

# Agricultural Change and Farmland Rental in an Urbanising Environment : Waterloo Region, Southern Ontario

Christopher R. Bryant and Geoffrey A. Fielding

Volume 24, Number 62, 1980

URI: <https://id.erudit.org/iderudit/021473ar>

DOI: <https://doi.org/10.7202/021473ar>

[See table of contents](#)

Publisher(s)

Département de géographie de l'Université Laval

ISSN

0007-9766 (print)

1708-8968 (digital)

[Explore this journal](#)

Cite this article

Bryant, C. R. & Fielding, G. A. (1980). Agricultural Change and Farmland Rental in an Urbanising Environment : Waterloo Region, Southern Ontario. *Cahiers de géographie du Québec*, 24(62), 277–298. <https://doi.org/10.7202/021473ar>

Article abstract

In geographic research into urbanisation-agriculture interactions, a strong emphasis has been given to the negative effects of urbanisation on agriculture. Here, it is argued that the urbanisation-agriculture interaction process may provide certain opportunities for agricultural progress and development, depending upon the specific regional circumstances; the phenomenon of farmland renting from nonfarm landowners is thus studied as an example of such a potentially beneficial interaction. Statistical associations between agricultural and population variables for an area in southern Ontario provide the context for a detailed farmer survey. The results show farmland rental from nonfarm owners to be a significant factor in agricultural development in the urban fringe environment of the medium-sized, yet fast-growing cities in the study area, and add to recent literature which has stressed the complexities of urban fringe agriculture.

## AGRICULTURAL CHANGE AND FARMLAND RENTAL IN AN URBANISING ENVIRONMENT: WATERLOO REGION, SOUTHERN ONTARIO

by

Christopher R. BRYANT and Jeffrey A. FIELDING

*Department of Geography, University of Waterloo, Ontario*

### RÉSUMÉ

**Christopher R. BRYANT et Jeffrey A. FIELDING : Le développement agricole et la location des terres dans une région en voie d'urbanisation : la région de Waterloo dans le sud de l'Ontario**

Dans l'analyse des rapports entre l'urbanisation et l'agriculture, la recherche géographique s'est surtout intéressée, jusqu'à maintenant, aux effets néfastes de la croissance urbaine sur l'agriculture. Nous émettons l'idée que cette interaction, lorsque prévalent des conditions régionales bien précises, peut jouer un rôle positif dans le progrès agricole. C'est à titre d'exemple d'effets potentiellement bénéfiques que nous étudions ici le phénomène de la location des terres agricoles appartenant à des propriétaires non-exploitants. Pour une région donnée du sud de l'Ontario, des corrélations statistiques entre certaines variables agricoles et démographiques justifient une enquête approfondie auprès des agriculteurs. Les résultats de cette enquête montrent, qu'autour des villes de taille moyenne à haut niveau de croissance de cette région, la location des terres appartenant à des non-exploitants joue un rôle important dans le développement agricole. Cette recherche contribue donc à alimenter une littérature récente qui tend à démontrer la complexité de l'agriculture en milieu péri-urbain.

**MOTS-CLÉS :** Agriculture péri-urbaine, location des terres agricoles, sud de l'Ontario.

### ABSTRACT

In geographic research into urbanisation-agriculture interactions, a strong emphasis has been given to the negative effects of urbanisation on agriculture. Here, it is argued that the urbanisation-agriculture interaction process may provide certain opportunities for agricultural progress and development, depending upon the specific regional circumstances; the phenomenon of farmland renting from nonfarm landowners is thus studied as an example of such a potentially beneficial interaction. Statistical associations between agricultural and population variables for an area in southern Ontario provide the context for a detailed farmer survey. The results show farmland rental from nonfarm owners to be a significant factor in agricultural development in the urban fringe environment of the medium-sized, yet fast-growing cities in the study area, and add to recent literature which has stressed the complexities of urban fringe agriculture.

