STUDY OF FARMLAND LOSS IN CENTRAL ONTARIO 1951-1971

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by

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In this investigation, a model is developed to explain the loss of farmland to other uses in Central Ontario in the period 1951-1971. Furthermore, it attempts to identify the socio-economic characteristics of operators involved in the loss of farmland process, as well as ascertaining the factors responsible for the change in land use.

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CHAPTER ONE

INTRODUCTION

The loss of farmland is a problem of great current interest in Southern Ontario. It has been growing in importance during the last few decades and has emerged as a complex and varied phenomenon in agriculture. Although the loss of farmland has been taking place at an increasing rate over the last twenty years, the factors which determine the process are not clearly understood. The principal aim of this investigation is to determine the main causes of farmland loss in Central Ontario in the period 1951-1971. The analysis falls into three parts. Firstly, a model is developed which attempts to throw some new light on the factors responsible for the loss of farmland in Central Ontario. Secondly, individual farm properties in Northumberland County which have become inactive in the period are examined in an attempt to distinquish the characteristics of farms and farmers involved in the loss of farmland process. Lastly, the reasons given by Northumberland farmers for leaving agriculture are analyzed. The collection of both physical and socio-economic data on these properties is an approach which has not been carried out before in Ontario. The findings should provide a more valid basis for the

development of land-use policies and for regional planning in an area which is somewhat removed from the pressures of urban expansion which characterize the Toronto-Centred-Region and the Niagara Peninsula.

Study Area

The area under consideration comprises Victoria, Peterborough, Durham and Northumberland Counties, and is commonly referred to as Central Ontario (see Figures 1 and 2). The main emphasis in agriculture is on the livestock industry, although cash cropping and fruit growing are also found. In recent years, dairying has declined in favour of beef cattle, hogs and poultry. The area is particularly suited for pasturing stocker cattle in the summer months.

The physical environment is an important determinant of the present agricultural land use in Central Ontario. Factors such as physical topography, soils and climate continue to influence the type and intensity of agricultural production. Therefore, before any discussion of farmland loss is attempted, the physical environment of the area will be described briefly.

Central Ontario possesses a variety of topographic features and relief varying from the steeply sloping Dummer Hills in the north to a level sandy plain paralleling Lake

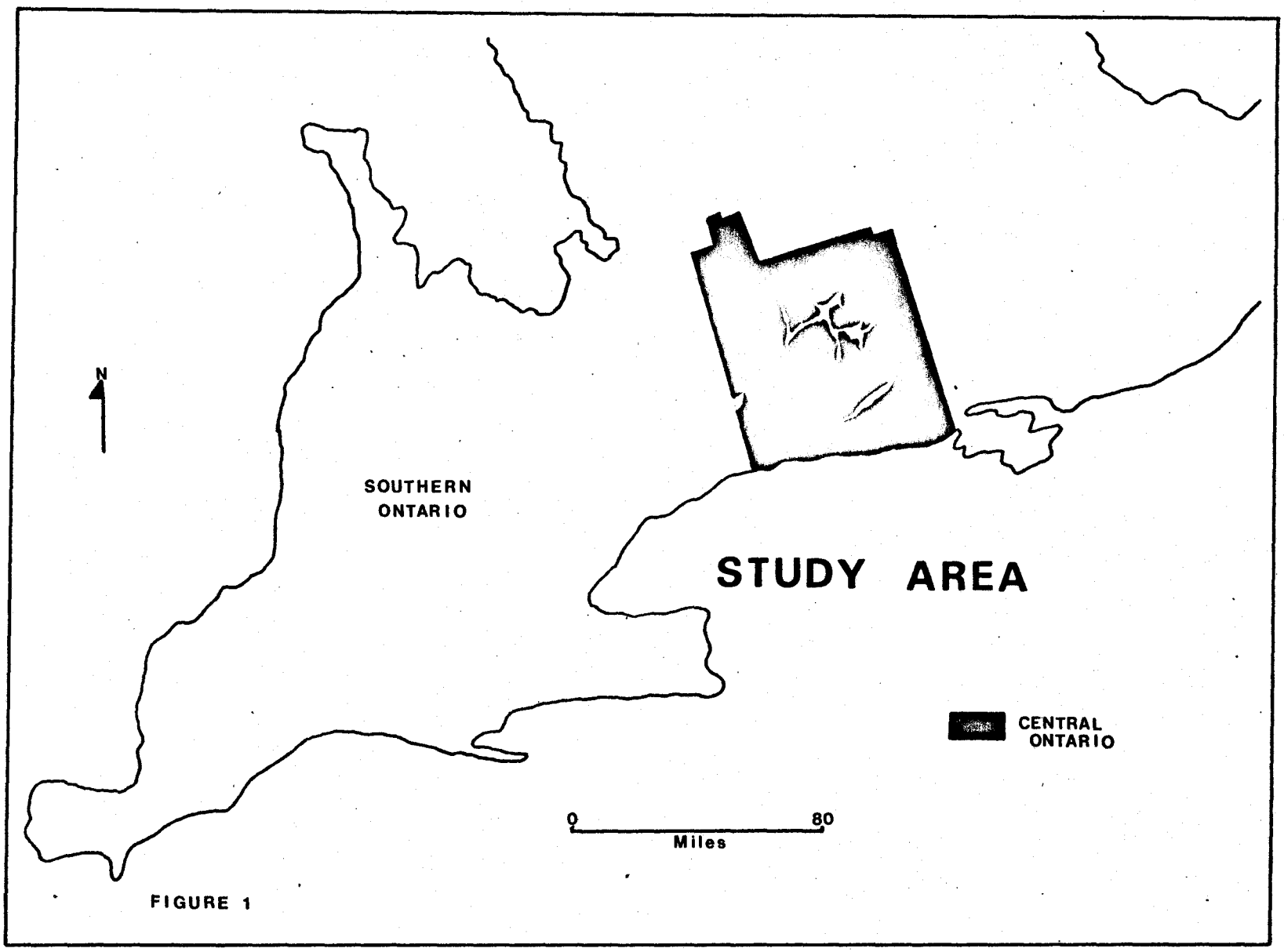

FIGURE 1

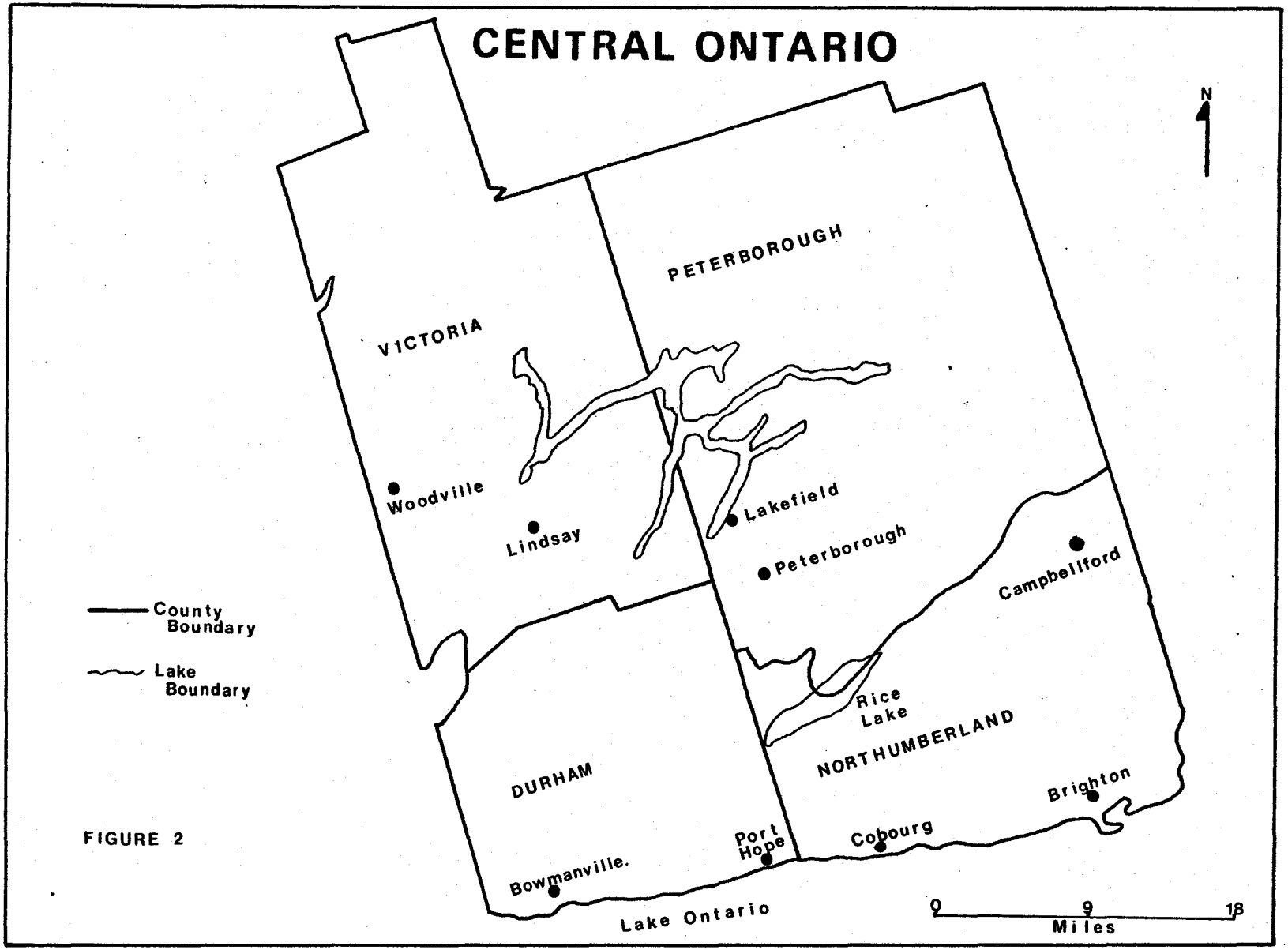
CENTRAL ONTARIO
N
PETERBOROUGH
VICTORIA
Woodville
Lindsay
Lakefield
Peterborough
Campbellford
Rice
Lake
NORTHUMBERLAND
DURHAM
Brighton
Cobourg
Port
Hope
Bowmanville.
Lake Ontario
0
9
18
Miles
County
Boundary
Lake
Boundary

FIGURE 2

Ontario in the south. Nevertheless, for the most part, Central Ontario has a rolling relief associated with morainic deposits. This type of relief is conducive to mixed and livestock farming. In some instances, steep slopes impede cultivation and result in the land being abandoned for agriculture or being utilized as permanent rough pasture.

