pearson, The Great Get-Away: The Quest for Outdoor Recreation, (Guelph, Ont.): University of Guelph, Centre for Resources Development, 1968).

in order to ascertain whether the total area was actually available for recreational use by the general public. These acreages included parking areas, conservation areas not used for recreation, reforestation areas and provincial park reserve lands as yet undeveloped for intensive use. Information provided from personal communication with the Metro Toronto and Region Conservation Authority stated that of 10,599 acres, only 10% or 1,060 acres were actually used for recreation.[3]

Table 10 shows that private and institutional acreages represented 9,744 acres or 18.9% of the total 51,518 recreational acres found in the 13 townships. Subtracting these acres which had restrictions against use by the general public. 41,774 acres remain. On average, Zone 2 townships had a higher proportion of recreational land under private ownership than either Zone 1 or Zone 3 townships.

Other acreages had another type of restriction on users, in this case financial. Although charges for such activities as camping are usually minimal at commercial establishments, fees for such activities as golfing, horseback riding and pleasure flying are often not, and these are all extensive users of recreational land in the study townships. In addition. these sports require some experience or investment in lessons which many people do not have,

[3]MTRCA, personal letter, November 20, 1977.

can not afford, or have no interest in acquiring. These are also sports which are not participated in by many population groups. In a survey by Yewer and Heit[4] golf, horseback riding and equestrian sports ranked 12th, 18th and 43rd respectively among 45 sports with 13.9%, 9.6% and 0.3% of the respondents having participated once in each sport in the 12 months prior to the survey. In the acreage survey, no figures were available differentiating between horseback-riding establishments which catered to a pay-as-you-ride type of clientele or more experienced riders participating in show-jumping or dressage (equestrian sports). In the 13 townships, golf courses, equestrian facilities and small airports covered 5,781 acres, or 52.3% of the commercial acreage and 11.22% of the total recreational acreage.

In total, approximately 15,525 acres or 31.6% of the recreational space in the 13 sample townships, were inaccessible to the general public due to user or financial restrictions. This figure does not include undeveloped park sites such as the 506 acre reserve for the Forks of the Credit Provincial Park in the Town of Caledon or Conservation Authority land not used for recreation. Perhaps, with these acreages included, land which was completely inaccessible or

[4]M. Yewer and M. Heit, Recreation Patterns in Ontario:A Statistical Profile, (Toronto: Ministry of Culture and Recreation, 1975).

had limited accessibility could comprise up to 50% of the recreational acreages. The remaining 26,759 acres could provide recreational space for only 2,575,900 or 1,725,853 people, depending which space standard was used.

The number and the percentage of total facilities by type are listed in Table 11 for the Town of Caledon. The Regional Municipality of Peel had 247 sites or 22.3% of all recreational facilities and these were evenly divided among the three municipal sub-divisions. These figures are slightly misleading, though, as a large number of small urban parks in Mississauga and Brampton contributed the majority of sites in these areas.

The Town of Caledon was well-supplied with golf courses and downhill skiing centres relative to the other townships. There were 655 sites available to the general public in the Town's campgrounds. Eight vacation camps were located here but only one was operated on a commercial basis. An above average number of fishing areas was found here, but only one was open to the public. The trails located in the Town provided a variety of sports opportunities; 11 for hiking, 9 for cross-country skiing, 9 for horseback riding and 2 for snowmobiling.

Many establishments were available only to specific users; 14 or 16% of the total facilities in the Town and 14.3% of the acreage fell in this category. Caledon had

Table 11: Recreational Facilities in the Town of Caledon

type	number	% of total
golf	4	21.1
downhill skiing	2	16.7
camping	9	16.4
vacation camp	8	16.0
nature exhibit	4	13.3
fishing	3	13.0
fairgrounds	2	12.5
racetracks	1	11.1
trails	22	9.3
picnic areas	18	6.3
beaches	7	5.2
boat rental	1	3.9
accommodations	5	3.6
hunting	0	0.0
boat docking	0	0.0

Table 12: Agricultural Capability of Land Used for Recreation

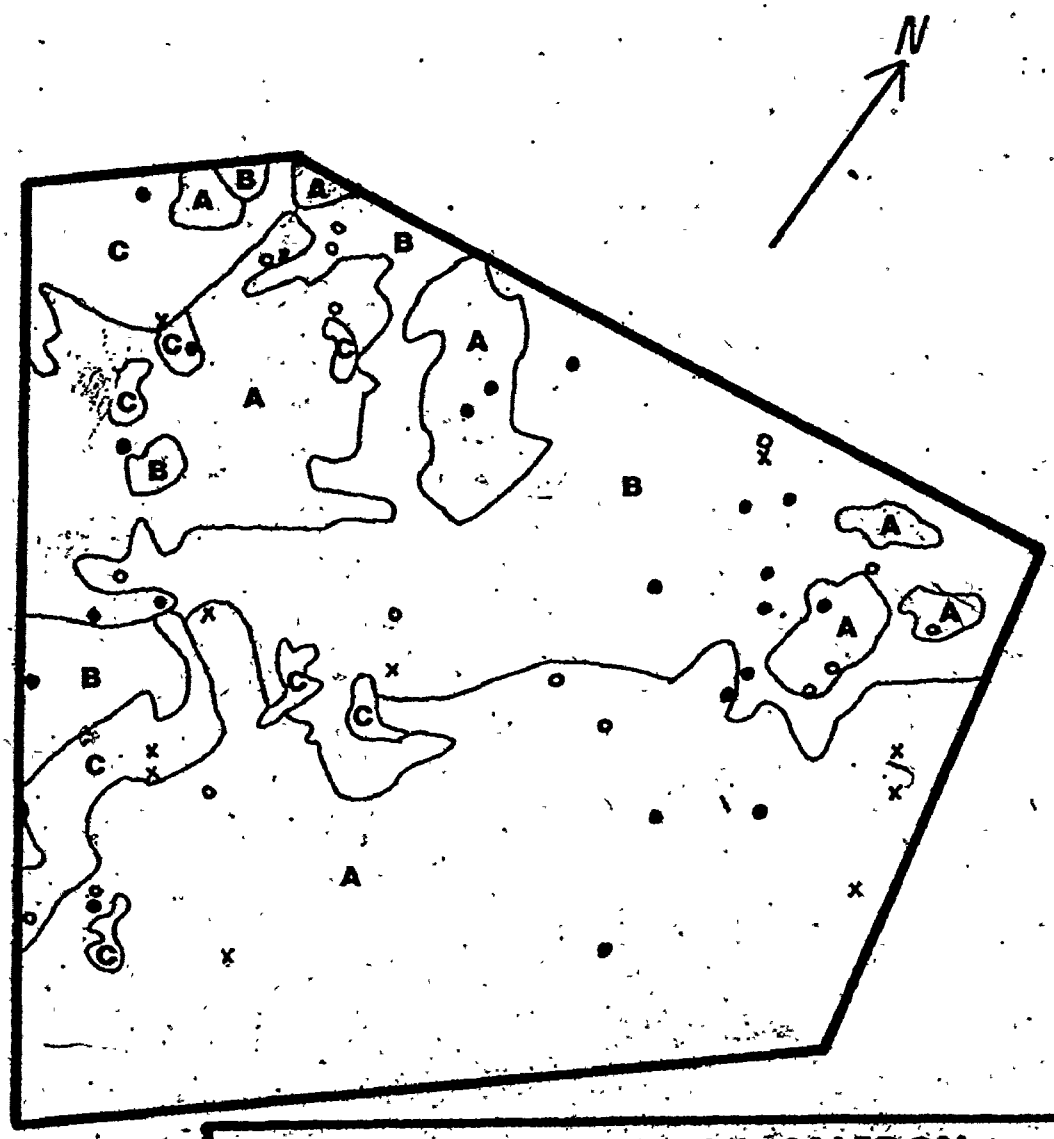
class	total acreages	public	comm.	pr/inst.
1 - 3	49.8%	44.2%	69.0%	66.0%
4 & 5	37.5%	41.5%	31.0%	7.8%
6, 7 & Org.	12.7%	14.3%	1.0%	26.2%

one of the highest percentages of land inaccessible to the general public, after King and Milton which had very high percentages of institutional and private acreages respectively (Table 10). In addition, four commercial golf clubs, representing 931 acres, had substantial membership fees and the Credit Forks Park Reserve and other undeveloped parkland (746 acres) and regional forests (2,022 acres) had some restrictions on use. This represented 3,699 or 31.2% of the Town's recreational space. Therefore, in total, 45.5% of the recreational land in the Town of Caledon had some restrictions on use.

Figure 9 shows the spatial distribution of all recreational sites in the Town of Caledon which were 25 acres or larger in size. Of the 48 sites, almost 50.0% were situated on class 1 to 3 agricultural soils (Table 12). Nearly 40.0% were on class 4 or 5 soils. Only approximately 10.0% were on land with very little or no agricultural value or organic soils.

The largest percentage of recreational land, 66.2%, was publicly owned while 18.4% was in commercial recreational use and 15.4% was owned by private or institutional groups. These three types of ownership had different agricultural land-use patterns. Publicly owned land had the most even distribution among the three classes but even these recreational sites were concentrated on class 1 to 3 soils.

FIGURE 9



TOWN OF CALEDON

RECREATIONAL SITES > 24 ACRES

A	cl. 1-3 agr. soils	•	public ownership
B	cl. 4&5 agr. soils	o	commercial ownership
C	cl. 6,7 & organic soils	x	priv./instit. ownership

0 — 10 km.

Commercial sites and private/institutional sites had even greater concentrations on these soils, 69.0% and 66.0% respectively. Publicly-owned sites and commercially operated sites had their second greatest concentrations on class 4 and 5 soils while the private/institutional group had their second highest concentration on very poor agricultural soils.

These figures show that recreational space in the Town of Caledon is heavily concentrated on the better agricultural soils, although the area is amply supplied with poor agricultural soils.