**KEY WORDS:** Urban fringe agriculture, farmland renting, southern Ontario.

\*  
\* \* \*

It has been argued that much existing geographic research literature has often viewed agricultural change in metropolitan regions as urban-induced and essentially negative for agriculture (Bryant, 1976). Munton (1974) has suggested that the tendency has been to underestimate the extent to which urban fringe agriculture is still responding to market, technological and managerial pressures unrelated to metropolitan development, while attention has been drawn recently to the relative lack of consideration given to regional variation in the processes of urbanisation-agriculture interaction (Bryant and Greaves, 1978). For instance, positive forces generated by urbanisation include the effect of market concentrations, the stimulus for greater use of labour-saving technology consequent upon heightened labour competition, and the possibility of renting land from nonfarm land owners; these positive forces may vary considerably regionally in terms of strength and relationship to the more commonly identified negative forces of urbanisation.

The objectives of this paper are therefore twofold: first, to analyse and interpret patterns of agricultural change for a specific region in terms of whether such patterns reflect particular types of urbanisation-agricultural interactions or patterns of change unrelated to metropolitan development; and second, to investigate in detail a relationship identified in this broader analysis, one that involves a potentially positive interaction between urbanisation and agriculture, viz. the rental of farmland. In the remainder of this introductory statement, some general comments are made 1) about urbanisation-agriculture interactions, especially the effects on agriculture of nonfarm ownership of farmland and farmland rental, and 2) about overall changes in farmland rental in the Canadian context. Second, an analysis of agricultural census data at the census subdivision level for a two-county area in southern Ontario, viz. Waterloo and Wellington, is discussed, drawing upon the results of a broader national analysis (Bryant, 1976)<sup>1</sup>. Third, for one municipality within this two-county area, the phenomenon of farmland rental is investigated through a sample survey of farmers (Fielding, 1979). Finally, some conclusions are offered on the nature of urbanisation-agriculture interactions and future research directions are identified.

#### AGRICULTURAL CHANGE, FARMLAND RENTAL AND THE DEMAND FOR LAND FOR NONFARM PURPOSES

Urbanisation produces pressures of demand for labour, agricultural produce and land, all of which can elicit substantial changes in the agricultural system. However, it is the demand for land for nonfarm purposes that has received most attention in the geographic literature. The effects of land demand for nonfarm purposes on agriculture—and of the ultimate conversion of land use—can be regarded as either *direct* or *indirect*. By *direct* impact, we refer to the actual loss or removal of land from agricultural production leading to nonfarm land use development or perhaps idling of land. By *indirect* impact, we refer to impacts that are created in the residual or ongoing agricultural structure. These impacts may involve modification of the farm input and enterprise structure, as well as changing the potential adaptability of the agricultural system. The range of such indirect impacts of this land demand is large, including fragmentation of the farm unit and farmscape, the juxtaposition of potentially incompatible land uses, high property taxes and the increased expectation of nonfarm development associated with increasing farmland values and nonfarm land ownership.

One effect of high property values and increasing nonfarm land ownership has been suggested as creating greater difficulties for farmers wishing to expand their operations, as well as making it difficult for young farmers wishing to establish themselves (Ironsides, 1979). The ability to increase farm size by expanding the physical land base has been important in agriculture; faced with the cost-price squeeze and a changing pattern of

agricultural technology demanding higher and higher farm size thresholds, expansion of the land base has allowed many farmers to maintain and even improve farm viability. If this process of farm enlargement is interrupted, the possibility of deterioration in the competitive structure of agriculture arises, implying a declining resistance of agriculture to development pressures. In an urban fringe environment, the supply of land for farm enlargement by land purchase is reduced both by higher land prices and by increasing nonfarm land ownership. The potential exists, then, for a conflict between these urban-induced forces of change and the more agriculturally-oriented processes of change, such as technological progress in agriculture.