As can be seen in Figure 3, Chapman and Putnam (1951) have identified nine major physiographic regions in Central Ontario. The Iroquois Plain adjacent to Lake Ontario was formed from inundation in late Pleistocene times by Lake Iroquois, which resulted in lacustrine deposits. These deposits have provided a mosaic of soil types varying from deep loamy soils in the vicinity of Bowmanville to sands, fine sands and silts in the Cobourg and Brighton areas. They are particularly suitable for dairying and mixed farming and where well drained are suitable for apple orchards.

The South Slope is a drumlinized and gullied till plain lying to the north of the Iroquois Plain. The dominant soil on the Slope is a well-drained fine sandy loam. In general, the South Slope may be considered a productive agricultural area. However, in some instances, the steep drumlin slopes provide moderate to serious limitations for agriculture.

The Oak Ridges Moraine extends through the central portion of Durham County and terminates near the eastern end of Rice Lake. The relief of this region consists of

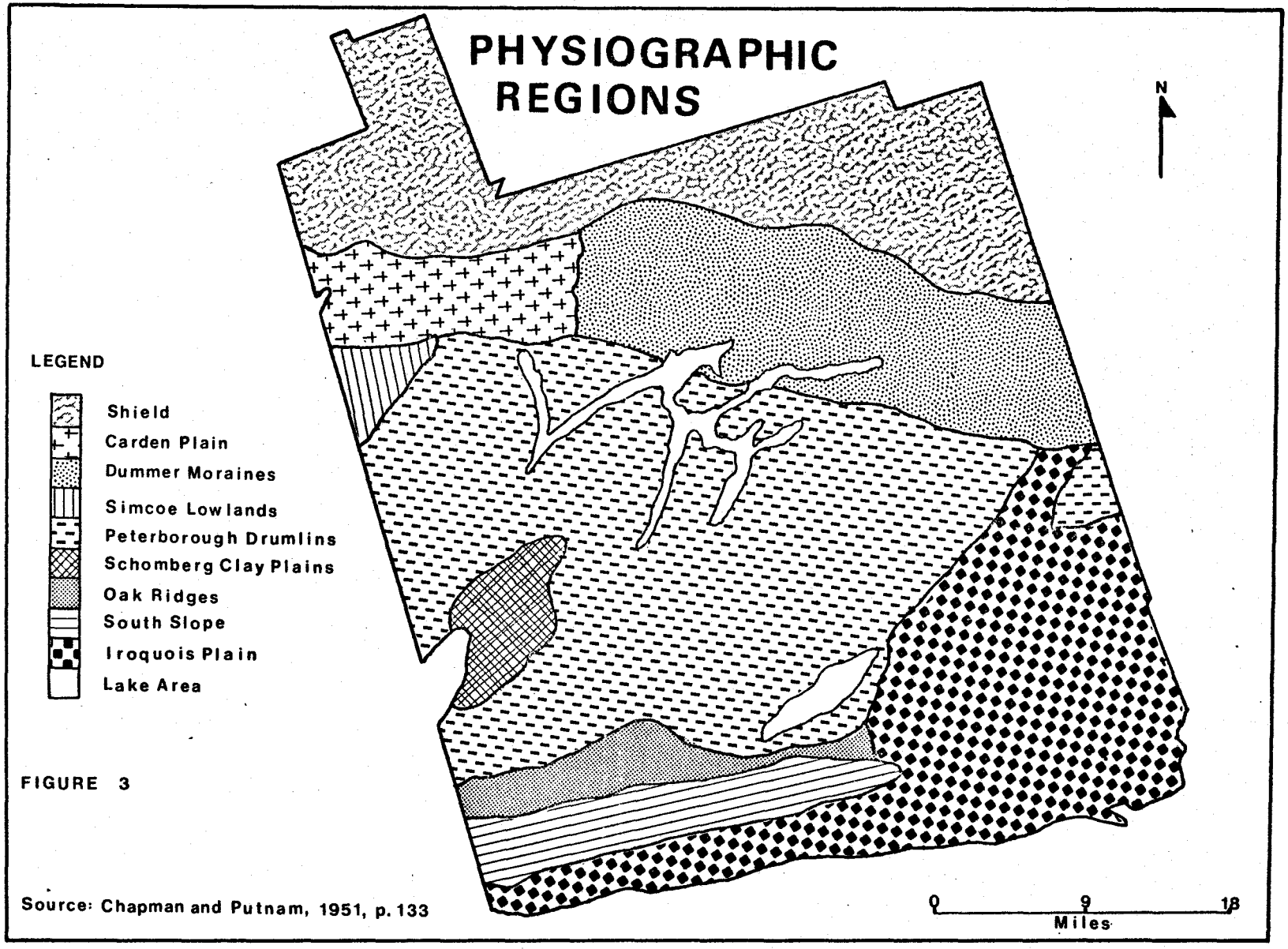

FIGURE 3

Source: Chapman and Putnam, 1951, p. 133

knolls and basins. On the Oak Ridges Moraine the soil is light and sandy which encourages drifting. Much of the interior of Central Ontario is occupied by the Peterborough Drumlin Field. Drumlins, eskers and outwash gullies dominate the physiography of this region. Soils on the drumlins have developed on an highly calcareous till. The Dummer Moraines extending in a north-west direction through Peterborough County constitute an area of rough stony land. The till is coarse and shallow, and has been eroded in places to expose the underlying sedimentary bedrock. The agriculture of the Oak Ridges, Peterborough Drumlin Field and Dummer Moraines provides a good illustration of physical controls. The low quality, shallow and often stony soils which occupy the area and its rugged drumlinized and morainic relief have encouraged specialization in beef farming. This type of rough relief is suitable for grazing, while in the basins between the drumlins and moraines, some clay and clay loam pockets are found which support cultivated crops.

An extension of the Schomberg Clay Plain can be found to the north of Lake Scugog in the vicinity of Lindsay. This flat well-drained clay plain is one of the more productive dairy and mixed farming regions in Central Ontario. Another clay plain identified as the Simcoe Lowlands occupies a small portion of Victoria County in the Woodville area. However, this plain is stony and poorly drained which limits

its agricultural productivity.

The remaining two physiographic regions of Central Ontario, the Carden Plain and the Shield present serious limitations for agriculture. The Carden Plain located in the north-west portion of Victoria County is a sandy limestone plain. The soils are shallow and poorly developed resulting in much farm abandonment in recent years. Similarly, the Shield occupying the northern parts of both Victoria and Peterborough possesses shallow and infertile soils as well as steep slopes which prevent cultivation. Agriculturally, they may be utilized for permanent rough pasture. However, forestry is a more suitable use.

Table 1 presents the acreages of soil capability classes for agriculture by county in Central Ontario. Hoffman (1970, p. 13) considers the first three classes as suitable for sustained production of common field crops if specified management practices are observed. The fourth class is described as physically marginal for sustained arable agriculture. Classes five and six present serious limitations for agriculture and are best suited for pasture. The soils comprising class seven are considered to be unsuitable for agriculture.

In totalling the acreages in the first three classes for each county, it is quite apparent that the soils of Northumberland and Durham have the greatest potential for agriculture. For instance, Northumberland and Durham have 68

TABLE 1

ACREAGES OF SOIL CAPABILITY FOR AGRICULTURE

County	Soil Classes								
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Organic	Total
Durham	148,525 (36.9%)	55,950 (13.9%)	20,685 (5.1%)	60,245 (15.0%)	30,945 (7.7%)	48,385 (12.0%)	8,130 (2.0%)	29,695 (7.4%)	402,560 (100.0%)
Northumberland	133,885 (28.5%)	51,535 (11.0%)	133,630 (28.5%)	39,680 (8.5%)	17,180 (3.7%)	51,980 (11.0%)	6,950 (1.4%)	34,860 (7.4%)	469,700 (100.0%)
Peterborough	114,450 (12.6%)	31,040 (3.4%)	59,890 (6.6%)	52,930 (5.8%)	122,960 (13.7%)	116,910 (12.9%)	270,190 (29.8%)	137,230 (15.2%)	905,600 (100.0%)
Victoria	133,505 (18.9%)	56,065 (7.9%)	15,680 (2.2%)	138,220 (19.5%)	7,910 (1.1%)	147,765 (20.9%)	144,135 (20.4%)	64,000 (9.1%)	707,280 (100.0%)

Source: A.R.D.A., Land Use Capability For Agriculture, 1970

and 55.9 per cent respectively of their total soil acreage in classes one to three. In contrast, Victoria has 29 per cent and Peterborough 22.6 per cent in these three classes. Moreover, Durham and Northumberland have a modest combined total of 3.5 per cent of their soil in class seven, while Victoria and Peterborough on the other hand have a substantial 50.2 per cent in this class.

The climate of the area is favourable for the growing of most crops associated with mixed farming. According to Brown, McKay and Chapman (1968, p. 48) the average growing season varies from 195 days in the north to about 205 in the south. The average annual precipitation in the area ranges from 32 to 35 inches. Although under normal conditions, the precipitation received in the area is sufficient, crops which are grown on steep sandy loam slopes may experience a moisture deficiency during the hot summer months.

As an overview, the physical environment has an influential role to play in determining the type of agriculture practised in any given region. With respect to Central Ontario, the soils and topography of the area appear to present considerable limitations for agriculture.

Sources of Data

Data was obtained from two primary sources. Firstly, all census information from 1951 to 1971 were collected and examined to determine the nature and magnitude of the problem.