The inventory of recreational space in the western section of the Toronto Centred Region indicated that the raw acreages were adequate to serve the local and metropolitan Toronto populations. Zone 2 townships were major suppliers of recreational space with an average of 6.0% of their total areas under recreational uses. However, the inclusion of many restricted-access institutional and privately-owned acreages masked the fact that a large amount of recreational space was not available to the general public. Other acreages had financial restrictions and/or were geared to specific "elite" sports e.g. golf, equestrian sports or flying. In addition, many park acreages were not yet in use and Conservation Authority figures included large acreages not used for recreation.

The Town of Caledon had a relatively large proportion of all facilities, but again, a large number of acres were inaccessible to the general public. A large percentage, 49.8%, of all sites 25 acres or larger in size were situated on class 1 to 3 agricultural soils. Public, commercial and private or institutional sites were all concentrated on these soils, especially the commercial sites.

The problems which exist in the supply of recreational facilities are the types of acreages which are supplied and what population groups benefit from the space, and the tendency for recreational uses to be concentrated on good agricultural land, rather than in the scenic areas more suited to recreation than agriculture.

CHAPTER VII

ANALYSIS OF LOT FRAGMENTATION TRENDS

The fragmentation of 100-acre lots into a number of smaller parcels is one of the more noticeable results of urbanization pressures in a rural area as non-residents purchase land, either as an investment or as a site for a rural home. If this type of land ownership pattern develops in an area, it marks a transition from a situation of relatively few land holdings to many holdings more characteristic of an urban than rural area. If it is desirable to keep an area essentially rural in character. it is necessary to curtail such land fragmentation activities. As the Town of Caledon has been designated a "rural, open space" area in the Toronto Centred Region, a description of the extent of this land fragmentation activity in the Town is important to the formulation of planning policy.

Details of land sales within the Town of Caledon between 1955 and 1977 were obtained from land registry rolls for 179 100-acre sample lots. The lot distribution among the four former township sampling areas was Albion 35% (62 lots), Caledon East 22% (40 lots), Caledon West 25% (44 lots) and northern Chinguacousy 18% (33 lots).

Branching tree diagrams were drawn in order to trace land holdings back to the original 1955 owner or owners. The parcel sizes and names of the 1976 owners were compared to assessment data for that year to ensure accuracy. In addition, the number of parcels per sample lot were gathered for the year 1877 from Pope's Historical Atlas of Peel County, Ontario[1] to determine the amount of fragmentation which had occurred over the 88 years prior to the study period.

The frequency distributions of numbers of parcels per lot is given in tabular form in Table 13 and in graphic form in Figure 10 for the years 1877, 1955, 1960, 1965, 1970 and 1977.

i. Changes in Proportion of Parcel Classes

In order to justify planning intervention i.e. controls on land sales, a significant increase in the number of land holdings had first to be proven. The frequency histograms of Figure 10 indicate a marked decrease in the number of one-parcel lots and a corresponding increase in the number of lots with more than two parcels. A test of difference of proportion was used to determine the significance of these changes.[2]

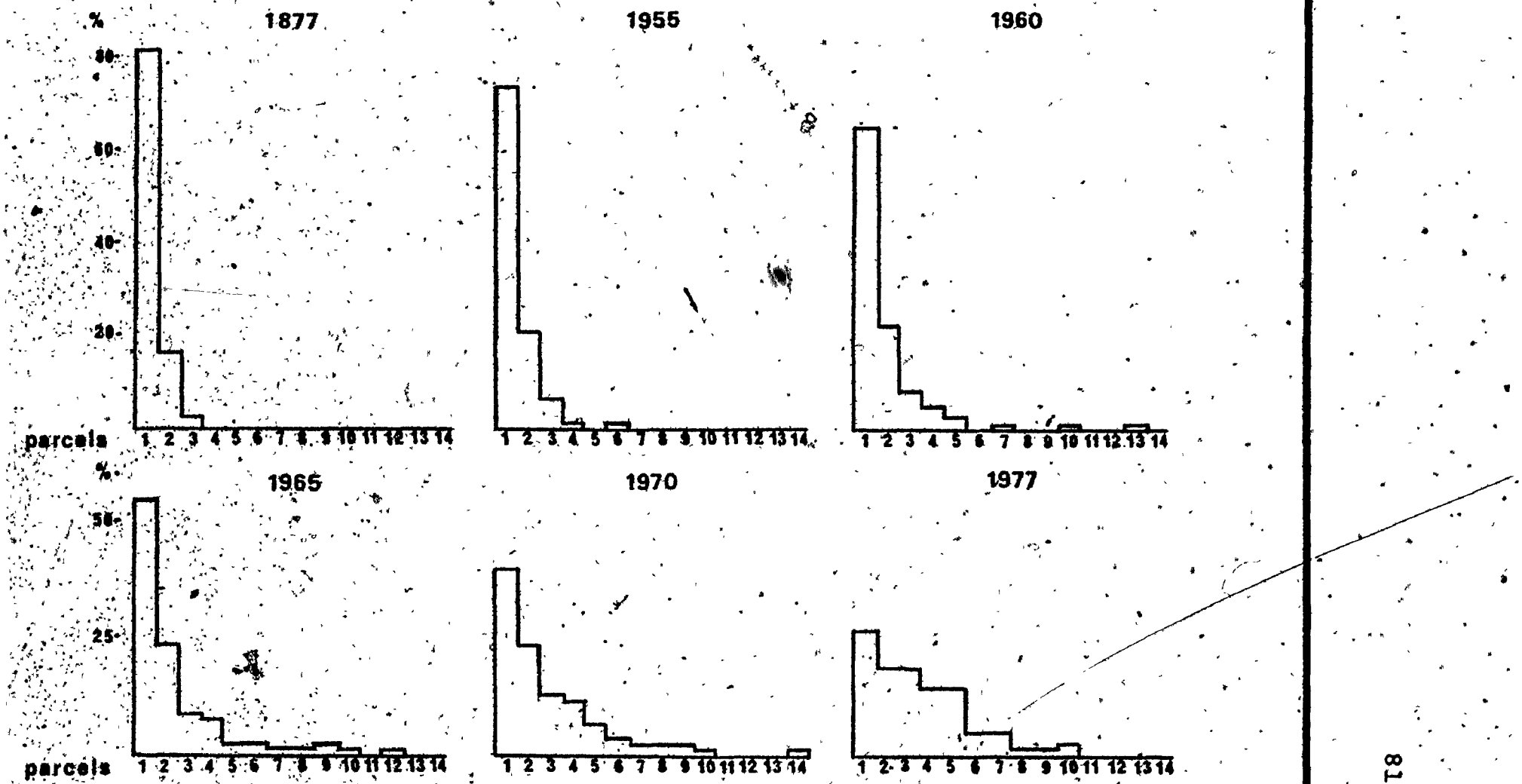
[1] J.H. Pope, Historical Atlas of Peel County, Ontario. (Toronto: Walker and Miles, 1877).

Table 13: Frequency Distribution of No. of Parcels per Lot
N = 179

date	parcels/	no.	%	date	parcels/	no.	%
1877	1	146	81.56	1955	1	130	72.63
	2	29	16.20		2	36	20.11
	3	4	2.24		3	11	6.15
	4	-	-		4	1	0.56
	5	-	-		5	-	-
	6	-	-		6	1	0.56
	7	-	-		7	-	-
	8	-	-		8	-	-
	9	-	-		9	-	-
	10	-	-		10	-	-
	11	-	-		11	-	-
	12	-	-		12	-	-
	13	-	-		13	-	-
	14	-	-		14	-	-
1960	1	114	63.69	1965	1	97	54.19
	2	38	21.23		2	41	22.91
	3	13	7.26		3	14	7.82
	4	7	3.91		4	13	7.26
	5	4	2.24		5	4	2.24
	6	-	-		6	4	2.24
	7	1	0.56		7	1	0.56
	8	-	-		8	1	0.56
	9	-	-		9	2	1.12
	10	1	0.56		10	1	0.56
	11	-	-		11	-	-
	12	-	-		12	1	0.56
	13	1	0.56		13	1	0.56
	14	-	-		14	-	-
1970	1	69	38.56	1977	1	46	25.70
	2	41	22.91		2	32	17.88
	3	21	11.73		3	32	17.88
	4	19	10.61		4	23	12.85
	5	11	6.15		5	23	12.85
	6	6	3.25		6	8	4.47
	7	4	2.24		7	8	4.47
	8	3	1.68		8	1	0.56
	9	3	1.68		9	1	0.56
	10	1	0.56		10	4	2.24
	11	-	-		11	-	-
	12	-	-		12	-	-
	13	-	-		13	-	-
	14	-	-		14	-	-

FIGURE 10

PARCEL CLASS DISTRIBUTION OF LOTS
N = 179



The 1955 distribution was similar to the 1877 distribution with over 90% of the sample lots having only one or two parcels. A test of difference of proportion showed that statistically, the proportions of one-parcel lots at both dates had been drawn from the same population. The obtained z score of 1.5 fell below the critical value at the 95% confidence level. During the 88-year time period, land ownership patterns in the Town had remained remarkedly stable.

Significant changes in the proportion of one-parcel lots were expected within the 22-year study period. However, comparisons of proportions at five-year intervals did not show significant differences as all z scores fell below the critical value. The null hypothesis that these pairs of proportions were drawn from the same population had to be accepted. Significant differences in proportion did exist, however, between dates marking the beginning and end of ten-year periods.

Changes in the proportions of one-parcel lots throughout the study period were not characterized by large decreases in short periods, but by a slower, steady decrease in their numbers which produced a very different pattern of land ownership in 1977 than what had existed in 1955.

The 1977 distribution (Figure 10), despite fragmentation processes, still was heavily skewed to the left

indicating a high proportion of lots with one, two or three parcels; 87% of the sample 100-acre lots contained five or fewer parcels but, 74.3% had more than one parcel and 56.42% had more than two. The percentage of one-parcel lots had decreased by 49.63% since 1955 and the percentage of lots with more than two parcels had increased by 49.15%.