However, processes of change are not necessarily one-sided. One potentially beneficial effect of land demand for nonfarm purposes is the possibility of renting land from nonfarmers on favourable terms. Thus, urban and nonurban forces of change may combine to produce conditions conducive to agricultural progress. Whether or not the rental of farmland provides a long term positive element to agricultural structure depends partly on the conditions surrounding the lease and the farmer's perception of how precarious or permanent the lease is. If the lease is viewed as temporary or precarious, then farmers might begin mining the soil or "farming to quit" (Wibberley, 1960). Conversely, if renting is viewed as relatively permanent, then farmers may not have to tie up large amounts of capital in unproductive ownership of land, thus releasing capital for productive improvements.

Certainly, this sort of adjustment is reflected in the increasing number of farms in which rented land is included as a regular part of the farm operation. Although the proportion of total farm area that is rented has increased only slightly at the national level over the past three decades (Figure 1), the proportion of farms incorporating both owned and rented land has increased significantly (Figure 2); the situation in Ontario is similar, although the increase in area rented has been more significant. Patterns of change for the two scales of study area used below are similar with, however, the increase in renting being particularly dramatic for the Waterloo Township study area.

However, there is much unknown about this phenomenon (Kelsey, 1959; Sublett, 1975). How extensive is farmland rental in urbanising environments and how is it related to other ongoing agricultural changes in such situations? How do farmers react to renting farmland from nonfarmers and what is its impact on farm structure, particularly in relation to the farm enlargement process? It is to these two sets of questions respectively that we now turn in the following two analytic sections.

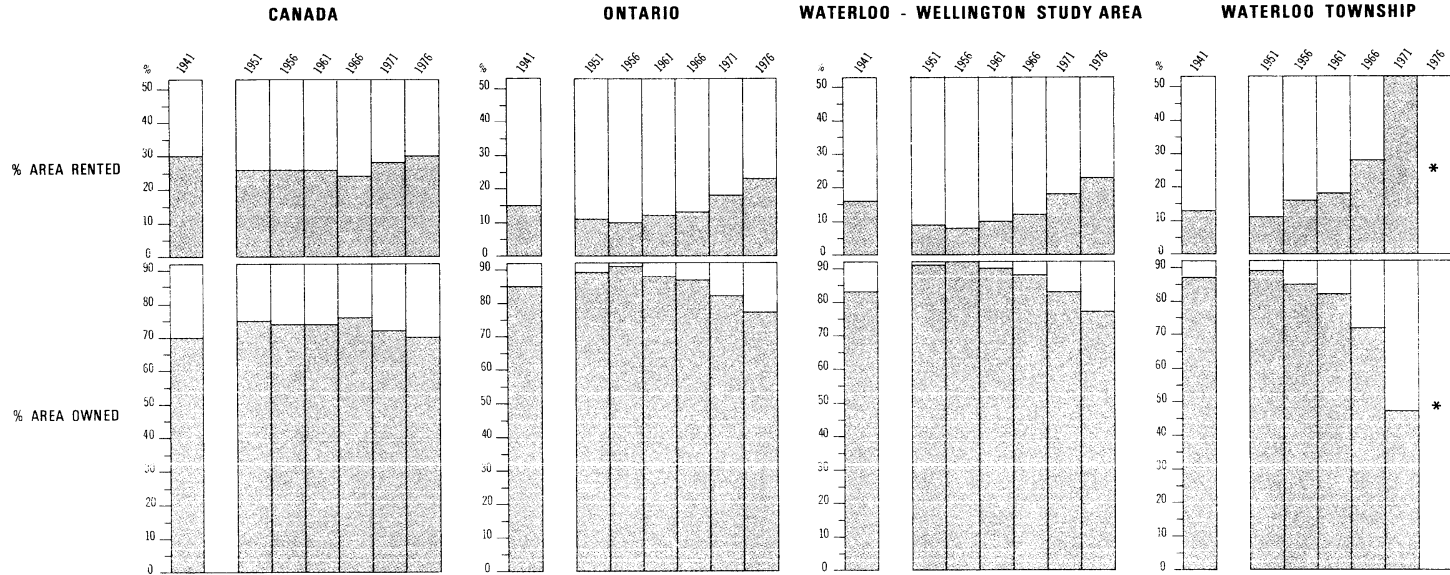
## URBANISATION, AGRICULTURAL CHANGE AND FARMLAND RENTAL: THE WATERLOO-WELLINGTON COUNTY AREA