Secondly, 105 Northumberland County farms which had gone out of production in the period were examined in depth. Questionnaires were employed to gather the relevant socio-economic and physical data about these farms and their operators.

Magnitude of Farmland Loss in Central Ontario

As can be seen in Table 2, occupied farmland in Central Ontario has declined by 346,616 acres or by 22.3 per cent in the period 1951-1971. Approximately half of this decline (169,310 acres or 48.8 per cent) was recorded in the interval 1966-1971. In the three preceding five year intervals, the decrease in farmland ranges from 3.3 to 4.3 per cent. The percentage decrease in farm acreage on a individual county basis for the twenty year period ranges from 19.4 for Northumberland to 27.6 for Peterborough.

TABLE 2

CHANGE IN FARM ACREAGE

	Durham	Northumberland	Peterborough	Victoria	Central Ontario
farm acreage 1951	323,765	395,496	358,766	477,508	1,555,535
farm acreage 1956	312,765	381,913	343,330	466,908	1,504,916
acreage change 1951-56	-11,000 (-3.4%)	-13,583 (-3.4%)	-15,436 (-4.3%)	-10,600 (-2.2%)	-50,619 (-3.3%)
farm acreage 1961	290,023	368,749	327,070	454,157	1,439,999
acreage change 1956-61	-22,742 (-7.3%)	-13,164 (-3.5%)	-16,260 (-4.7%)	-12,751 (-2.7%)	-64,917 (-4.3%)
farm acreage 1966	290,333	356,429	299,028	432,439	1,378,229
acreage change 1961-66	310 (0.0%)	-12,320 (-3.3%)	-28,042 (-8.6%)	-21,718 (-4.8%)	-61,770 (-4.3%)
farm acreage 1971	252,370	318,666	259,725	378,158	1,208,919
acreage change 1966-71	-37,963 (-13.1%)	-37,763 (-10.6%)	-39,303 (-13.1%)	-54,281 (-12.6%)	-169,310 (-12.3%)
acreage change 1951-71	-71,395 (-22.1%)	-76,830 (-19.4%)	-99,041 (-27.6%)	-99,350 (-20.8%)	-346,616 (-22.3%)

Source: Census of Canada, Agriculture Ontario, 1951-1971

CHAPTER TWO

REVIEW OF THE LITERATURE

In reviewing the literature, it is quite apparent that previous research on the loss of farmland has neglected to develop an analytical approach to the subject, particularly at a micro level. Descriptive studies at various scales dominate the literature. Academics and researchers have undertaken numerous studies describing the trends of farmland loss. However, in most instances, they have avoided the investigation or development of methodologies which would provide for a better understanding of the underlying forces involved in the processes of farmland loss. A notable gap exists in our understanding of the spatial dynamics or mechanics of land conversion from agricultural to non-agricultural uses. The spatial and temporal variations in the rates of land-use change are in need of a more thorough examination.

Acknowledging this deficiency, there have been several studies which have made useful contributions to the field. The framework in which these relevant studies will be reviewed is illustrated in Table 3. The pertinent studies have been categorized into three major study types. This review begins by examining those studies which have been classified as measurement.

TABLE 3

FRAMEWORK OF STUDIES TO BE REVIEWED

Type of Study	Author	Major Objectives
Measurement	Stamp (1948 Br.)	- awareness of the problem
	Best (1958, 1968 Br.)	- trends of farmland loss
	Wibberley (1959 Br.)	- attempt to measure acreage lost
	Bogue (1956 U.S.)	
	Crerar (1960 Can.)	
	Hind-Smith and Gertler (1962 Can.)	
	Boyce (1963 U.S.)	
	Russwurm (1967 Can.)	
	Doucet (1970 Can.)	
	Krueger (1970 Can.)	
	Noble (1974 Can.)	
	McKeague (1975 Can.)	
Causative	Johnson and Wooten (1958 U.S.)	- identify and investigate factors responsible for farmland loss
	Nelson and Nicolson (1960 Can.)	
	Noble (1962 Can.)	
	Clawson (1962, 1971 U.S.)	
	Bryant (1965, Can.)	

TABLE 3 - Continued

Type of Study	Author	Major Objectives
Planning	Vogel and Hahn (1971 U.S.)	- preservation of agricultural land
	A.R.D.A. Report No. 7 (1972 Can.)	- demands on agricultural land
	Hills (1973 Can.)	- planning recommendations
	Pearson (1975 Can.)	
	McCormack (1975 Can.)	

Measurement Studies

Measurement studies have focused their attention on attempting to calculate the amount of farmland lost in a given area. The primary objective behind the majority of these descriptive studies has been to create a public awareness of the problem. The basic approach utilized in these studies involves collecting and comparing census farm acreage data at varying time periods.

The first significant studies pertaining to the loss of farmland originated in Britain. During the 1900's, Britain experienced a rapid rate of population growth which exerted much pressure on its limited agricultural resource. Responding to a need for an inventory of Britain's resources, Stamp (1948) conducted a land-use survey of the country in the 1930's and 1940's. This survey led to the publication of land-use maps, which revealed significant acreages of farmland being converted to non-agricultural uses. Urban encroachment and farm abandonment were held accountable for much of this change in land use. Stamp attributed high rates of farm abandonment to poor accessibility and low land quality. The primary objective of Stamp's work was to reveal general land-use trends in Britain. However, in doing so, he stimulated a number of researchers to focus their attention on the problem of farmland loss. For instance, Best (1958) relying on data supplied by Ministry of Agriculture

Fisheries and Food calculated, annually, the net losses of agricultural land in England and Wales to non-rural uses from 1927 to 1959. Although Best's study confirmed Stamp's earlier observation that poor accessibility and low land quality contributed to farm abandonment, it also indicated that factors such as the uncertain economics of agriculture had an important role to play in the farm abandonment process.

Wibberley's (1959) study examined the competition for land between agricultural and urban use and noted the amount of agricultural land lost from 1900 to 1950 in Britain. The most significant aspect of his research was an attempt to analyze the variation in the rates of agricultural land transferred between 1922 to 1954. Wibberley's analysis produced two general observations: 1) during the period 1922 to 1939, urban areas experienced vast suburban development, resulting in the encroachment on large areas of farmland; and 2) after 1945, suburban growth resumed at a much slower rate than in the 1930's, which resulted in a significant decrease in the rate of farmland loss.

Since Wibberley's work, Best (1966,1968,1970,1973) has undertaken numerous studies investigating the aggregate rates of agricultural land being converted to urban use in Britain. Best (1968) argues that there is a close relationship between transfers of farmland to urban use and economic trends. In periods of economic prosperity, the demand for land and rate

of farmland loss is much greater.

A growing interest and need for research concerning the conversion of farmland to non-agricultural uses was experienced in the United States and Canada during the 1950's and 1960's. Vast metropolitan growth in the period resulted in urban encroachment on much farmland. Bogue (1956) attempted to measure the amount of farmland being lost in the United States as a result of population increases. Bogue posed the question, 'Under present conditions, how many acres of land are removed from agricultural production per 1,000 population?' (p. 55). Before attempting to answer the above question, Bogue recognized the limitations of the statistics. The problem had to be attacked in such a manner as to avoid the fact that the conversion of land from agricultural to urban uses had no boundary recognized in the official statistics of urban populations. The approach Bogue finally selected was to note the amount of decrease of agricultural land in relation to the increase of urban population. In proceeding with this approach, Bogue observed a decrease in farmland acreage in the vicinity of metropolitan areas from one census to the next. He then related the amount of this decrease to the amount of population growth that took place in the area during the inter-censal period. Bogue, in utilizing this approach, concluded that from 1929 to 1954 between 0.17 and 0.26 acres of farmland were converted to

urban uses for each additional member of the urban population (p. 72).

Crerar (1960), who patterned the analysis of his study after Bogue's, attempted to calculate the loss of farmland due to metropolitan growth for major urbanizing regions in Canada. Crerar's study, which analyzed census data, noted a decrease in the amount of farmland consumed per person as the city increased in size. For instance, beginning with the largest: Montreal consumed 374 acres; Toronto-Hamilton 382 acres; Winnipeg 383 acres; and London 458 acres per 1,000 population increase (p.p. 185-188). Perhaps, the most curious finding of Crerar's study concerned the Ottawa and Quebec City region which lost approximately 1,000 acres of farmland for every 1,000 increase in population (p. 186). Crerar attributed this high rate of land conversion to poor land quality and the increasing demand for recreational facilities. Crerar's most alarming finding was that all the cities examined in the study were consuming more land than they required. Crerar notes that with generous planning standards, cities need only 108 acres to accommodate an additional 1,000 increase in population (p. 193). Thus, the Toronto-Hamilton region might be considered to be wasting 2.74 acres for each one that they require.

After viewing Crerar's work, Hind-Smith and Gertler (1962) recognized the need for a more comprehensive study, focusing on smaller urban areas in Ontario. The urban centres selected

for this study consisted of Lindsay, Kingston, Stratford and London. Hind-Smith and Gertler's primary objective was to determine the 'quantity, location and quality of land consumed directly for development and affected indirectly - in the sense of being taken out of or gradually pressured out of agricultural production' (p. 156). The analysis of data obtained from census statistics, assessment rolls and municipal land-use records indicated that acreage consumed per 1,000 population increase, decreases as the city expands in size. This finding confirmed a similar observation by Crerar. In specific reference to Kingston, Hind-Smith and Gertler noted that soil quality influences the extent of urban penetration. Low quality soils which have serious limitations for agriculture provide little resistance to urban penetration and create conditions conducive to farm abandonment.

Boyce (1963) attempted to measure the loss of agricultural land in terms of population growth and increase in urban land area. The approach he selected was to relate population size to the area of urbanized centres for 1950 and 1960 in the United States. This allowed him to determine changes in the rate of urban land consumption. In using regression analysis, Boyce observed a strong relationship between population and urban land area with the slope of the regression line revealing that smaller urban centres use more land per capita than larger centres. This finding supported Crerar

and Hind-Smith and Gertler's observation that a decreasing amount of farmland was consumed as cities increased in size.