The largest decreases and increases in proportion occurred in the last half of the study period. The proportion of one-parcel lots did not decrease as much between 1970 and 1977 as in the previous five-year period but the proportion of lots with more than two parcels continued to increase (Table 14). Perhaps the Town is slowly approaching a base population of owners who do not want to fragment their 100-acre holdings at the present time. Increases in the number of parcels in the future then, would be the result of continued fragmentation of previously-divided lots. To determine whether this is the start of a new trend, an analysis of the 1977 to 1980 period is needed. The effect of severance regulations should also be examined in conjunction with land fragmentation patterns.

ii. Spatial Variation of Lot Fragmentation Trends

The pattern of lot fragmentation was not uniform in the Town of Caledon, as shown by the frequency histograms for each of the four former townships (Figures 11 and 12).

Table 14: Proportion and Changes in Proportion of One-Parcel Lots and Lots with more than Two Parcels

date	% of lots with one parcel	% of lots with more than two parcels
1877	81.56	2.24
1955	72.63	7.27
1960	63.69	15.08
1965	54.19	22.90
1970	38.56	38.53
1977	25.70	56.42

period	change in prop. of lots with one parcel	change in prop. of lots with more than 2 parcels
1877-1955	-8.93%	5.03%
1955-1960	-8.94%	7.82%
1960-1965	-9.50%	7.81%
1965-1970	-15.63%	15.63%
1970-1977	-12.86%	17.89%

These values are derived from Table 13.

FIGURE II

PARCEL CLASS DISTRIBUTION OF LOTS

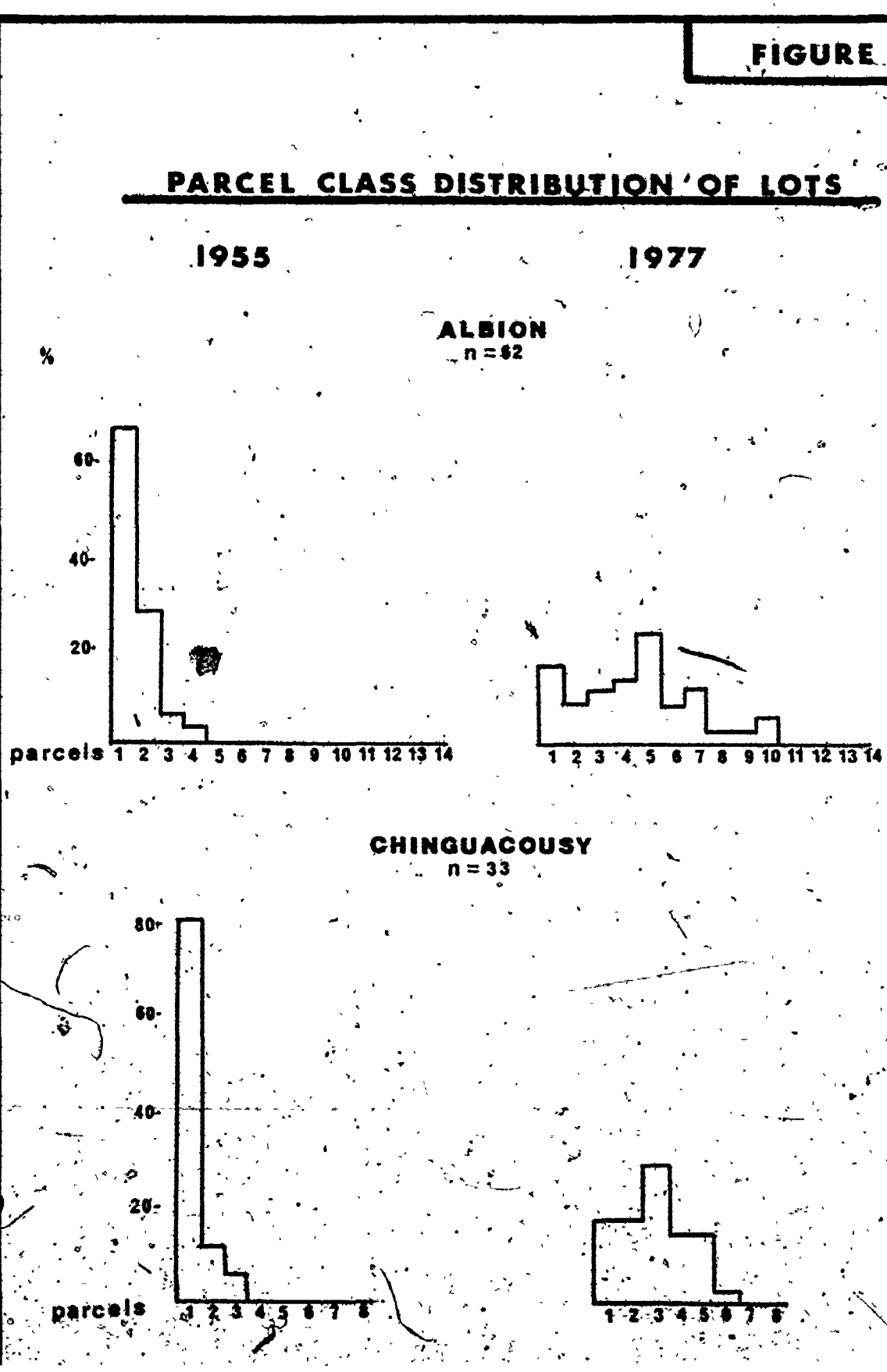
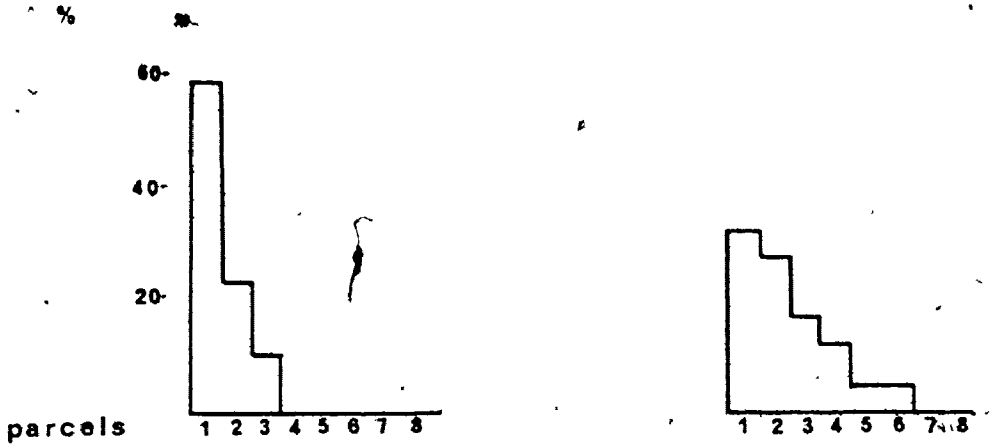


FIGURE 12

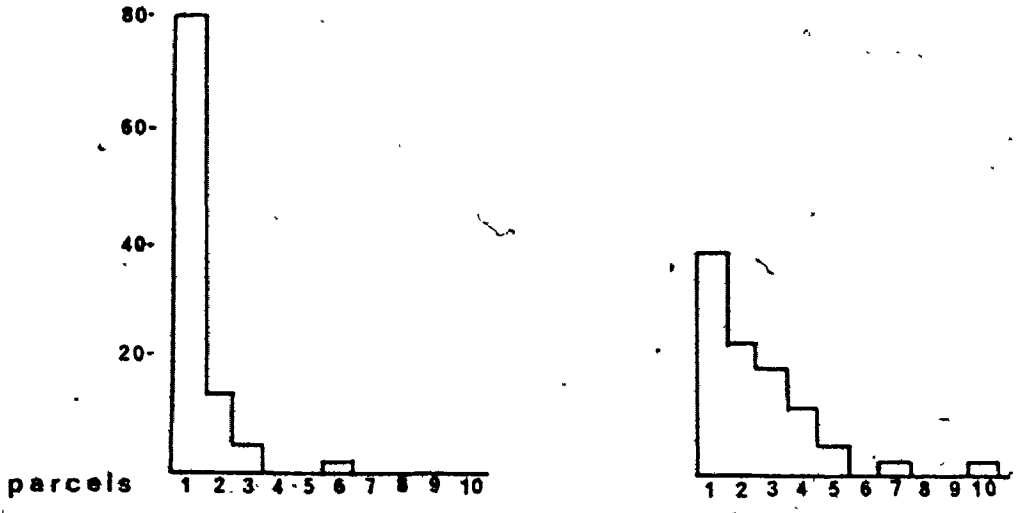
PARCEL CLASS DISTRIBUTION OF LOTS

1955 1977

CALEDON EAST
n = 40



CALEDON WEST
n = 44



By 1977, the sample lots from Albion and Chinguacousy approached a normal distribution while those of Caledon East and Caledon West were still skewed to the left. Only 38.64% of the lots in Caledon West had more than two parcels while Caledon East had only 40.0% in this category, compared to Albion with 75.18% and Chinguacousy with 63.64%.

This trend of greater lot fragmentation activity in Albion and Chinguacousy can not be related to a higher initial proportion of lots with more than two parcels. In 1955, Albion and Chinguacousy had the lowest proportions of lots in this category, 6.45% and 6.06% respectively while Caledon East and Caledon West had 10.00% and 6.83% respectively. The greater amounts of fragmentation activity in these two former townships perhaps may be explained by the greater accessibility that they have to metropolitan Toronto. If this relationship is supported in the later regression analysis, it would suggest that lot fragmentation has been guided by potential commuter residence location rather than less location-conscious investment interest.