### The study area

In a broad national analysis of urbanisation-agricultural change (Bryant, 1976), regions based on the 22 Canadian Census Metropolitan Areas (C.M.A.'s) of 1971 were defined to include any Census Division that fell wholly or in part within 25 miles of the centre of the principal C.M.A. city for C.M.A.'s of less than 1 million in population in 1971, and within 35 miles of the edge of the principal city area for those with over 1 million in population in 1971. This generous delimitation of "urban regions" ensured the inclusion of both rural-urban fringe and parts of the rural hinterland. The region based on the Kitchener C.M.A. thus comprised Waterloo and Wellington counties, containing 17 census subdivisions during the 1961 to 1971 period (Figures 3 and 4). The spatial filter used thus allows us to identify areas in close proximity to the major urban areas, as well as those further removed from them<sup>2</sup>.

Figure 1

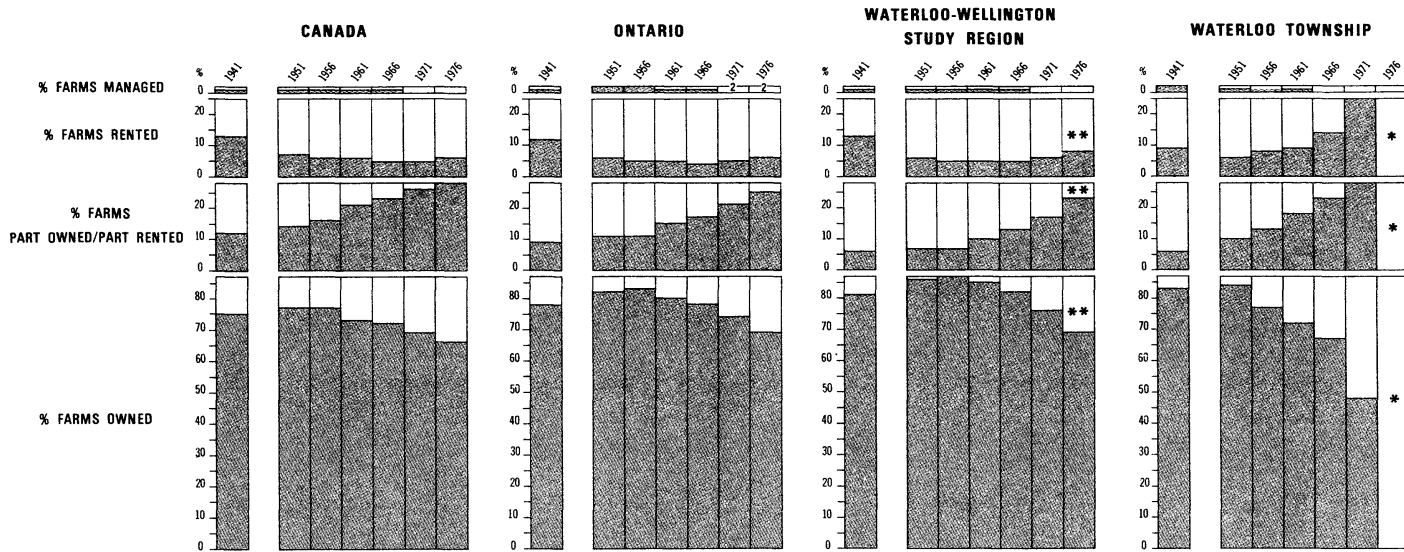
# TENURE OF FARMLAND, 1941 TO 1976: CANADA, ONTARIO AND THE STUDY REGION