Russwurm (1967) completed a study dealing with the expansion of urbanization in South Western Ontario from 1941 to 1961. Utilizing census data, he calculated that the net loss of improved farmland in the study area was 50,231 acres or about 180 acres for each 1,000 people (p. 107). Russwurm challenges Crerar's postulation that by the year 2,000 no significant agricultural production would occur in his expected urban agglomeration focusing on the Toronto-Hamilton area. Russwurm's data revealed that a large percentage of the agricultural land in this area would still be in production by the year 2,000. From this, Russwurm implies that perhaps researchers and the Canadian public are over reacting to the problem of farmland loss. This study has proven to be important as it awakened and introduced many academics and researchers in the field to 'the other side of the coin' regarding farmland loss. Nevertheless, one should point out that his study was located in the Hamilton-Stratford area where urban pressures have not been as great as in the Golden Horseshoe region.

The findings from Doucet's study (1970) of trends in Toronto's land consumption for the period 1963 to 1968 supports Russwurm's contention that the rate of farmland loss in this area is not as large as previously noted by Crerar and others. Doucet observed a decline in the number of acres

per 1,000 population for residential development as well as a decline in the amount of idle land. Doucet concluded that the suburbanization process is slowing down and resulting in less land being occupied for urban uses. Russwurm and Doucet's study demonstrate the need for devising a standard measurement which would accurately calculate the amount of farmland lost in a given area.

Krueger (1970) undertook an intensive investigation dealing with the reduction of fruitland in the Niagara Fruit Belt. Krueger devised a novel approach in studying farmland loss. Krueger relied entirely on aerial photographic interpretation in determining acreages of farmland lost in the Niagara Fruit Belt. From air photographs of the region, he determined that about 12,000 acres of farmland were occupied for urban uses between 1934 and 1954 (p. 118). Krueger emphasizes the fact that much of the above acreage in farmland loss consisted of tender-fruit soil which is an invaluable and limited resource in Canada. Krueger concludes his study by recommending that restrictive planning legislation is needed to control urban encroachment on the Niagara Fruit Belt.

In analyzing census data, Noble (1974) has determined the percentage decreases in farm acreage for all census divisions in Ontario 1941 to 1971. This decline in farm acreage has been categorized and illustrated in a series of carefully prepared maps. These maps have provided an important data source for further research in this area, as they visually illustrate

which regions of Ontario have experienced the largest losses of agricultural land. Noble's study revealed three regions in Ontario which had large percentage decreases in farm acreage, the most notable being the Golden Horseshoe.

McKeague (1975) undertook an inventory of Canada's agricultural resources. McKeague's study revealed that the area of farmland absorbed for every increase of 1,000 in urban population varied from 10 to 400 ha (p. 12). The higher figure included urban fringe land alienated from agriculture by land speculation and escalating land prices. Furthermore, the study indicates that if a value of 80 ha per 1,000 increase of urban population were used, the projected permanent conversion of land to urban development in Quebec and Ontario between now and the year 2,000 would be 300,000 and 500,000 ha respectively. More than half of this land would be good agricultural land with soil capability classes one to three, in climatically favourable areas (p. 12). Since Canada has a limited resource of prime agricultural land, McKeague concludes his study by inferring that policy is needed to preserve high quality farmland surrounding cities such as Montreal, Toronto and Vancouver.

In summary, measurement studies have attempted to describe and calculate the amount of farmland loss in a given area. Spatial variations in the rate of farmland loss have been observed by several studies (Bogue 1956, Crerar 1960, Hind-Smith

and Gertler 1962) relating change in agricultural land use to change in urban population. These studies have focused on the measurement of farmland loss rather than examining the causes or mechanics of this phenomenon. Measurement studies have succeeded in creating a public awareness of the problem, as well as stimulating other researchers to investigate the causative aspects of the problem.

Causative Studies

During the 1960's, causative studies began to appear in the literature. The primary objective in studies of this type, has been to examine the factor(s) responsible for farmland loss. The causes of farmland loss have been emphasized, rather than attempting definite measurements of the quantity of agricultural land lost in a given area.

Until a study by Johnson and Wooten (1958) appeared, the causes of farmland loss were associated primarily with urban encroachment and farm abandonment. Previous research had failed to identify numerous other non-agricultural demands on farmland such as transportation, parks, reforestation projects, wild life areas, national defense, flood control, institutional and other intensive special uses. Perhaps, the most important contribution of the study is that it does provide proof of an early concern for the demands being placed on agricultural land and indicates the range of uses to which farmland is put when no longer used for agriculture.

Since 1941, farm abandonment has been a significant cause of farmland loss in Canada. Nevertheless, until a study by Nelson and Nicolson (1960) appeared, very little literature was available pertaining to the subject. Nelson and Nicolson noted the regional differences in the rate of farmland lost in Ontario from 1941 to 1956. Since Northern Ontario had experienced significant losses of agricultural land, the study attempted to investigate the factors responsible for this trend. Farm abandonment was indicated as the primary factor in the conversion of land to non-agricultural uses. A group of Northern Ontario townships were selected for further investigation, in an attempt to gain new insights into the mechanics of farm abandonment. This investigation revealed that abandonment was greatest in the townships in which crop acres per farm were low, occupied farm acreage was a small part of the whole and average farm values were low (p. 11). The above findings are useful in achieving a better understanding of the forces which underlie the processes of farm abandonment. However, a shortcoming of the study is that it only explores those aspects of farm abandonment in which there is census data readily obtainable. As a result, the relationships between farm abandonment and land quality or the socio-economic characteristics of the farm operator are not fully investigated or understood.

Noble (1962) attempted to overcome this shortcoming by

gathering data at the micro level concerning various socio-economic characteristics of farm operators involved in farm abandonment. Noble recognized the need to undertake field research if further insights were to be gained concerning the factors responsible for farm abandonment. This survey produced data varying from the origin of the operator's wife to the occupation of his mature children (p.p. 74-75). However, the study lacked an appropriate methodology which would allow Noble to analyze and assess this data. In several instances, Noble lists findings from his sample and leaves it to the reader to interpret them and relate their significance to farm abandonment in the area.

Clawson (1962) was the first North American researcher to undertake an intensive investigation of urban sprawl and speculation, and to relate its impact on agricultural activity. For the time period, Clawson's study revealed several important findings regarding the wastage of land by post-war sub-urbanization in North America. He estimated 'there was about as much idle land in and around cities as there was land used in any meaningful sense for urban purposes' (p. 106). Since much of the growth of cities is on good agricultural land, the above statement alerted planners and researchers to the fact that perhaps policy was required to prevent further unnecessary losses of agricultural land surrounding urban areas. Clawson suggested that increasing taxes on idle suburban land would encourage speculative owners to productively

utilize their property.

Clawson views urban sprawl and speculation as a conflict between the demands of an expanding economy and a fixed area of land. Clawson argues that land is converted from rural to urban uses because of economic pressures. In his most recent study, Clawson (1971) examines the factors affecting the rate of suburbanization in the United States. Clawson noted that land costs were an important factor influencing the rate of suburbanization. Since land prices comprise a large portion of the total cost of residential building, Clawson observed that the intensity of residential development increased with rising land costs. As land values continue to increase, the study notes that cities will be forced to expand onto cheaper land. This projection by Clawson may be somewhat unrealistic, as uniform land values often occur on land awaiting development. Clawson also notes that Federal Housing Policy, which determines the availability of credit for residential building, has a significant effect on the rate of suburbanization.

Bryant (1965) emphasizes the key role land speculation has played in taking large areas of prime agricultural land out of production. Bryant perceives the problem as being a conflict between public interest and private profit. In North America, Bryant argues that private profit has always reigned victoriously, resulting in land speculation (p. 111). Although

Bryant's study fails to quantitatively substantiate the land speculation problem in North America, it does provide a basic understanding of this phenomenon and its impact on agricultural land.

Causative studies have descriptively examined factors which are responsible for farmland loss. Aside from Nelson and Nicolson (1960) most of these studies have failed to adopt an analytical approach in assessing the impact of urban sprawl or farm abandonment on the loss of farmland. As a result, studies such as Johnson and Wooten (1958) have produced little more than general inventories of the causes of farmland loss in an area. Causative studies have not provided a comprehensive understanding of the mechanics of land conversion from agricultural to non-agricultural uses. Thus, further research is needed outlining the major characteristics of the processes involved in the transferring of land out of agricultural production.

Planning Studies

Planning studies have dominated the literature on loss of farmland during the 1970's. The preservation of prime agricultural land has been the central theme of these studies. Planning studies have attempted to provide answers for a number of fundamental questions concerning the issue of farmland loss. For instance, is preserving agricultural land desirable or possible? What type of land-use policy is required for preserving our prime agricultural land? These studies

have recognized the need for going beyond simply measuring the amount of farmland loss in a given area or examining the factors responsible for declining acreages of agricultural land. By investigating and developing methods of preserving agricultural land, planning studies have examined an aspect of farmland loss which previously received limited attention.

Vogel and Hahn (1971) attempted to objectively assess the issue of farmland preservation. Most planning studies make the assumption that the preservation of agricultural land is both desirable and necessary because of the jobs, incomes and other economic assets it produces. This study questioned the above assumption by noting that technological developments in American agricultural production have made it possible to grow more food with less labour and less land (p. 191). Vogel and Hahn's query had a significant impact on subsequent studies as planners began to rigorously defend the necessity of preserving farmland.

Vogel and Hahn recognized the need for planning in rural areas but denounced zoning as a device for preserving farmland because it would negate the farmer's rights to sell his land for urban or related purposes (p. 192). This study has helped put the issue of farmland preservation in perspective, an aspect other studies have avoided.

A.R.D.A. Project No. 7 (1972) completed at the University of Guelph indicates that factors such as soil capability, farm production, population growth and the demand for food

must be carefully examined before formulating guidelines for the preservation of agricultural land. Planning studies which neglect to investigate the above variables, have often produced unwise and ill-timed policy recommendations.