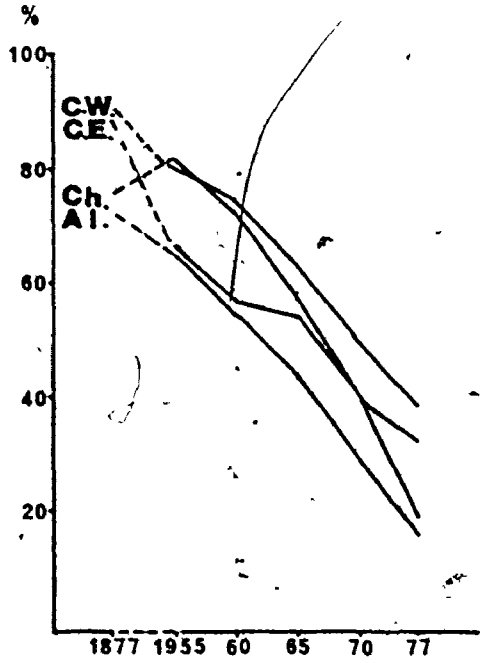
Spatial variations in the number of parcels per lot were also found within the former township of Albion. Although a large amount of averaging was done in this analysis to produce values for concessions (north/south oriented blocks) and blocks (east/west oriented blocks), a pattern emerged in the south and east sections of the township

showing higher frequencies of heavily fragmented lots. Lowest values were found in the northwest section which also has the greatest straight-line distance to downtown Toronto. High values along the centre of the township perhaps can be explained by the presence of Airport Road and Highway 50, two major highways leading to Toronto.

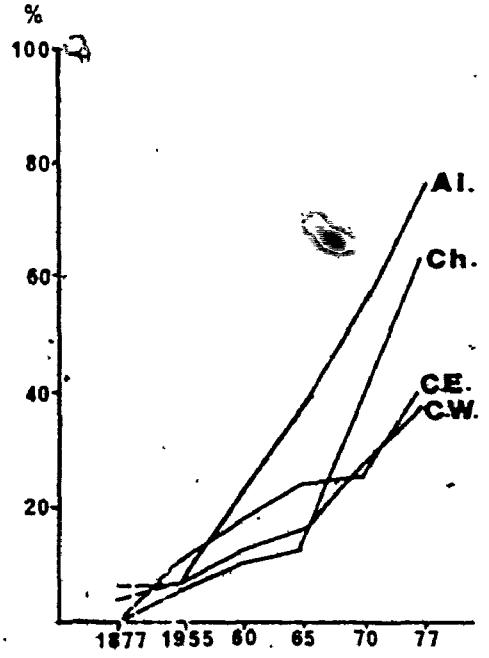
A brief analysis of the changing proportions of the parcel per lot classes re-affirmed the belief that land fragmentation trends in Albion and Chinguacousy differed from those in Caledon East and Caledon West. Figure 13 shows the decreases and increases through time in the proportion of one-parcel lots and lots with more than two parcels for each township. Decreases and increases in Albion and Chinguacousy were more pronounced, especially in the later periods. Only Chinguacousy showed an increase in the proportion of one-parcel lots (between 1877 and 1955) perhaps due to farm consolidation in this good agricultural area. However, in the last two periods, Chinguacousy had the most intense land fragmentation activity. This former township had both the largest decreases in the proportion of one-parcel lots and the largest increases in the proportion of lots with more than two parcels. From 1965 to 1977, Chinguacousy increased its proportion of lots in the latter category by 51.51% while Albion's increased by 40.32%, Caledon West's by 22.72% and Caledon East's by only 15.00%. In addition, only

FIGURE 13

CHANGING PROPORTIONS OF 1-PARCEL LOTS



CHANGING PROPORTIONS OF LOTS WITH MORE THAN 2 PARCELS



Chinguacousy's lots increased their rate of fragmentation in the last period. The other three townships showed a decreasing rate of parcel creation. As the best agricultural area in the Town of Caledon, this land fragmentation in Chinguacousy does not coincide with the stated government policy of preserving large tracts of land for agriculture.

iii. Stability of Lots with Regard to the Number of Parcels

Counter to the phenomenom of instability in the number of parcels per 100-acre lot through time, is the fact that some lots did remain in the same state. Some lots were maintained as intact one-parcel lots or, when some additional parcels were created, the fragmentation process did not continue and the number of parcels remained constant throughout the remainder of the study period. Tables of the state of each lot were compiled for five dates; 1955, 1960, 1965, 1970 and 1977 in order to study this phenomenom. From these, transition matrices for each time period e.g. 1955 to 1960 were compiled which could be used to predict the probability of transitions from state to state The probabilities of lots remaining in the same state are shown in Table 15.

The probability of a lot remaining in the same state for all periods between 1955 and 1977 tended to decrease as the number of parcels per lot increased, until a certain number of parcels per lot was reached. Only those parcel classes with more than five sample lots were studied, which

in this analysis, were those lots with seven or fewer parcels per lot.

The seven states could be divided into three groups of low, medium or high stability. The average probability of state stability for the entire 22-year period was used for this classification. In general, those lots with the greatest number of parcels were the most stable, those with one or two parcels per lot had medium stabilities and those with three to five parcels per lot were the least stable. This supports the theory that once lot fragmantation has been initiated, without controls on land sales, it will continue to a certain point, which this analysis suggests to be six or seven parcels.

Through time, two trends were evident. For lots with one to three parcels, the probability of remaining in the same state decreased through time (Table 15). In contrast, the lots with five or six parcels had a greater probability of remaining in the same state in the later periods. The lots with seven parcels were equally stable in all time periods.

These analyses through time and for varying numbers of parcels per lot indicated that today, the least stable lots are those with three of four parcels and the most stable are those with five to seven parcels.

The state stability of lots also varied among the four former townships. Chinguacousy had the least stable lots with

Table 15: Probability of State Stability

period	1 - 1	2 - 2	3 - 3	4 - 4	5 - 5
1955-1960	.86	.78	.73	1.00	-
1960-1965	.85	.74	.54	.71	.25
1965-1970	.71	.61	.71	.54	.75
1970-1977	.67	.56	.62	.68	.91

period	6 - 6	7 - 7	8 - 8	9 - 9	9+ - 9+
1955-1960	-	-	-	-	-
1960-1965	-	1.00	-	-	1.00
1965-1970	.75	1.00	1.00	1.00	1.00
1970-1977	.83	1.00	.33	.33	1.00

N = 179

an average state stability of 0.67 and Caledon East's were the most stable with a transition probability of 0.71. Through time, average state stability for all states decreased from a probability of 0.81 in the 1955 to 1960 period to a transition probability of 0.61 in the 1970 to 1977 period (Table 16). Chinguacousy, the most stable area at the beginning of the study period, became the least stable area by 1965. Stability also decreased as the number of parcels per lot increased. Again, Chinguacousy had some of the lowest stabilities for one and two-parcel lots.

Despite these variations in lot stability, throughout the study period, the largest transition probabilities were those representing the probability of a lot remaining in the same state. In all transition matrices, the largest frequencies were found along the diagonals indicating no state change. In the majority of cases, the second highest probabilities were a transition to the next parcel class, indicating the creation of only one new parcel on the lot in the five-year period. For all time periods and all initial states, the average probability of a lot remaining in the same state or moving to the next one was 91%. This suggests once again a process of gradual lot fragmentation rather than an abrupt transition from one to many parcels per lot. This tendency for no or only small state changes has been stronger since 1965 than in the 1955 to 1965 period.

Table 16: Transition Probabilities

A: state stability - states 1 to 3, varying time periods

1955-1960		1960-1965		1965-1970		1970-1977	
Ching.	.88	Cal. W.	.78	Albion	.69	Cal. E.	.67
Albion	.88	Cal. E.	.78	Cal. E.	.67	Cal. W.	.64
Cal. W.	.75	Ching.	.76	Cal. W.	.64	Albion	.56
Cal. E.	.74	Albion	.66	Ching.	.47	Ching.	.55
$\bar{x}$	= .81	$\bar{x}$	= .75	$\bar{x}$	= .62	$\bar{x}$	= .61

B state stability --- entire study period, varying states

1 - 1		2 - 2		3 - 3	
Cal. E.	.84	Cal. E.	.81	Albion	.77
Cal. W.	.83	Cal. W.	.65	Ching.	.65
Albion	.71	Ching.	.64	Cal. E.	.63
Ching.	.71	Albion	.62	Cal. W.	.61
$\bar{x}$	= .77	$\bar{x}$	= .68	$\bar{x}$	= .67

This perhaps indicates the importance of severance controls on the land fragmentation process.

iv. Size Class Distribution of Sample Parcels

The previous section described the changes in the number of individually-owned parcels. An analysis of the size of the parcels provided additional information on the pattern of land ownership in th Town of Caledon in 1977.

Trends in severance activity and the effects of severance controls on land sales were evident in the parcel size distribution of the sample lots for the Town as a whole and for the individual former townships (Table 17). As expected, the largest percentage of the total number of parcels, 42.3%, was in the smallest size class, representing land holdings of 10 acres or less. Relatively larger percentages in classes 2, 3, 5 and 10 reflected the 10-acre severance restriction, the 25-acre severance restriction[3], lots with two 50-acre parcels originally and relatively intact 100-acre lots, respectively.

As so many parcels were 20 acres or less in size, the first two classes were broken down further (Table 18). Once again, larger frequencies in the 10 acre size class reflect the 10-acre severance restriction.

[3]J. Punter, op. cit., p. 161.