\* Figures for Waterloo Township are not available in 1976 due to municipal reorganisation in 1973

Figure 2

# TENURE OF CENSUS FARMS, 1941 TO 1976: CANADA, ONTARIO AND THE STUDY REGION

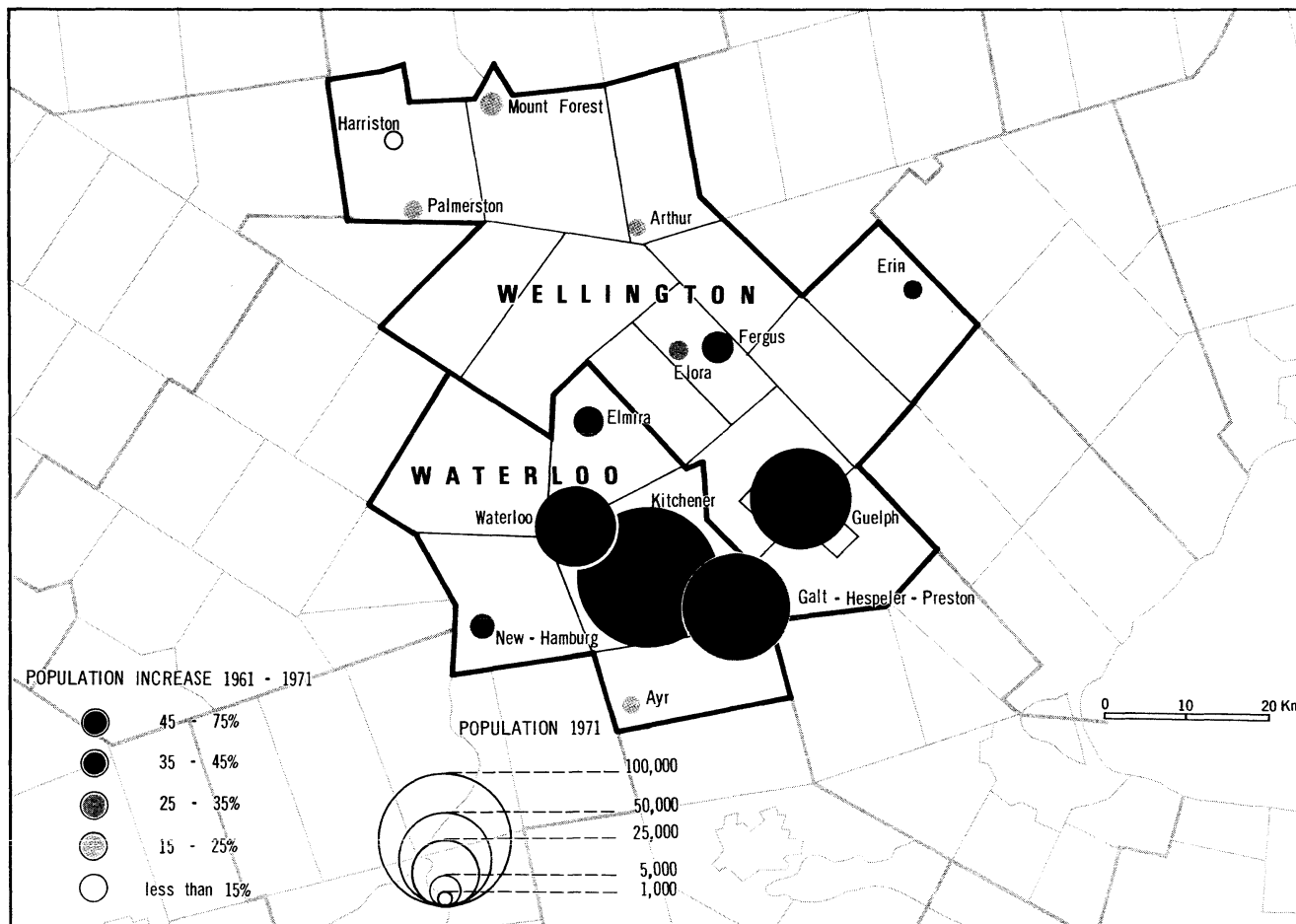


\* Figures for Waterloo Township are not available in 1976 due to municipal reorganisation in 1973.