Hills (1973) notes that the traditional approach to land use has been one of planning for a single purpose use. Often this has resulted in land not producing its greatest economic potential. In a comprehensive study of the Simcoe Region, Hills formulates a plan for the multiple-use management of agricultural land. He suggests, for instance, that land could be used for intensive agriculture in the summer, and during the winter it could be used for recreation. An important objective of multiple land-use planning is to produce the crop for which the land is best suited, consistent with social and economic welfare. The crop may be wheat, pasture, or trees, or combinations of these. Hills assumed that the most important aspect of social and economic welfare is the production of food, and thus the amount and quality of land required for farming and grazing should be the initial consideration in land-use planning. Hills concludes that the establishment of multiple land-use plans will ensure that sufficient land is available for agricultural development.

During the 1970's, several governmental schemes have been applied in North America for the preservation of agricultural land. The British Columbia experience in preserving agricultural land has been evaluated by Pearson (1975). On April 18, 1973,

the Land Commission Act was established which provided for the zoning of Agricultural Land Reserves (p. 64). The primary purpose of these reserves was to terminate the conversion of agricultural land to urban uses. The policy also provided for the stabilization of farm incomes within these Agricultural Land Reserves.

Pearson concludes his study by suggesting that the Agricultural Land Reserve system is a fail-safe device to conserve land for food production (p. 73). A shortcoming of this scheme of land preservation which Pearson ignores is that it infringes upon the rights of the farmer to sell his land to the highest bidder, while also dictating the type of land use which will be allowed on his property in the future. This restriction of individual rights has been a key issue behind the ensuing controversy which has raged since the adoption of this policy. Further research is needed in examining and distinguishing between severely infringing upon an individual's rights, on the one hand, and providing for effective land-use policy on the other.

McCormack (1975) illustrated that agriculture is only one of many activities competing for land in Canada. Activities such as outdoor recreation, forestry, urban and rural development are all placing demands on Canada's land resource, resulting in a variety of land-use conflicts. Although the demand on land is increasing substantially with each passing year, McCormack notes that land in Canada is not at present, being allocated to

its highest and best use (p. 21). Conflicting objectives of planning agencies at the local, Provincial and Federal level have contributed to this problem. McCormack suggests that a national land-use policy is required in which on a national basis, policy objectives necessary to protect critical land resources could be uniformly enforced. Within this national framework, Provincial policies relating to Provincial priorities could be developed (p. 31). McCormack's study has demonstrated that perhaps a national land-use policy is required if we want to effectively prevent unnecessary losses of Canadian farmland in the future.

In summary, planning studies have focused their attention on the preservation of agricultural land. The usefulness of these studies can be improved by attempting to formulate policy which can be readily adopted as a tool in preventing unnecessary losses of agricultural land. Further research is required in developing a national land-use policy which will plan in the best interests of society.

This review has demonstrated that the literature on loss of farmland falls into three general categories. Measurement studies have attempted to calculate the rate of farmland loss at various scales and develop a public awareness to the problem. Different data sources and measurement techniques have often produced conflicting and inconsistant findings. These studies have described, rather than analyzed, trends in declining acreages of farmland. Few insights have been gained concerning

the temporal and spatial variations in the rates of farmland loss at both the macro and micro level. Causative studies, which consider the factors responsible for farmland loss have also adopted a descriptive approach. As a result, certain aspects of the subject are overlooked, such as the mechanics of land conversion from agricultural to non-agricultural uses. In addition, the forces which underlie the processes of farmland loss are awaiting a more comprehensive investigation. Planning studies have focused attention on the issue of farmland preservation. However, until planners can agree upon the type of policy required for more effectively preserving farmland, governments will have a tendency to overlook the problem.

The above review of the available and pertinent literature indicates a lack of studies which may be directly applicable to this investigation. No one to the author's knowledge has investigated the problem at the micro level by gathering and analyzing socio-economic data on those farmers whose land has been converted to non-agricultural uses. An approach of this type should lead to a better understanding of the processes involved in the loss of agricultural land and provide a foundation for the creation of theory and the formulation of policy.

CHAPTER THREE

FARMLAND LOSS MODEL

The purpose of this chapter is to present a model which may be helpful in explaining the loss of farmland to other uses in Central Ontario in the period 1951-1971.

Description of Step-wise Multiple Regression Analysis

Step-wise multiple regression analysis is derived from simple regression analysis which examines the relationship between dependent and independent variables. The program computes a sequence of multiple linear regression equations in a step-wise manner. At each step, one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error of the sum squares or commonly referred to as the regression coefficients (Nie, et al, 1975, p.p. 321-322). In simplistic terms, the program seeks to distinguish variables which provide the highest level of explanation for the relationship between the dependent and independent variables. The general equation for multiple linear regression is:

$$Y = a + b_1X_1 + b_2X_2 \ldots + b_nX_n + u,$$

where

Y is the dependent variable;

each X is an independent variable;

a is the constant term;

each b is a regression coefficient which indicates the change in Y expected for a unit change in the associated X, while all other independent variables are held constant;

and u is the residual or error term.

Variables in Analysis

The dependent variable in this analysis was the percentage decrease of farm acreage for each township in Central Ontario in the period 1951-1971.

As can be seen in Table 4, six independent variables based on 1951 township data were inserted in the model. Variable one, a measure of farm capitalization, was considered as an important factor influencing the magnitude of farmland loss in this region. It was hypothesized that the lower the average capitalization per farm, the greater the loss of farmland. Farms which had a large amount of capital invested in them would have more resistance to farm abandonment. A similar hypothesis was formulated for the variable farm size. It was predicted that the lower the average size of farm, the greater the loss of farmland. Using the insight gleaned from preliminary field work, small farms in this region appeared less viable and more susceptible to change to non-farm uses.

The hypothesis associated with the part-time farming variable was that the greater the ratio of part-time farms to

TABLE 4

VARIABLES IN ANALYSIS

Dependent Variable Y - percentage decrease of farm acreage for each township, 1951-1971

Independent Variables	Quantified Form (1951 twp. data)
X_1 Capitalization	$\frac{\text{Total Farm Capital}}{\text{Total Farm Operators}}$
X_2 Farm Size	Average Farm Size
X_3 Part-time Farming	$\frac{\text{Total Part-time Farmers}}{\text{Total Farm Operators}}$ *
X_4 Length of Shoreline	$\frac{\text{Miles of Developable Shoreline}}{\text{Square Miles of Farmland}}$
X_5 Soil Quality	$\frac{\text{Total Adjusted Acreage}}{\text{Total Acreage of Farmland}}$ **
X_6 Age of Farmers	$\frac{\text{Farmers Greater Than 60 Years}}{\text{Total Farm Operators}}$

* Part-time farmer defined as having 97 or more days of off-farm work

** Adjusted acreage calculated by multiplying the acreage in each class of agricultural land (Canada Land Inventory) with the appropriate Noble conversion factor (Hoffman, 1971, p. 47)

total farms, the larger the magnitude of farmland loss. Part-time farming was viewed as an important transition stage for farmers who were phasing out their operations. A similar relationship was predicted for the length of shoreline variable. Since cottage development had encroached on farmland along shoreline areas, it was hypothesized that the larger the ratio of developable lake or river shoreline to the total area, the greater the loss of farmland.

As noted from previous studies, low quality soils offer little resistance to urban penetration and create conditions conducive to farm abandonment (Crerar, 1960; Hind-Smith and Gertler, 1962). Based on the above observation, it was hypothesized that the lower the soil quality, the larger the amount of farmland loss.

A final hypothesis was formulated concerning the age of the farmer. It was anticipated that the greater the proportion of farmers over 60 years, the larger the magnitude of farmland loss. Since many of these farmers would be entering a stage of declining health and increased aspirations for retirement, they would be more likely to sell when offers of purchase became available or to abandon their farms. A summary of these six a priori hypotheses is contained in Table 5.

Regression Analysis

In referring to Table 6, the part-time farming variable entered the regression equation first, by explaining 71.7 per cent of the farmland lost in Central Ontario in the period

TABLE 5

SUMMARY OF A PRIORI HYPOTHESES

Independent Variables	Predicted Hypotheses
Capitalization	the lower the average capitalization per farm, the greater the loss of farmland
Farm Size	the lower the average size of farm, the greater the loss of farmland
Part-time Farming	the greater the ratio of part-time farms to total farms, the greater the loss of farmland
Length of Shoreline	the larger the ratio of developable shoreline to the total area, the greater the loss of farmland
Soil Quality	the lower the soil quality, the greater the loss of farmland
Age of Farmers	the greater the proportion of farmers over 60 years, the greater the loss of farmland

TABLE 6

REGRESSION RESULTS

Dependent Variable - Percentage Decrease of Farm Acreage from 1951-1971

Variable	Coefficient	t value	Cumulative Amount Explained	Incremental Amount Explained
Part-time Farming	59.93	5.47*'	0.717	0.717
Farm Size	0.01	0.71	0.764	0.047
Length of Shoreline	0.34	1.78*	0.782	0.018
Age of Farmers	47.56	1.55	0.793	0.011
Soil Quality	-10.71	-1.35	0.801	0.008
Capitalization	0.00	0.67	0.804	0.003

F ratio - 21.23 significant at the 0.01 level

Durbin-Watson Statistic - 2.00 no positive autocorrelation

Significance at the 0.05 level is indicated by an *

Significance at the 0.01 level is indicated by an '

Source: Computer Printout

1951-1971. The part-time farming coefficient of 59.93 was significant at the 0.01 level with a t value of 5.47. The positive coefficient direction supports the a priori hypothesis that in those areas where, in 1951, the ratio of part-time farms to total farms was high, there has tended to be a greater amount of farmland loss over the period 1951-1971 (ceteris paribus).

The length of shoreline variable increased the explanation level of the model by 1.8 per cent. The length of shoreline coefficient of 0.34 was significant at the 0.05 level with a t value of 1.78. The positive direction of the coefficient verifies its respective a priori hypothesis that farmland loss has been greater in areas with a large ratio of developable shoreline to the total area (other things being equal).