Table 17: Parcel Size Distributions - Percentage of Township Totals

size class (acres)	Albion n=62	Ching. n=33	Cal. E. n=40	Cal. W. n=44
0 - 10[1]	49.2	49.0	30.0	32.5
10.1 - 20[1]	18.1	1.0	15.4	11.4
20.1 - 30[2]	7.1	10.4	5.5	11.4
30.1 - 40	2.9	3.1	5.5	2.6
40.1 - 50[3]	5.8	5.2	5.5	12.3
50.1 - 60	1.7	3.1	5.5	3.5
60.1 - 70	0.8	0.0	0.0	0.0
70.1 - 80	1.3	0.0	4.4	1.8
80.1 - 90	0.8	2.1	5.5	0.9
90.1 - 100[4]	8.8	24.0	15.4	14.0
100.1 +	3.4	2.1	7.7	9.6

[1] 10-acre severance restriction
[2] 25-acre severance restriction
[3] lots with two 50-acre parcels originally
[4] original 100-acre lots

Table 18: Parcel Size Distribution - Percentage of Township Total

size class (acres)	Albion n=62	Ching. n=33	Cal. E. n=40	Cal. W. n=44
0 - 2	26.1	43.8	12.1	8.8
2.1 - 4	8.4	1.0	9.9	9.6
4.1 - 6	3.4	1.0	2.2	4.4
6.1 - 8	1.7	0.0	2.2	3.5
8.1 - 10[1]	9.7	13.5	3.3	6.1
10.1 - 12	8.8	0.0	4.4	2.6
12.1 - 14	2.1	0.0	6.6	4.4
14.1 - 16	0.4	0.0	1.1	0.0
16.1 - 18	4.2	0.0	0.0	1.8
18.1 - 20	2.5	1.0	3.3	2.6

[1] 10-acre severance restriction

General land-use descriptions were listed in the assessment for each parcel. Residential parcels composed 73.1% of the holdings 20 acres or smaller in size; 64.4% were non-farm residences (RU) while 8.7% were small farms (FRU).

As in the pattern of lot fragmentation, there were spatial variations among the former townships with regard to the parcel size distribution of their sample lots. Albion and Chinguacousy had respectively 49.2% and 49.0% of their sample parcels in the 10 acres or less class, while Caledon East and Caledon West had only 30.0% and 32.5%. Albion also had a relatively large percentage of parcels in the 10.1 to 20 acre and the 20.1 to 30 acre classes. These were probably land sales affected by the severance restrictions mentioned earlier. Chinguacousy, however, had very few parcels in any other class except the 90.1 to 100 acre class. Of the 49 small parcels (smaller than 20 acres), 42 or 86% were two acres or smaller in size. These figures show, that in this area of the Town, the past pattern of land sales involved the severance of only one or two small parcels from 100-acre holdings. Residences were found on 81.3% of these small parcels compared to only 63.1% in Albion. This indicates that, at least, there are not as many small, idle parcels on the good agricultural soils of Chinguacousy as there

are on the poorer soils of Albion. Overall, the large number and proportion of small parcels in both these townships again indicate a more active land market in those areas of the Town nearest to Toronto.

The townships of Caledon East and Caledon West had a relatively minor role in the provision of residential parcels. Their parcel size distributions were more uniform with only about one third of their parcels in the 10 acres or smaller class. Only 12.1% and 8.8% respectively of their sample parcels were two acres or smaller in size. In both areas 78% of the small parcels had a residential structure..

v. First Order Markov Chain Analysis

The analysis of transition probabilities showed that the number of parcels per lot in the Town of Caledon had a marked tendency to remain stable or to increase by only one parcel in each five-year period. Some rudimentary analysis was undertaken to determine what processes govern the transitions from state to state when they do occur. A first order Markov chain analysis was chosen as its predictive ability, if this process was found to exist, would be useful in describing future land fragmentation patterns in the Town if development was allowed to continue under the present system of planning controls.

First order Markov chain theory[4] states that the state of a variable under study at time t + 1 is solely dependent on the state at time t. For example, in this study, the number of parcels contained by a lot in 1960 would depend entirely on the number of parcels in that lot in 1955.

Initially, the data set of 179 lots was tested to determine whether the number of parcels at a certain time was statistically independent of the number of parcels per lot in the previous time period. If this independence was proven, no further analysis on processes controlling state transitions would be necessary.

Under the hypothesis of independence, the proportion of sample lots which would make the transition from state i to state j between the time t and t + 1 would be equal to the product of the proportions of the total sample in each respective state at time t and t + 1. This proportion was then multiplied by the total number of sample lots to determine the actual number of lots which would make this transition given the concept of independence. In this manner, expected values were generated for four transition tables representing the periods 1955 to 1960, 1960 to 1965, 1965 to 1970 and 1970 to 1977. One criterion which was

[4] R.A. Howard, Dynamic Probabilistic Systems: Markov Models, (New York: John Wiley and Sons, 1971), chap. 1.

established was that lots could only remain in the same state or move into a higher state. Lot consolidation was not permitted (moving to a lower state) as allowing this type of transition would greatly distort the transition probabilities causing the expected values to differ very greatly from the observed data.

The matrices of expected values were then compared to the matrices of the observed values for each of the four periods and chi-squared tests were performed. All chi-squared values exceeded the critical value and so the null hypothesis, that state transitions were independent, was rejected and further analysis to determine the processes governing transitions was undertaken.

In first order Markov chain analysis, the probabilities of state transition between time t and t + 1 are used to determine the probabilities of state transition between time t + 1 and t + 2 and therefore the t + 2 distribution. The t to t + 1 matrix is squared to produce the t + 1 to t + 2 matrix and the resulting probabilities are converted, in this case, to the number of lots which would make each particular transition.

Only four states were used in this analysis, the one to four parcel states, in order to eliminate non-accessible states. If some state in the initial distribution had a zero probability of being entered, this would prevent entry

into that state at any time in the future.

Preliminary analysis of lot fragmentation trends indicated that the transition from few to many parcels per lot was not governed by a first order Markov chain process. The number of parcels per lot at one time period did not seem to determine the number of parcels which existed by the next period. Table 19 shows that the 1955 to 1960 transitions were not good indicators of parcel state distributions in 1965. A chi-squared goodness of fit test was used to compare observed and expected values. The chi-squared value fell below the critical value and the null hypothesis that these probabilities were not governed by a Markov process had to be accepted. The expected probabilities under-estimated the number of lots which remained in the one-parcel state and over-estimated those which would move to a higher parcel class.

The data was again tested using the 1960 to 1965 probability distribution as a starting point. The matrix derived was a good predictor of the distribution in 1970 but it could not be extended accurately to produce the 1977 distribution. The 1965 to 1970 distribution, when used as a starting point, under-estimated the stability of one-parcel lots and over-estimated the probability of transition of the other states, as the 1955 to 1960 distribution had done.

Table 19: Generation of Expected Values in Markov Analysis

p^2 =

1955 parcel class	1960 parcel class 1	2	3	4+
1	.86	.07	.02	.05
2	.05	.78	.05	.12
3	0	0	.73	.27
4+	0	0	0	1.00

=

	1	2	3	4+
1	.74	.11	.04	.11
2	.08	.61	.08	.23
3	0	0	.53	.47
4+	0	0	0	1.00

1960 to 1965

expected distribution — observed distribution

1960	1965 1	2	3	4+
1	84	12.5	5	12.5
2	3	23	3	9
3	0	0	7	6
4+	0	0	0	14

1960	1965 1	2	3	4+
1	97	12	2	3
2	0	28	5	5
3	0	1	7	5
4+	0	0	0	14

X^2 = 18.42

critical value at the 95% confidence level and 9 degrees of freedom = 16.92

From this brief analysis, one could conclude that the transition of lots from one parcel class to another is not governed by first order Markov chain processes. However, the tests of independence had shown that the transitions were not independent. One possibility is that the transition probabilities are the results of a higher order Markov chain sequence and that "waiting periods", before a change in state occurs, are a major controlling factor. The first order Markov chain analysis did tend to under-estimate the stability of one-parcel lots. If this process had been proven to exist in the fragmentation of lots in the Town of Caledon, some predictions could have been made concerning future trends in the Town.

There are several reasons why a first order Markov process using the number of parcels per lot as the transitory variable, has proven difficult to apply to this lot fragmentation analysis. First of all, the tendency to fragment was not constant through time. In the latter part of the time period, there was a greater demand for rural land for residential development. Also, the owner of a 100-acre parcel has several options available if he decides to sell some property. Options include severing one lot, severing several lots or selling one or more larger sections. The actual number of parcels created depends on the circumstance that the original owner(s) has (have) decided to sell,

rather than on the number of owners present. The number of sales which the owner decides to make reflects his financial situation, the use to which the land has been put, the availability of buyers and current controls on land sales, among other influences. The same is true of the fragmentation of 100-acre land areas which have more than one landowner. The responsibility for further parcel creation often rests with the major land holder and his decisions. As more parcels exist in a 100-acre area, the probability of further fragmentation will decrease rather than increase due to the fact that the major land holder has received sufficient financial returns from past sales and no longer needs to improve his financial position in this manner, but this will vary among owners. Creation of any more new parcels could interfere with the major land holder's reasons for owning the land, such as farming. Also, owners of small severed parcels would be unlikely to fragment their holdings.

Future attempts to understand processes governing land fragmentation trends should concentrate on identifying similar "types" of sellers with similar decision processes rather than actual numbers of sellers.

vi. Regression Analysis of Land-Use Variables Related to Variations in the Number of Parcels per Lot in 1977.

A stepwise multiple regression analysis was performed using the number of parcels per 100-acre lot as the dependent variable. The independent variables measured certain locational, physical and land-use characteristics of the lots believed to be linearly related to variations of the dependent variable. These variables are listed in Table 20 with each expected relationship to the dependent variable. Nominal variables were represented in the analysis by dummy variables. These are explained in Table 21. The ARDA agricultural capability variable was transformed into an interval scale with the use of Noble's index[5].

Three separate regressions were performed for each of the three types of variables. The seven variables contributing the greatest amount to the increase in their respective r^2 values were used in a final regression analysis. The interval variables all exhibited the expected relationships to the dependent variable. The dummy variables used indicated that a larger number of parcels per lot would be associated with the presence of a stream and a smaller number of parcels would be associated with gravel roads and shrub woodland vegetation covering over 75% of the lot.

[5]H.F. Noble, An Economic Classification of Farms in Eastern Ontario, (Toronto: Department of Agriculture, 1971).