\*\* For 1976, the value for the Waterloo part of the region refers to the Regional Municipality of Waterloo whose boundaries are slightly different to the Waterloo County area used in previous years

2 Not identified separately in 1971 and 1976

**CENSUS SUBDIVISIONS, 1971, AND POPULATION SIZE AND CHANGE, 1961-71,  
OF INCORPORATED SETTLEMENTS OVER 1000: WATERLOO-WELLINGTON STUDY AREA**

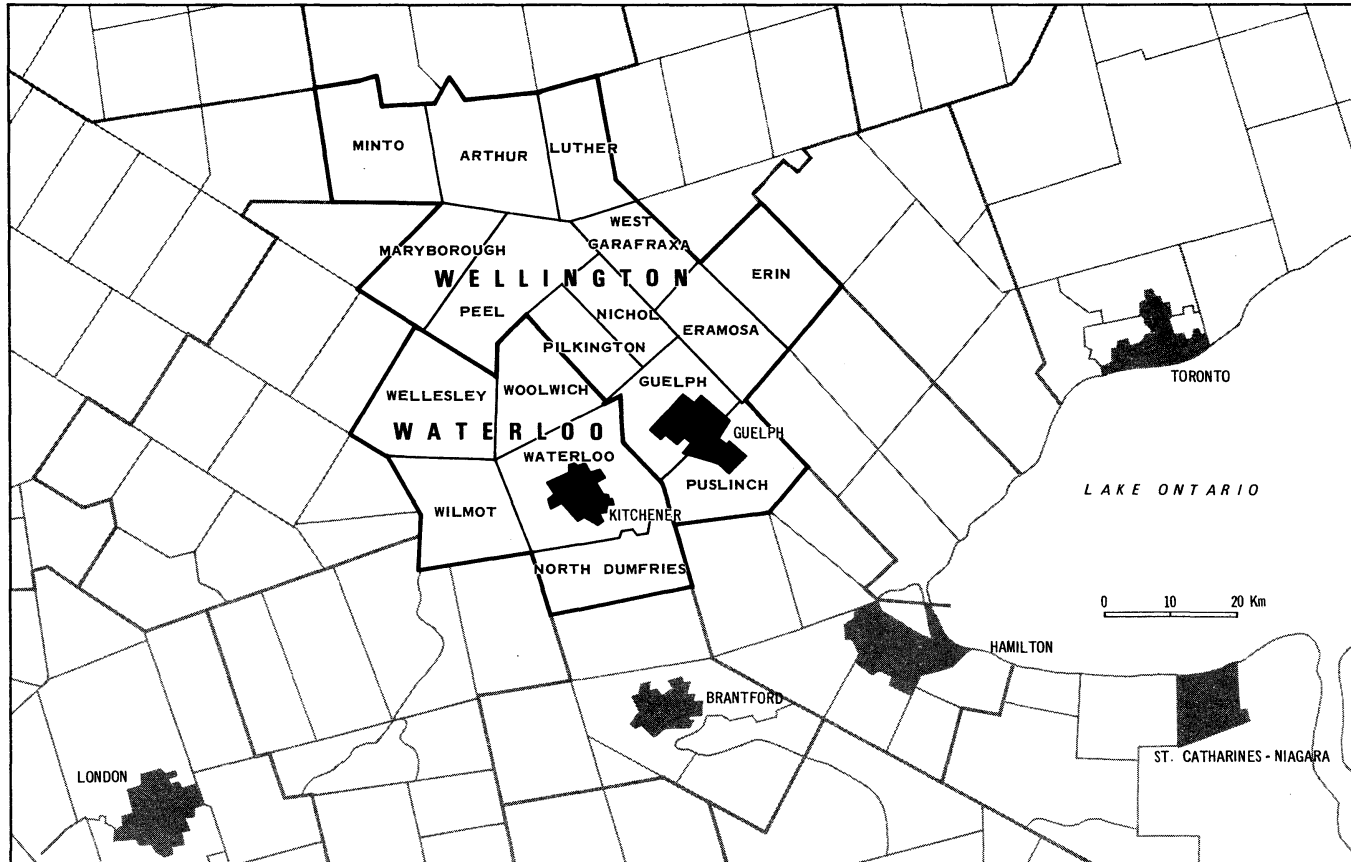


Note : Kitchener includes village of Bridgeport data.

Source: Census of Canada, 1971

Figure 3

**THE LOCATION OF THE WATERLOO-WELLINGTON  
STUDY AREA AND ITS CONSTITUENT CENSUS SUBDIVISIONS, 1971**



**Figure 4**



A number of agricultural structural characteristics, and urban growth and size characteristics, were used in a typological analysis of these 22 C.M.A.—based regions (Bryant, 1976; Bryant and Greaves, 1978). The Kitchener region was placed in a major group comprising the regions centred on Regina, Winnipeg, London and Quebec, and Edmonton, Calgary, Saskatoon, Kitchener and Ottawa-Hull. Overall, this group was characterised by relatively simple urban systems; a lack of physical barriers to development; medium urban size; relatively high urban population growth, 1961 to 1971; a relative lack of intensive agriculture, part-time and small-scale agriculture and by the presence of a good to medium quality agricultural land resource. The group was split into two subsets with the last five regions mentioned above being characterised by high urban population growth, 1961 to 1971. This helps place the region under study here into its national context. While the 1971 Kitchener C.M.A. population had a population of only 226 800, it experienced the fastest growth rate (46,6 per cent) of any Canadian C.M.A. over the 1961 to 1971 period. Urban growth in the region was thus dominated over this period