The remaining variables in the regression equation were not significant at the 0.01 or 0.05 level. Nevertheless, it is interesting to note that the direction of their coefficients support the a priori hypotheses. The negative direction of the soil quality coefficient confirmed the hypothesis that areas with low quality soils have greater amounts of farmland loss (all other variables held constant). Similarly, it was hypothesized that the greater the proportion of farmers over 60 years, the greater the amount of farmland loss. The positive direction of the age of farmers coefficient confirms this relationship (everything else being the same). Although the variables farm size and capital reveal positive coefficients as was hypothesized, their size 0.0134 and 0.0004 respectively,

indicate that they do not merit any consideration. The resulting equation of the model was:

$$Y = -3.45 + 59.93X_1 + 0.01X_2 + 0.34X_3 + 47.56X_4 - 10.71X_5 + 0.00X_6 + e.$$

From Table 7, it can be seen that multicolinearity was kept within reasonable limits. However, some intercorrelation is noticeable with the part-time farming and length of shoreline measures which suggests that these two variables might be amalgamated.

By examining the model's F ratio of 21.23, it can be noted that the regression was significant at the 0.01 level (see Table 6). Furthermore, the Durbin-Watson Statistic indicates that there was no significant autocorrelation of the residuals.

Conclusions

This model has isolated the variable of part-time farming as an important contributor to the loss of farmland in Central Ontario from 1951-1971. It suggests that part-time farming is a significant force underlying the process of farmland loss. In this part of the province, part-time farming in many cases represented a transition from full-time farming to the sale of the property for non-farm uses or to abandonment. Thus, the model has observed a strong relationship with part-time farming and declining farm acreages which sheds some new light on the mechanics of farmland loss.

TABLE 7

CORRELATION MATRIX

1	1.00						
2	-0.46	1.00					
3	-0.36	0.21	1.00				
4	-0.52	0.35	0.73	1.00			
5	0.70	-0.43	-0.40	-0.60	1.00		
6	-0.38	0.39	0.85	0.75	-0.49	1.00	
7	0.31	0.28	-0.17	-0.32	0.41	-0.04	1.00
Variable Number	1	2	3	4	5	6	7

Legend

Variable Number	Variable
1	Capitalization
2	Farm Size
3	Part-time Farming
4	Length of Shoreline
5	Soil Quality
6	Percentage Decrease of Farm Acreage (Dependent)
7	Age of Farmers

Source: Computer Printout

CHAPTER FOUR

DATA ANALYSIS

This chapter presents a descriptive analysis concerning the characteristics of farms and farmers involved in the loss of farmland process. A total of 105 Northumberland County farms which have gone out of production in the period 1951-1971, are examined. This investigation attempts to identify the socio-economic characteristics of these operators at the time their property was transferred from agricultural to non-agricultural uses. Furthermore, it attempts to distinguish the physical characteristics of these properties, as well as ascertaining the factors responsible for the change in land use. Certain socio-economic characteristics of 105 operators will be compared with a control group from the census representing the general farm population of Northumberland County. The approximate location of the 105 sample farms are shown on Figure 4.

Part-time Farming Comparison

As can be seen from Table 8, the percentage of part-time farmers in Northumberland County has increased from 11.2 in 1951 to 28.4 in 1971. In contrast, the percentage of part-time farmers in the sample, comprising farms which have been

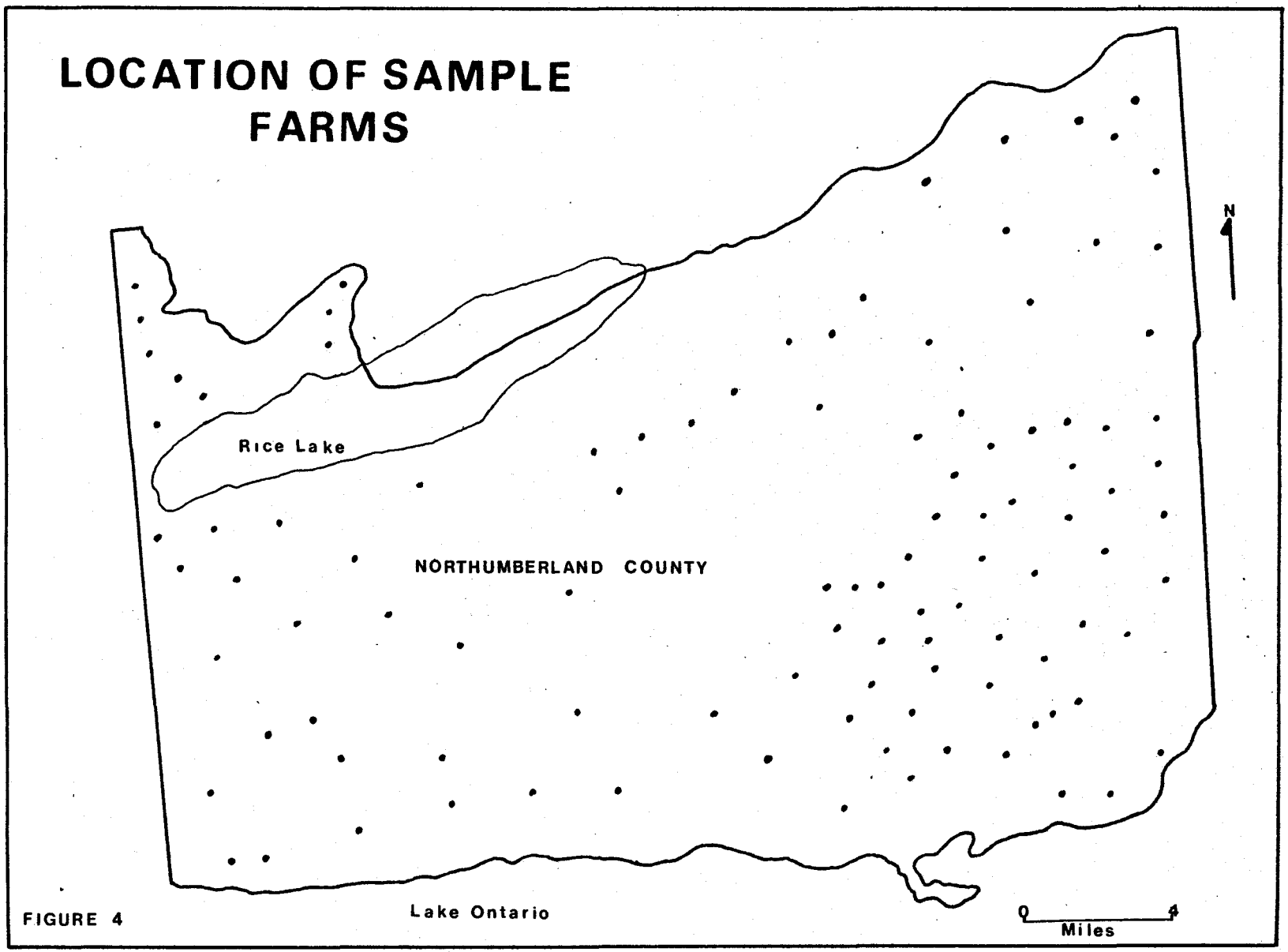
LOCATION OF SAMPLE FARMS
Rice Lake
NORTHUMBERLAND COUNTY
Lake Ontario
N
0
4
Miles

FIGURE 4

TABLE 8

PART-TIME FARMING

NORTHUMBERLAND COUNTY

Census Year	# of Part-time*	Total # of Farmers	% Part-time
1951	308	2,760	11.2
1956	498	2,660	18.7
1961	515	2,276	22.6
1966	569	2,075	27.4
1971	509	1,793	28.4
1951-1971'	480	2,313	21.7

SAMPLE

Sample Years	# of Part-time*	Total # of Farmers	% Part-time
1951-1971	38	105	36.2
1956-1971	32	91	35.2
1961-1971	29	83	34.9
1966-1971	27	66	40.9

* 97 days or more of off-farm work per year

' average for five census years

Sources: Census of Canada, Agriculture Ontario, 1951-1971 and Northumberland Research Data

converted to non-farm uses, has remained relatively constant throughout the period. In addition, the percentage of part-time farmers varied considerably for the two groups. The average percentage of part-time farmers in Northumberland during the period 1951-1971 was 21.7. For the same time period, 36.2 per cent of the sample was part-time. This statistic supports the relationship observed by the model developed in chapter three, that part-time farming was during this period an important transitional stage in the change from full-time farming to non-agricultural use of the land.

Age Comparison

In order to have comparable data for the age distribution of farmers in the sample and Northumberland farmers in general, the following equation was devised:

$$A_{51} = A_t - (Y - 1951)$$

where

A_{51} is the calculated age in 1951;

A_t is age at transfer of farm to non-farm uses; and

Y is year of land-use change.

Similarly, to calculate the age of the sample at 1956, 1961 and 1966, the respective equations were as follows:

$A_{56} = A_t - (Y - 1956)$;

$A_{61} = A_t - (Y - 1961)$; and

$A_{66} = A_t - (Y - 1966)$.