Table 20: Independent Variables Used in the Analysis of Variations of the Number of Parcels per Lot

variable	description	type of data	relation to Y
1) physical characteristics			
TOPO	change in elevation within the 100-acre lot	interval	positive
WOOD	presence of a woodlot	nominal	-
DRAIN	presence of a stream or lake	nominal	-
AGRIC	soil capability for agriculture	interval	negative
REC	land capability for recreation	ordinal	positive
2) locational characteristics			
ROADTY	type of road surface on concession road	nominal	-
NOROAD	number of roads bordering the lot	interval	positive
DCOMM	straight-line distance to nearest low order goods commercial settlement	interval	negative
DMETRO	straight-line distance to downtown Toronto	interval	negative
3) land-use characteristics			
LANUS	intensity of agricultural land-use	nominal	-

(continued on page 108)

Table 20: continued

variable	description	type of data	relation to Y
TRANS	number of land transactions since 1955 excluding inheritances	interval	positive
NRES	number of residences on 3 neighbouring lots	interval	positive
NLANUSA NLANUSO NLANUSB	intensity of agricultural land use on the lots above, opposite and below (3 variables)	nominal nominal nominal	- - -
PRLANUS	intensity of agricultural land use in 1969	nominal	-

Table 21: Dummy Variables

DRAIN
1 - no water bodies
2 - stream
3 - lake

WOOD
1 - no woodlot
2 - woodlot

ROADTY
1 - gravel
2 - sealed
3 - regional road
4 - provincial highway

LANUS
NLANUSA
NLANUSO
NLANUSB
PRLANUS
1 - intensive agriculture
2 - non-intensive agric.
3 - idle land
4 - scrubland
5 - woodland
6 - recreation
7 - urban

The linear equation produced by this analysis was

$$Y' = 3.32 + .33\ (TRANS) - .05\ (DMETRO) + .04\ (NRES) + .25\ (DRAIN\ 2) - .40\ (ROADTY\ 1) - .27\ (LANUS\ 4)$$

The summary table is presented in Table 22.

The variable representing the number of land transactions between 1955 and 1977 alone explained 55% of the variation in the dependent variable. The stepwise addition of the remaining variables raised the final explanation to 64% with the variable measuring the straight-line distance to Toronto (DMETRO) contributing the second largest amount to the overall explanation. Therefore, lots with a greater number of parcels would tend to have had a large number of land transactions in the past and would be located nearer to Toronto.

The use of the transactions variable might be questioned. Lots with a large number of parcels would need to have had an equal number of transactions in the past, but a large number of transactions does not necessarily require the existence of a large number of parcels. These transactions could have involved the transfer of large, intact blocks of land. Invariably, the number of transactions on lots with a large number parcels greatly exceeded the number of parcels while lots with only a few parcels had, usually, only the number of transfers needed to create the parcels. Therefore, the strong relationship

Table 22: Summary Table of Regression Coefficients

variable	B	r	mult. r	r^2	change r^2	F	sign.
TRANS	.33	.74	.74	.55	.552	52.9	0.0
DMETRO	-.05	-.37	.79	.63	.074	35.1	0.0
NRES	.04	.21	.79	.63	.004	23.2	0.0
NOROAD	.29	.20	.80	.63	.004	17.3	0.0
DRAIN 2	.25	.23	.80	.64	.003	13.7	0.0
ROADTY 1	-.40	-.30	.80	.64	.002	11.2	0.0
LANUS 4	-.27	-.22	.80	.64	.001	9.4	0.0

between parcels and transactions really indicated that those lots had been very active in the land market, more so than was necessary to simply create the parcels.

vii. Summary

The fragmentation of 100-acre lots into a number of individually-owned parcels during the study period was examined in order to study changes in land ownership patterns. Little change in the land holding pattern occurred between 1877 and 1955 but noticeable changes in the proportion of one-parcel lots and lots with more than two parcels were found in the 22-year study period.

The largest increase in the number of lots with more than two parcels occurred after 1965. Decreases in the proportion of one-parcel lots slowed after 1970, perhaps suggesting the existence of a base population not interested in fragmenting their holdings at the present time. In the latest period, 1970 to 1977, the former township of Chinguacousy had the most intense fragmentation activity.

In 1955, the majority of the sample lots in all former townships were in the one-parcel class, but by 1977, the distributions in Albion and Chinguacousy were approaching normal distributions, with modes in the five-parcel and three-parcel class respectively.

The highest transition probability for all time periods was for a lot to remain in the same state, but

these probabilities decreased through time. The second highest probabilities were for lots to increase their parcel class by only one parcel, indicating processes of gradual, rather than abrupt, fragmentation.

Lots with the greatest number of parcels, six or seven, were the most stable, followed by one or two-parcel lots. Through time, the stability of one to four-parcel lots tended to decrease while the stability of five and six-parcel lots tended to increase. Therefore, today, those lots which are the least stable are those with three or four parcels. Since 1965, of all the former townships, Chinguacousy had the lowest state stabilities, especially for lots with two or three parcels.

The largest percentage of all sample parcels was in the 10 acres or less size class and a majority of these were less than two acres in size. Albion and especially Chinguacousy, had large proportions of these very small parcels. Relatively larger frequencies in the distribution marked the effects of minimum lot size severance restrictions.

The proportion of parcels 20 acres or less in size with residential structures varied among the townships from 81.3% in Chinguacousy to 63.1% in Albion. The rapid lot fragmentation found to exist in Chinguacousy, and this relatively high incidence of residential structures on small parcels, would indicate that newly-created parcels are being

put to residential uses immediately, rather than being left idle as the case appears to be in Albion.

A first order Markov chain analysis did not adequately predict parcel class distributions. The 1960 to 1965 transition probabilities produced a distribution similar to the actual 1970 distribution, but could not be extended to accurately predict the 1977 distribution. The predicted distributions tended to under-estimate the probability of a lot remaining stable. One reason for the failure of this technique in predicting land fragmentation trends was perhaps the fact that the tendency for a lot to fragment was not constant, but increasing, through the latter half of the study period, especially for lots with more than two parcels. Also, the number of newly-created lots was not dependent on the number of parcels in the former time period, but on the decision processes of the individual land owners.

A multiple regression analysis showed that the number of transactions of land and the distance to downtown Toronto explained the largest amounts of variation in the number of parcels per lot. Lots with a large number of parcels were those whose land owners, past and present, had been active in the land market and were located within a convenient commuting to distance to Toronto.

In conclusion, the overall picture that these various analyses have provided of land uses in the Town of

Caledon, was that the land is rapidly being divided into small parcels which serve as residential sites. The increased fragmentation since 1965, the large number of very small parcels, the active land market and the location of lots with a large number of parcels near to Toronto indicated that land fragmentation in the Town has been geared towards the provision of residential sites for commuters.

CHAPTER VIII

ANALYSIS OF RURAL RESIDENCE CONSTRUCTION TRENDS

Fragmentation of 100-acre lots usually brings about a decline in agricultural activity as many parcels of land remain idle after sub-division. However, actual urban penetration into a rural area is not accomplished until newly-created parcels become the sites for exurban residences. An analysis of the change in the number of residences per 100-acre lot was undertaken in order to determine whether the new parcels created in the Town of Caledon were being used for residential purposes, or, by remaining vacant, represent at this time more of an investment interest for their owners.

The data used for this analysis were obtained from provincial and federal aerial photography as well as field surveys. Coverage was available for 1955, 1964 and 1976. No attempts were made to distinguish farm and non-farm housing. The difference in length of the two time periods defined by these three dates did prevent a comparison of trends between time periods such as was possible with the lot fragmentation data.

In 1955, by far the largest proportion of sample lots had only one parcel and one residence (Tables 13 and

23). Of the 184 sample lots used in the residence analysis, 72.28% had one residence and 22.28% were vacant. By 1977, the proportion of one-residence lots had decreased to 34.24% while the proportion of vacant lots decreased to 13.50%. Two and three residence lots increased their proportions most noticeably but the final distribution (Figure 14) remained skewed to the left. The proportion of lots in each residence class had clearly been changing through time as the number of parcels per lot increased. One obvious question is whether residence construction had proceeded at the same rate as parcel creation or whether there was a noticeable difference in the rate of these two activities.

A simple ratio measure of the number of parcels to the number of residences was used to study the rate of residence construction. Between 1955 and 1977, the number of parcels increased by 313, or 129% while the number of residences increased by only 128, or 89%. This slower rate of residence construction produced increasing parcel to residence ratios for the three dates: 1955 - 1.68, 1964 - 1.87 and 1977 - 2.04.

The analysis of state stabilities and transition probabilities concentrated on comparisons among frequency classes within each time period, rather than between time periods (Table 24). Between 1955 and 1964, one-residence lots had the greatest probability of remaining in the same

Table 23: Frequency Distribution of Number of Residences per Lot

no. of residences	% 1955	% 1964	% 1977
0	22.28	19.57	13.59
1	72.28	63.04	34.24
2	5.44	10.87	21.20
3	-	4.35	16.30
4	-	1.63	6.53
5	-	0.54	2.72
6	-	-	2.72
7	-	-	0.54
8	-	-	0.54
9	-	-	0.54
10	-	-	0.54
more than 10	-	-	0.54