by growth of the main urban centres (Figure 3), with the City of Waterloo growing by 71 per cent, Kitchener 50 per cent, Guelph 51 per cent and the Galt-Hespeler-Preston complex by 41 per cent. This growth is reflected in the distribution of population change by census subdivision (Table 1). The rapid urban development implied by these data was accompanied by considerable land speculation and land assembly by nonfarmers (Ferguson, 1975), largely in the immediate vicinity of the main urban centres.

This development was, and has been, taking place in an area of good agricultural land. In 1961, 81 per cent of the census farmland in the region defined above was "improved" and 83 per cent of the land within a 50 mile radius of the Kitchener C.M.A. is in classes 1, 2 and 3 of the Canada Land Inventory land capability classification for agriculture (Manning and McCuaig, 1977). Some internal differences in agricultural structure exist with the Waterloo Division being somewhat more intensive than the Wellington area, e.g. in terms of smaller farm sizes and higher levels of capital investment in the Waterloo Division (Table 2). There were also indications of the positive influence of market forces, such as nursery and greenhouse operations especially in the Waterloo and Guelph subdivisions; overall, however, the region was dominated by animal husbandry, with dairy produce, cattle, pigs, eggs, hens and chickens accounting for 86 per cent of the total value of agricultural production in 1961 and 91 per cent in 1971. The most spectacular crop change reflects this animal orientation, viz. the increase in corn for grain acreage, used mainly in livestock and poultry operations. This development must be seen in terms of the general changes that have occurred in the technology and economics of corn cropping during the 1960's (Keddie, 1975).