In referring to Table 9, the age distribution of Northumberland farmers, as well as those for the sample calculated by

TABLE 9

AGE

Years	Northumberland County 1951	%	Sample 1951*	%
less than 35	484	17.5	7	7.1
35-39	308	11.2	10	10.1
40-44	323	11.7	20	20.2
45-49	333	12.1	24	24.2
50-54	348	12.6	20	20.2
55-59	302	10.9	9	9.1
60-69	452	16.4	7	7.1
70+	210	7.6	2	2.0
Total	2,760	100.0	99	100.0

Years	Northumberland County 1956	%	Sample 1956**	%
less than 35	463	17.4	7	8.0
35-39	299	11.2	2	2.3
40-44	310	11.7	9	10.2
45-49	318	12.0	19	21.6
50-54	338	12.7	23	26.1
55-59	290	10.9	18	20.5
60-69	443	16.7	9	10.2
70+	199	7.4	1	1.1
Total	2,660	100.0	88	100.0

TABLE 9 - Continued

Years	Northumberland County 1961	%	Sample 1961***	%
less than 35	300	13.2	3	3.7
35-44	523	23.0	7	8.5
45-54	589	25.9	27	32.9
55-59	289	12.7	20	24.4
60-64	222	9.7	18	22.0
65-69	166	7.3	5	6.1
70+	187	8.2	2	2.4
Total	2,276	100.0	82	100.0

Years	Northumberland County 1966	%	Sample 1966****	%
less than 35	241	11.6	0	0.0
35-44	455	21.9	7	10.8
45-54	584	28.1	11	16.9
55-59	267	12.9	16	24.6
60-64	225	10.8	18	27.7
65-69	148	7.2	9	13.8
70+	155	7.5	4	6.2
Total	2,075	100.0	65	100.0

* six farmers were excluded from sample as they were not operating in 1951

TABLE 9 - Continued

** three farmers were excluded from the sample as they were not operating in 1956 - another fourteen farmers have been omitted from the sample as they had abandoned agriculture during the period 1951-1955

*** one farmer was excluded from the sample as he was not operating in 1961 - another twenty-two farmers have been omitted from the sample as they had abandoned agriculture during the period 1951-1960

**** one farmer was excluded from the sample as he was not operating in 1966 - another thirty-nine farmers have been omitted from the sample as they had abandoned agriculture during the period 1951-1965

Year	Chi-square Value	Interpretation
1951	38.19	columns are significantly different at the 0.01 level
1956	42.83	columns are significantly different at the 0.01 level
1961	37.63	columns are significantly different at the 0.01 level
1966	42.01	columns are significantly different at the 0.01 level

Sources: Census of Canada, Agriculture Ontario, 1951-1971 and Northumberland Research Data

the above equations are shown. Using the Chi-square Statistic, it was noted that the age distribution of the sample compared to Northumberland farmers in general was significantly different. For 1951, 1956, 1961 and 1966, the computed chi-squares indicated that the age distribution of the two groups were significantly different at the 0.01 level. From viewing the percentage figures in Table 10, it is quite apparent that Northumberland in general has a younger age distribution than the sample. For instance, the average percentage of Northumberland farmers in the age category 45-69 years in the period 1951-1966 was only 54.7 as opposed to 76.9 for the sample. Furthermore, the sample had only an average percentage of 4.7 in the age category less than 35 years compared with 14.9 for Northumberland. Although the greater than 70 years category does not reflect this trend, it represents a low percentage of the total in either group.

As was anticipated, one would expect the sample to have a high percentage of farmers in the advanced age categories. Farmers approaching retirement age or experiencing health problems and declining aspirations would have a greater probability of leaving agriculture.

Type of Farm Comparison

The types of farm enterprise characteristic of these two groups are illustrated in Table 11. By studying this table, some distinguishable characteristics of the two groups may be observed. For instance, the mean percentage of operators

TABLE 10

AGE DISTRIBUTION

Age in Years	Northumberland (%)	Sample (%)	Year
less than 35	17.5	7.1	1951
	17.4	8.0	1956
	13.2	3.7	1961
	11.6	0.0	1966
	14.9	4.7	1951-1966*
35-44	22.9	30.3	1951
	22.9	12.5	1956
	23.0	8.5	1961
	21.9	10.8	1966
	22.7	15.5	1951-1966*
45-69	52.0	60.6	1951
	52.3	78.4	1956
	55.7	85.4	1961
	58.9	83.0	1966
	54.7	76.9	1951-1966*
70+	7.6	2.0	1951
	7.5	1.1	1956
	8.2	2.4	1961

TABLE 10 - Continued

Age in Years	Northumberland (%)	Sample (%)	Year
	7.5	6.2	1966
	7.7	2.9	1951-1966*

* average for four census years

Sources: Census of Canada, Agriculture Ontario, 1951-1966 and Northumberland Research Data

TABLE 11

TYPE OF FARM

Year	Dairy (%)	Cattle-Hogs-Sheep (%)	Poultry (%)	Small Grains (%)	Field Crops (%)	Vegetables and Fruits (%)	Mixed (%)	Live-stock (%)	Other (%)	Total (%)
1961	28.7	37.3	4.3	0.9	3.3	5.7	9.5	8.1	2.2	100.0'
1966	34.7	38.9	3.9	1.8	4.4	5.5	4.9	3.7	2.4	100.0'
1971	38.5	41.3	2.5	1.5	4.1	5.5	2.5	1.5	2.6	100.0'
1961-71*	34.0	39.2	3.5	1.4	3.9	5.6	5.6	4.4	2.4	100.0'
1951-71	10.5	14.3	3.8	2.9	4.8	4.8	46.7	7.6	4.6	100.0"
1956-71	11.0	15.4	3.3	1.1	4.4	3.3	48.4	7.7	5.4	100.0"
1961-71	10.8	18.1	3.6	2.4	4.8	3.6	49.4	4.8	2.5	100.0"
1966-71	13.6	18.2	4.6	1.1	3.0	4.6	48.5	4.6	1.8	100.0"

' represents Northumberland farmers in general
" represents Northumberland farmers that have abandoned agriculture
* average for three census years
Northumberland County census data on type of farm not available for 1951 or 1956
Definition of farm type: 51.0 per cent or more of total sales of agricultural products obtained from a given agricultural product or combination of farm products
Sources: Census of Canada, Agriculture Ontario, 1961-1971 and Northumberland Research Data

engaged in mixed farming in Northumberland County in the period 1961-1971 was 5.6. Forty-nine point four per cent of farmers in the sample were carrying on a mixed farming type of operation prior to going out of business. However, with reference to the dairy and cattle-hogs-sheep categories, only 10.8 per cent and 18.1 per cent respectively of the farmers in the sample were operating enterprises of this type. Northumberland on the other hand, had a mean percentage of 34.0 of its total farms classified as dairy and cattle-hogs-sheep enterprises.

One would anticipate low percentages of dairy and cattle-hogs-sheep enterprises for the sample because these two farm types are capital and labour intensive. Farmers intending to leave agriculture would be more likely to operate a farm type requiring a minimum amount of labour and capital investment. Mixed enterprises generally have considerable acreage devoted to pasture. Although forage and small grain crops are also grown which provide fodder for livestock kept on the farm. Nevertheless, this farm type requires modest amounts of labour and capital as opposed to the more commercial oriented dairy and cattle-hogs-sheep enterprises. Thus, the mixed farm type appears to be an appropriate one for those operators contemplating leaving farming.

Farm Size and Improved Land Acreage Comparisons

As can be seen from Table 12, the farm size and acreage

TABLE 12

FARM SIZE AND IMPROVED LAND ACREAGE

Farm Size

Northumberland

Acres	% 1951	% 1956	% 1961	% 1966	% 1971	% 1951-71
less than 9	3.1	3.7	4.0	3.5	4.0	3.7
10-69	16.3	17.1	14.3	14.7	14.9	15.5
70-129	34.2	33.4	28.9	27.2	26.4	30.0
130-179	18.5	17.2	17.5	15.3	14.7	16.6
180-239	15.4	15.2	16.6	16.4	15.8	15.9
240-399	9.9	10.8	14.7	17.5	17.2	14.0
400+	2.6	2.6	4.0	5.4	7.0	4.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sample

Acres	% 1951-71	% 1956-71	% 1961-71	% 1966-71
less than 9	-	-	-	-
10-69	19.0	18.7	19.3	24.2
70-129	41.9	41.8	41.0	37.9
130-179	12.4	12.0	12.1	12.1
180-239	16.2	16.5	15.6	15.2
240-399	10.5	11.0	12.0	10.6
400+	-	-	-	-

TABLE 12 - Continued

Sample

Acres	% 1951-71	% 1956-71	% 1961-71	% 1966-71
Total	100.0	100.0	100.0	100.0

Improved Land Acreage

Northumberland

Acres	% 1951	% 1956	% 1961	% 1966	% 1971	% 1951-71
less than 9	5.9	7.4	8.3	6.8	9.6	7.6
10-69	38.5	35.1	28.3	28.4	30.3	32.1
70-129	39.0	39.1	37.0	34.2	30.2	35.9
130-179	11.2	11.7	14.0	14.3	12.2	12.7
180-239	3.4	4.2	8.0	9.8	9.7	7.0
240+	2.0	2.5	4.4	6.5	8.0	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sample

Acres	% 1951-71	% 1956-71	% 1961-71	% 1966-71
less than 9	-	-	-	-
10-69	27.6	24.2	25.3	28.8
70-129	42.9	46.2	44.6	43.9
130-179	16.1	16.5	15.7	13.6
180-239	10.5	11.0	12.0	12.1
240+	2.9	2.1	2.4	1.6

TABLE 12 - Continued

Sample Acres	% 1951-71	% 1956-71	% 1961-71	% 1966-71
Total	100.0	100.0	100.0	100.0

' average for five census years

Sources: Census of Canada, Agriculture Ontario, 1951-1971 and Northumberland Research Data

of improved land for the two groups are illustrated. It is interesting to note that the sample was not represented by farms in the less than 9 or greater than 399 acreage categories. As one would expect, moderate size farms in the 70-129 acreage range were most common. Of those farmers in the sample who left agriculture in the period 1951-1971, 41.9 per cent had farms 70-129 acres in size. In contrast, the mean percentage of Northumberland farms in this category for the same time period was 30.0, significantly lower. A general trend is noticeable for Northumberland in that the percentage of farms in the small acreage categories are decreasing through the period 1951-1971. While the percentage of farms in the large acreage categories are increasing. Since the 1950's, this has been a persistent trend in Ontario agriculture, as farmers increase their acreage in order to take advantage of economies of scale. However, this trend is not prevalent for the sample group. For the most part, the farm size acreage categories reflect a stagnation process in the period. Farmers in the sample appear to have had little interest in increasing the acreage of their properties.