FIGURE 14

RESIDENCE CLASS DISTRIBUTION OF LOTS
N = 184

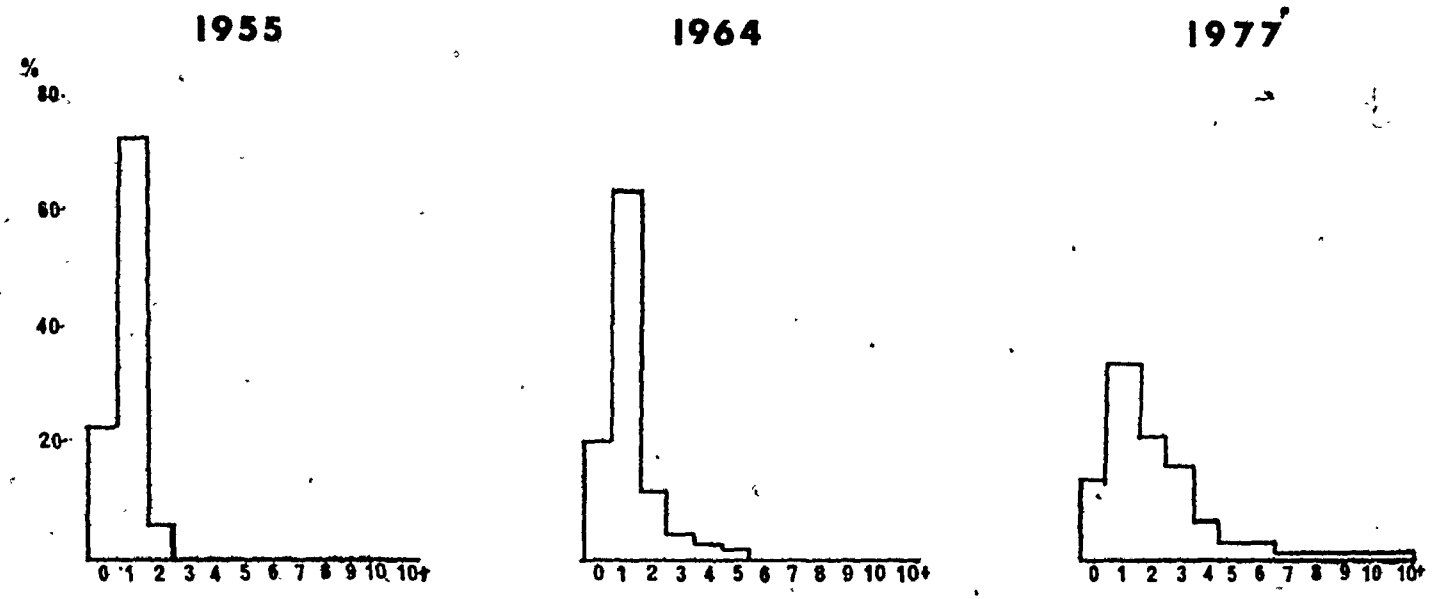


Table 24: Transition Probabilities

no. of residences 1955	no. of residences 1964									
	0	1	2	3	4	5	6	7	8	9+
0	.78	.15	.02	.05	.00	.00	.00	.00	.00	.00
1	.03	.83	.10	.03	.005	.005	.00	.00	.00	.00
2	.00	.00	.60	.20	.20	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

no. of residences 1964	no. of residences 1977									
	0	1	2	3	4	5	6	7	8	9+
0	.56	.17	.14	.06	.07	.00	.00	.00	.00	.00
1	.04	.48	.22	.17	.03	.00	.10	.05	.05	.10
2	.00	.05	.45	.20	.10	.05	.10	.00	.00	.05
3	.00	.00	.00	.50	.13	.37	.00	.00	.00	.00
4	.00	.00	.00	.00	.66	.33	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00
6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

state, followed by vacant and then two-residence lots. These one-residence lots had the lowest probability of increasing their number of residences while those lots with two residences in 1955 had the greatest probability of increasing to three residences by 1964. Two-residence lots also had the greatest probability of adding two more residences.

In the second, time period, 1964 to 1977, only those lots with three or fewer residences were studied as the other residence states each had fewer than five lots which tended to exaggerate transition probabilities. Lots with two residences were the least stable in this period and vacant lots were the most stable.

A contradiction appears to have occurred in the analysis as, on the one hand, the proportion of vacant lots declined; while, on the other hand, these lots are described as being the most stable between 1964 and 1977. However, this latter description is only a relative measure, indicating that the one, two and three-residence lots were even less stable.

Perhaps a similar situation to the lot fragmentation trends exists. The proportion of total lots which were classified as vacant decreased by only 8.68% because their owners represent a group which is not interested in converting their land to residential uses. In 1977, 48%

of these vacant lots contained only one parcel and 32% had two parcels. Therefore, the open space character of the 25 vacant lots was largely controlled by 28 land owners.

i. Spatial Variation in Residence Construction Trends

An analysis of the spatial variation in residence construction trends was undertaken using data for the former townships. Table 25 contains the ratio of parcels to residences for each township at the three study dates. All but Chinguacousy had the highest ratio in 1964. This indicates that by 1977, residences had been erected as parcels were created in addition to those erected on some formerly vacant parcels. Chinguacousy's rate of parcel creation, as explained in Chapter VII, continued to increase throughout the study period.

The total numbers of new parcels created, and residences constructed, between 1955 and 1977 are shown in Table 26. From these figures, yearly averages of parcel creation and residence construction could be computed, which show the universal trend of greater parcel creation and residence construction in the latter part of the study period. Also noticeable are the higher frequencies of these two activities in Albion, the former township nearest to Toronto. Albion also had the greatest potential for future residence construction, as 48 of its new parcels

Table 25: Ratio of Parcels to Residences

	1955	1964	1977
Albion	1.65	2.12	1.46
Ching.	1.60	1.53	1.56
Cal. E.	1.67	1.79	1.39
Cal. W.	1.80	1.83	1.60

Table 26: Increases in the Number of Parcels

	Albion	Ching.	Cal. E.	Cal. W.
total no.	172	55	37	49
1955-1964	54	12	12	23
1964-1977	118 (68.8%)	43 (78.2%)	25 (67.6%)	26 (53.1%)
average no. per year 1955-1964	6.0	1.3	1.3	2.6
1964-1977	9.8	3.6	2.1	2.2

Increases in the Number of Residences

total no.	124	37	33	35
1955-1964	14	10	10	12
1964-1977	110	27	23	23
	(88.7%)	(75.0%)	(69.7%)	(65.7%)
average no. per year 1955-1964	1.6	1.1	1.1	1.3
1964-1977	9.2	2.3	1.9	1.9

remained vacant, while Chinguacousy, Caledon East and Caledon West had only 19, 4 and 14 new vacant lots respectively.

The transition probabilities for the individual townships are summarized in Table 27 for those states which had five or more lots at the initial date. State stabilities varied spatially and temporally. In the first time period, vacant lots were more stable in Albion and Chinguacousy, while one-residence lots were more stable in Caledon East and Caledon West. By the second time period, the stabilities for all states had dropped considerably, especially in Albion. Both vacant and one-residence lots were more stable in Caledon East and Caledon West. As a consequence of these lower stabilities, the average transition probabilities had increased in the second time period. Albion again had the highest transition probabilities in this period.

ii. Changing Structure of the Rural Population

As the growth in the number of non-farm rural residences affects the size of the rural population, changes in this population group between 1956 and 1971 were examined using census data from these two years. Three population classes were defined - farm, residents of small unincorporated hamlets, and "others". The "other" class represented

Table 27: Transition Probabilities - Townships

1955 - 1964 state change	Albion	Ching.	Cal. E.	Cal. W.
0-0	.90	.86	.73	.69
1-1	.81	.80	.85	.85
0-1	-	.14	.18	.23
1-2	.13	.16	.04	.06

1964 - 1977 state change				
0-0	.30	.66	.66	.64
1-1	.33	.43	.52	.68
0-1	.30	.17	.11	.09
1-2	.23	.24	.32	.10

the low density, non-farm rural residence population.

In 1956, for all townships studied in the agricultural analysis (Figure 6), the largest proportion of each population was in the farm class. The farm residents on average represented 58.67% of the total population of each township. Unincorporated settlements represented an average of 21.28% and the "other" category, 22.13%. By 1971, the proportions averaged 25.77%, 24.77% and 49.46% respectively.

These figures indicate that the "other" category experienced the largest proportionate growth while unincorporated settlements only grew slightly at the expense of the declining farm population.

By 1971, those townships with a low proportion of farm population and a high proportion in the "other" class were those immediately adjacent to metropolitan Toronto: Esquesing, Nassagawaya, Albion, Caledon, Chinguacousy, King, Gwillimbury East, Whitchurch and Uxbridge. The "outer" townships had a higher average proportion of their population living on farms; 39.49% versus 18.15% for the "inner" townships.

The total rural population in the 16 townships increased by 24,838 people between 1956 and 1971, but the number of residents in unincorporated settlements increased by only 9,877. The number of residents in the "other"

category meanwhile increased by 25,561 persons. From these figures, it is evident that new rural residents have shown their preference for non-urban locations, even if the potential urban residential areas were small hamlets, usually with a population of less than 1,000 people and low order goods e.g. gas, groceries were immediately available in these communities.

From this brief analysis, one can conclude that rural non-farm residences were the new homes for almost all the new residents in Zone 2 of the Toronto Centred Region between 1956 and 1971 and were not just part of a more widespread building trend.

iii. Summary

A significant decline in the proportion of vacant and one-residence lots occurred between 1955 and 1977 in the Town of Caledon. The number of parcels increased by 129% while the number of residences increased by only 89%. In all areas of the Town, the yearly average rates of parcel creation and residence construction were higher between 1964 and 1977 than between 1955 and 1964. Lots with two residences were the most likely to increase their residences throughout the study period. The vacant lots has the greatest state stability, but only relative to the even less stable one, two and three residence lots.

The ratios of parcels to residences peaked in 1964 for all areas but Chinguacousy whose number of parcels continued to increase at a faster rate than residence construction. The smaller ratios in 1977 for the other areas indicated that residences were being constructed on parcels which had been vacant for some time, as well as on newly-created parcels. Albion, the former township nearest to metropolitan Toronto, had the highest overall rates of parcel creation and residence construction.

The proportion of the total rural population classified as farm declined significantly between 1956 and 1971 while the unincorporated settlements increased their proportion slightly. The largest proportionate growth was found in the number of non-farm residents. In 1971, those townships with relatively small farm populations and large non-farm residence populations, were those immediately adjacent to metropolitan Toronto. Absolute growth in the small unincorporated settlements was small compared to the growth in the number of non-farm residents. The policy directing residential growth in Zone 2 of the Toronto Centred Region to settlement areas[1] appears to be in contradiction to the trends in residence construction occurring during the last 22 years. Those who move to rural townships probably choose such a home site because they want to live in a rural

[1] Design for Development: The Toronto Centred Region. op. cit. p.3.

environment. Also, as more and more people move to townships lying in the hinterland of large urban centres, small settlements would quickly lose their distinctive character if they were forced to absorb all the new residents.

CHAPTER IX

SUMMARY AND CONCLUSIONS

This chapter summarizes the findings of the research and discusses the effects of the trends discovered on future land-use and planning policies.

Of the five minor hypotheses formulated regarding trends in agricultural land use, three were substantiated, one was partly substantiated and one was rejected.

1) Farmland loss was not uniform across Zone 2 townships.

2) Farmland loss was related to urban population growth but could not be related to variations in agricultural land capability or rural population growth.

3) The percentage decline in the number of farms since 1956 and the change in average farm size were the census variables which explained the greatest amount of variation in the amounts of farmland loss between 1956 and 1971.

4) The scale of the remaining farm units varied among Zone 2 townships. Decreases in the number of farms occurred in all townships, but, some areas had greater proportionate losses in the area of farmland than the number of farms. Here, contrary to national trends, farms tended to remain small.

5) There was no marked increase in the proportion of land under non-intensive agricultural uses. The proportion of acres devoted to cropland, pastureland and woodlots remained fairly stable.

The most important finding was that changes in agricultural land use have not been uniform across Zone 2

townships and therefore a single agricultural land-use policy is not sufficient. The land area devoted to agriculture has decreased in all townships and decreases in agricultural activity can be inferred i.e. output of agricultural goods in absolute terms has also decreased. However, 1971, the remaining agricultural land was being used in much the same way that it was in 1956. A zone of non-intensive agriculture as defined by Sinclair[1] has not materialised. In fact, the opposite seems to have occurred. Farmland which was removed from production tended to be non-improved land.

The regression analysis also showed that in some areas of Zone 2, farm sizes are decreasing or remaining stable, contrary to national trends. Agricultural productivity then would not be increasing as rapidly as in other areas of southern Ontario since the farm units are not sufficiently large to take a full advantage of economies of scale, mechanization and improved technology.

Major changes in agriculture, aside from the decreasing land base, indicated changes in structure. The increases in the number of small, part-time hobby farms common in urbanizing areas are examples of this change in structure. There is a great need to study the role of

[1]R. Sinclair, "von Thunen and Urban Sprawl," Annals of the Association of American Geographers 57 (1967) 72-87.

these types of farms in an urbanizing agricultural area. Of special concern is whether they are long-term or only short-term custodians of agricultural land. When these small farms change hands will they be purchased by other part-time or hobby farmers or will they become non-farm residences?

The decrease in agricultural land and the prevalence of many small farms in urbanizing areas indicate that, if agricultural production has not declined in some areas of Zone 2, it has failed to increase at the same pace as other Canadian agricultural areas not affected by urban growth pressures. The first sub-hypothesis should therefore be accepted.

Three of the five minor hypotheses related to recreational land uses were found to be acceptable.

1) There were large differences in the percentages of total land area under recreational use in Zone 1, 2 and 3 townships. Zone 2 townships had an average of 6.2% of their land area under recreational use while Zone 1 townships had 8.2% and Zone 3 had 2.5%. These figures were affected by extreme values though, for example, the 1,900 acre Bronte Creek Provincial Park in Oakville, a Zone 1 township, Two areas Milton and Caledon, had exceptionally high acreages.

2) Highly urbanized, large population areas had deficits of recreational land identified by large number of people to acres ratios.

3) Total raw acreages in this part of the Toronto Centred Region appeared to be sufficient for the people of southern Ontario.

4) More than a third of the sites had access restrictions or financial deterrents which limit their use by the general public.

5) Recreational land uses in the Town of Caledon were disproportionately located on class 1 to 3 agricultural soils, especially those run on a commercial basis.

If all the acres compiled in this survey were actually available for recreational use by the general public, the Toronto Centred Region would be very well-supplied with recreational land. However, many areas had access restrictions or financial deterrents to use and should not be included in a general recreation space budget. Also, recreational uses appear to be competing with agriculture for flat, well-drained land. The highest proportion of sites situated on land best suited to recreation were those held by private or institutional groups.

On the basis of the raw acreages, the second sub-hypothesis which stated that the provision of recreational space is inadequate, should be rejected. However, on examining the potential use levels and the quality of the recreational land available to the general public, one can conclude that problems in the amount and type of recreational land supplied do exist. The second hypothesis is acceptable.

Most of the trends in land ownership and land use described in the final ten minor hypotheses were found to

exist.

1) The number of individually-owned land parcels increased by 313 between 1955 and 1977 on the sample lots in the Town of Caledon.

2) Decreases in the number and percentage of lots with one or two parcels were most marked after 1965

3) The tendency for a lot to remain stable with a certain number of parcels tended to decrease through time. Lots with the largest number of parcels, however, were the most stable. Least stable were those with three or four parcels.

4) Sample lots in Albion and Chinguacousy; the two former townships nearest to Toronto, had on average, a larger number of parcels per lot. Decreases in the number and percentage of lots with one parcel, and increases in the number and percentage of lots with more than two parcels, were more pronounced in these areas.

5) The two variables which explained the largest amount of variation in the number of parcels per lot were the number of land transactions between 1955 and 1977 and the straight-line distance to downtown Toronto.

6) Approximately 49% of both Albion's and Chinguacousy's sample parcels were 10 acres or less in size compared to 30% and 33% of the parcels in Caledon East and Caledon West respectively. Of these, 26% of the parcels in Albion and 44% of the parcels in Chinguacousy were two acres or less in size.

7) The number of residences on all sample lots increased by 229 between 1955 and 1977.

8) Albion had the highest rates of both parcel creation and residence construction throughout the study period.

9) The ratio of the number of parcels to the number of residences decreased through time. As the rate of parcel creation did not abate, this decrease was due to a faster rate of residence construction.

10) The dispersed non-farm rural residential population showed the greatest percentage increase of the total rural population groups between 1956 and 1971.

Rural non-farm residence construction and the land fragmentation which must precede it, have been occurring throughout the Town of Caledon during the study period, especially in the former township of Albion which is adjacent to metropolitan Toronto. As some lots here have up to six or seven residences, these areas are essentially no longer rural in character. Those lots which have already experienced some fragmentation e.g. those with three or four parcels, or two residences, were found to be those most likely to move to a higher parcel or residence class. One-parcel lots by 1970 showed a decreasing tendency to fragment. Therefore, controls over land fragmentation should be geared towards those lots already exhibiting tendencies to increase their number of parcels and/or residences.

If these fragmentation and construction trends are allowed to continue, much of the Town would have residential strip development along the concession roads with agriculture or woodland occupying the back portion of the lot. Severance controls have checked the formation of new small parcels but existing vacant lots may be built on, under the

the provisions of the Official Plan[2].

By these trends, the open space character of the Town has been affected in some areas and the third sub-hypothesis may be accepted.

The research has shown that the major hypothesis that land-use trends in this part of the Toronto Centred Region have not been in line with the stated public policy objectives, can be accepted. If the Government of Ontario wishes to have a land-use pattern in accordance with the agricultural/recreational/opens space character proposed in 1970, it must realize that trends in land use under the free market will not result in the realization of these objectives.

The land market in the Town of Caledon is geared towards the maintenance of small, inefficient farm units and the provision of small, commuter residential sites. The Toronto Centred Region Program Statement[3] claimed that land-use trends since 1971 have been consistent with provincial goals, a statement which this research has proven to be false, especially with regard to lot fragmentation and rural residence construction trends. Planning controls must

[2]Official Plan of the Town of Caledon Planning Area op. cit., p. 17.

[3]Design for Development: The Toronto Centred Region Program Statement, (Toronto: Ministry of Treasury. Economics and Intergovernmental Affairs, 1976), p.3.

be introduced to counteract these trends, or the policies themselves must be re-evaluated and re-formulated to reflect present trends. If this latter option is followed, the policy must be centred around the role of this area as the Toronto Centred Region commutershed. Otherwise, agriculture in Zone 2 will be characterized by small land holdings which only exist despite the cost/price squeeze, due to the fact that the majority of the owners' incomes are generated in other sectors. Despite high land costs, the government must find the means to provide access to recreational land for the growing urban population. Most people would agree that the provision of recreational space does not mean space for a select few, but the widest cross-section of the population possible.

The provision of residential areas should be secondary to other uses if present land-use objectives are to be realized. Three residences per lot on many lots, as permitted by the Official Plan[4] does not guarantee the preservation of open space except perhaps in wooded areas where the residences are well-concealed. Population growth and residence construction should be directed completely towards the existing settlements, or the open space concept of Zone 2 should be abandoned. The Toronto Centred Region

[4] Official Plan of the Town of Caledon Planning Area. op. cit., p.22.

report called for population growth to be concentrated in the existing settlements, but interpretation of this goal, as by the Town of Caledon, allows a large amount of population growth to be accommodated in the rural sections. This approach would appear to be more realistic, as in the past, new rural residents have exhibited a decided preference for "true" countryside. However, the creation of rural estate residential areas, despite small lot restrictions, continues to allow urban penetration into rural areas and moreover, ensures that only the wealthy will be able to live in the countryside. The preservation of open space and the accommodation of more people in rural areas appear to be mutually exclusive goals.

Policies developed to guide and control land uses and land-use change must be tailored to deal with the existing trends. Agricultural policies must realize that variations in agricultural activity in urbanizing areas exist. In some areas, policies must be geared towards the protection of small farm units, as the costs of expansion in urban fringe areas are usually too high for most operators. The government must realize that recreational use of good agricultural land might have to be discontinued in the future if this land is needed for food production. Re-acquisition of poorer agricultural land for these displaced recreational uses would be more difficult and more expensive due to the large number of land owners found in

these scenic areas.

Although the intentions of the government are commendable, under the present system of planning where land-use controls are delegated to individual municipalities, the scope for individual interpretation of the provincial goals is too wide. The future pattern of land usage will depend upon the free market or on tight government controls. If the free market pattern is considered to be socially undesirable, the provincial government must accept its responsibility and act accordingly.

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