In comparing the acreages of improved land for the two groups, again the sample was not represented in the less than 9 acre category. Nevertheless, taking this into account, the remaining acreage categories for the two groups were remarkably similar. It is somewhat surprising that the sample

did not have a larger percentage of its arable acreage in the less than 9 and 10-69 categories. Farms with less than 70 acres of arable land are often not viable agricultural enterprises, which would encourage their operators to abandon agriculture.

Son Interested in Farming

An hypothesis was formulated that if a farmer had a son interested in farming, it would deter his desire to leave agriculture. Thus, one would expect a low percentage of the 105 farmers in the sample to have a son interested in farming. Empirical evidence supports this expectation. It was found that only 19 per cent of the sample had sons with aspirations for farming. Although some farmers might be influenced more by this factor than others, it does suggest the existence of a relationship between a farmer having no sons interested in farming and his decision to get out of agriculture.

Personal Considerations

It was anticipated that farmers abandoning agriculture would have little commitment to their communities and a low degree of sentimental attachment to their farms. Contrary to what one might expect, only 3.8 per cent of the farmers in the sample regarded themselves as having a weak degree of sentimental attachment to their farm. Similarly, only 7.6 per cent of the sample indicated a weak commitment to the community (see Table 13). Thus, it appears that these farmers were active

TABLE 13

PERSONAL CONSIDERATIONS

Sample

	Degree of Sentiment Attached to Farm	Commitment to Community (Clubs, Farm Organizations and Local Events)
Strong	47.6%	43.8%
Medium	48.6%	48.6%
Weak	3.8%	7.6%

Source: Northumberland Research Data

in their communities and had experienced much personal satisfaction from farming.

Length of Time on Farm

It is interesting to note that the majority of farmers in the sample had operated their property for a number of years. The length of time ranged from 3 to 73 years. The mean number of years was 33.7. One may have anticipated such a large figure because as was previously noted, a large percentage of the sample had ages greater than 45 years.

Soil Quality

From the sample, approximately 11,300 acres of farmland were recorded as going out of production in the period 1951-1971. Based on the observation by Crerar (1960) and Hind-Smith and Gertler (1962) that the loss of farmland was more prevalent on poor soils, it was anticipated that much of this acreage would be soils of low capability for agriculture. As can be seen from Table 14, 52.7 per cent of the acreage was in classes one to three which provide few limitations for agriculture. Another 40.6 per cent of the acreage was in classes four and five which have moderate to serious limitations for agriculture. However, to the researcher's surprise, only 2.4 per cent of the soils were in the sixth class. This soil class has severe limitations for agriculture and is capable of use only for grazing. These results suggest that the acreage of farmland lost on low quality agricultural soils was not of an alarming magnitude.

TABLE 14

SOIL CAPABILITY FOR SAMPLE FARMS

Active Farm Transferred To	Acreage in Soil Classes							
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Organic	Total
Residential	157 (1.5%)	215 (1.9%)	670 (5.9%)	155 (1.4%)	520 (4.6%)	50 (0.4%)	125 (1.1%)	1,892 (16.8%)
Abandoned	185 (1.6%)	917 (8.1%)	1,984 (17.6%)	1,340 (11.9%)	1,112 (9.9%)	150 (1.3%)	358 (3.2%)	6,046 (53.6%)
Reforestation	-	-	-	-	605 (5.4%)	75 (0.7%)	-	680 (6.1%)
Recreation	511 (4.5%)	282 (2.5%)	65 (0.6%)	80 (0.7%)	202 (1.8%)	-	-	1,140 (10.1%)
Extractive Industries	225 (2.0%)	44 (0.5%)	485 (4.3%)	340 (2.9%)	-	-	-	1,094 (9.7%)
Cottages	-	70 (0.6%)	125 (1.1%)	-	35 (0.3%)	-	-	230 (2.0%)
Other	-	-	-	-	195 (1.7%)	-	-	195 (1.7%)
Total	1,078 (9.6%)	1,528 (13.6%)	3,329 (29.5%)	1,915 (16.9%)	2,669 (23.7%)	275 (2.4%)	483 (4.3%)	11,277 (100.0%)

Sources: Northumberland County Soil Capability for Agriculture Map, 1970 and Northumberland Research Data

It is also noticeable from Table 14, that almost 54 per cent of the farm acreage was abandoned or in other words allowed to revert to a state of idleness. Of the acreage abandoned, over half (51.1 per cent) was class one to three soil. Again low quality soils do not appear to have been a major contributor to the extensive farm abandonment in the area. A total of 16.8 per cent of the acreage was transferred to residential uses which includes idle land held for speculation. Since Northumberland is predominately a rural county, somewhat removed from the urban related pressures of the Golden Horseshoe region, one would not expect a large amount of farmland to be converted to residential uses. Recreation, extractive industries and reforestation projects were the other significant users of agricultural land. Nevertheless, farm abandonment appears to be the dominant factor contributing to farmland loss in Northumberland.

Reasons for leaving Agriculture

In order to shed some light on the range of stimuli affecting the decision-making process, the farmers in the sample were asked to state their reasons for leaving agriculture. One must keep in mind, there are numerous problems associated with this approach. For instance, individuals may have only vague recollections of the basis of their decision, particularly when that decision was made several years ago. In addition, respondents may be influenced by the researcher's questioning.

Nevertheless, Table 15 demonstrates the reasons for which farmers transferred out of agriculture.

More than two-thirds of the farmers in the sample cited low farm profits as an important reason for leaving agriculture. Low prices for farm products and increasing costs of production were noted as the major contributors of low agricultural incomes. Many individuals expressed angry sentiments of being forced out of agriculture due to the poor economic conditions of farming. Others noted the shortage of farm labour as a factor influencing their decision to abandon agriculture. However, some indicated that even if sufficient labour had been available, they could not afford to employ farm hands.

A considerable proportion of the sample stated that health problems had an important role to play in their decision to leave agriculture. Since much of the sample was greater than 55 years in age, one would anticipate that many farmers might be experiencing health problems. As well, a substantial number in the sample, particularly those with small holdings, stated that the uneconomic size of their farms was a major reason for leaving agriculture. Again, many complained that low farm incomes prevented them from enlarging their properties in order to benefit from economies of scale. As an overview, it appears that low farm profits was the basic reason for their decision to withdraw from agriculture.

Contagious Effect

A contagious effect may also be operating. For instance,

TABLE 15

REASONS FOR LEAVING AGRICULTURE

Sample

Reason	Frequency*
Low farm profits	81
Labour shortage	32
Health	27
Farm size	25
Soil deficiencies	7
Opportunity arose	4
Other	4

* several farmers cited more than one reason

Source: Northumberland Research Data

if several farmers in a rural community have abandoned or sold their properties to non-farm uses, it may encourage others in the immediate vicinity to do likewise. The following statistic supports this premise. Approximately, 95 per cent of the sample indicated that numerous other farmers had transferred out of agriculture in the local area at the same time they made their decision to leave farming. The impact of this contagious effect is difficult to assess as one must keep in mind that other factors, such as soils being similar in the area, may have also contributed to this phenomenon.

The Model Farmer leaving Agriculture

Table 16 demonstrates that the model farmer leaving agriculture in Northumberland County in the period 1951-1971, was a 60 year old man operating a 134-acre farm. Approximately, 107 acres of his farm was arable. The operation is about as large as one man can handle. He has operated the farm for about 34 years with considerable personal satisfaction. There is a tendency for him to acquire off-farm work to supplement his farm income. The mixed farm type which is less labour and capital intensive appears to be the most appropriate type. Since he does not have a son interested in farming, the likelihood of him selling or abandoning his farm is enhanced. However, the ultimate reason for his decision to leave agriculture is that it does not yield a satisfactory income. As a result, the decision is made to withdraw from agriculture.

TABLE 16

THE MODEL FARMER LEAVING AGRICULTURE

Sample

Length of time on farm	33.7 years'
Age	60.3 years'
Farm size	133.8 acres'
Amount arable	107.4 acres'
Type of farm	46.7% mixed''
Part-time farming	36.2%''
Son not interested in farming	81.0%''

' average for sample

'' percentage of sample

Source: Northumberland Research Data

CHAPTER FIVE

CONCLUSIONS

This study has examined the loss of farmland in four counties of Central Ontario from 1951-1971. A model was generated to help explain this loss of farmland. The model revealed that part-time farming was the most important explanatory variable. In other words, in this period, in this part of the province, part-time farming was the best indicator that a phasing out of agriculture was taking place.

The investigation also attempted to identify the characteristics of farms and farmers involved in the loss of farmland process. A descriptive analysis of 105 Northumberland County farmers who transferred out of agriculture in the period 1951-1971, provided several interesting findings. Part-time farming was a notable characteristic of these farmers. Furthermore, many were older farmers in their fifties and sixties operating modest sized mixed farms. The majority of them expressed a personal satisfaction from farming which is reflected in the considerable length of time they had operated their farms. Nevertheless, few individuals in the sample had a son who expressed an interest in farming.

Low farm profits were regarded as the dominant reason for their decision to leave agriculture. However, a shortage of

labour, health problems and uneconomic size of farm were also commonly cited.

This investigation can be useful to government, planners and other researchers, as it has isolated several factors which help to explain the loss of farmland in Central Ontario. It has also provided a better understanding of the underlying forces affecting the rate of farmland loss. This knowledge is urgently required if effective land-use policies are to be developed to ensure the continued economic viability of farming in Ontario.

More research on the decision-making process by farmers leaving agriculture is needed. The collection and analysis of data concerning the economic viability of the operation at the time of the land-use change may shed some new light on the farmer's decision to transfer out of agriculture.

It might also be useful to examine the farmers who continued in farming to ascertain if there are significant differences between them and those who left farming. Various statistical techniques could be used to achieve this end. By isolating unique characteristics of each group further insights might be gained in providing for a basic understanding of farmland loss. Once this process is more clearly understood, planners would then be in a better position to designate which areas should remain in agricultural use.

Finally, there is a need to investigate further the temporal

and spatial variations in the rate of farmland loss at both the macro and micro levels. The use of time series data would be helpful in tracing the decline of agricultural acreage through time.

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