### **The methodology**

In order to investigate patterns of agricultural change in this region and, more specifically, to examine how farmland rental is related to other ongoing agricultural changes, two analytic steps were taken. First, a correlation analysis was performed on a set of variables representing agricultural structure, agricultural change and population change at the census subdivision level (Table 2). Variables were selected to represent major aspects of "initial" farm structure in 1961 (variables 5, 8, 10, 11, 14 and 16); major changes in agricultural structure (variables 2, 3, 4, 6, 7, 9, 12, 13 and 29), selected aspects of mechanisation (variables 17, 18, and 19) and selected enterprises (variables 20 through 28), as well as population change (variable 1). Second, based primarily on the most interesting relationships in this correlation analysis, thirteen agricultural variables (Table 2) were then selected and submitted to a principal components analysis, using the varimax criterion.

Table 1  
Population change and selected agricultural characteristics, 1961-1971: Waterloo-Wellington study area

Census subdivision	1961				% change 1961-1971			
	% change in population <sup>1</sup>	Average farm size (ha)	\$ value land/buildings per improved hectare	% land rented	Total farm area	Average farm size	\$ value land/buildings per improved hectare	Rented area
<i>Waterloo</i>								
N. Dumfries .....	37.1	59	554	12.4	-19.4	12.3	173	69.7
Waterloo .....	49.0	44	732	18.4	-19.5	30.6	177	132.2
Wellesley .....	17.4	46	436	4.4	- 0.8	1.8	127	74.5
Wilmot .....	26.8	44	515	7.2	- 9.0	13.9	170	190.2
Woolwich .....	25.5	45	614	13.7	- 4.7	4.5	105	- 5.6
<i>Wellington</i>								
Arthur .....	10.8	64	229	9.4	- 9.6	3.2	140	- 6.1
Eramosa .....	15.9	56	420	7.5	-12.4	8.7	169	80.8
Erin .....	35.6	56	370	10.7	-23.4	- 7.2	251	50.4
W. Garafraxa .....	9.6	65	282	5.2	- 7.1	8.1	174	36.4
Guelph .....	37.8	54	705	15.5	- 8.3	12.9	167	87.0
W. Luther .....	-12.9	71	208	6.2	- 4.3	11.2	149	65.1
Maryborough .....	12.0	55	308	8.3	0.4	10.3	153	46.4
Minto .....	8.6	60	276	9.9	- 4.8	11.6	127	52.1
Nichol .....	35.0	52	406	5.5	- 5.1	5.5	169	199.7
Peel .....	13.9	56	355	6.3	- 9.7	3.6	131	32.3
Pilkington .....	25.9	53	442	7.2	- 8.9	11.5	152	124.3
Puslinch .....	0.0	55	391	15.1	-26.4	0.7	305	- 12.1

<sup>1</sup> The population of incorporated villages, towns and cities have been added into the surrounding or adjacent subdivision.  
Source: compiled partially from Bryant, 1976, Tables 5.1 and 5.2.

**Table 2**  
**Variables used for the correlation and factor analyses**

<i>Variable identification number</i>	<i>Variable</i>
1 <sup>1</sup>	percent change in population, 1961-1971
2	percent change in total farm area, 1961-1971
3 <sup>2</sup>	percent change in improved farm acreage, 1961-1971
4 <sup>2</sup>	percent change in farm numbers, 1961-1971
5 <sup>2</sup>	average farm size (hectares), 1961
6 <sup>2</sup>	percent change in average farm size, 1961-1971
7 <sup>2</sup>	percent change in the area of farmland rented, 1961-1971
8	percent of farm operators over 45 years of age, 1961
9	percent change in the number of farm operators over 45 years of age, 1961-1971
10 <sup>2</sup>	\$ value of land and buildings per improved hectare, 1961
11	\$ value of machinery and equipment per improved hectare, 1961
12 <sup>2</sup>	percent change in the \$ value of land and buildings per improved hectare, 1961-1971
13 <sup>2</sup>	percent change in the \$ value of machinery and equipment per improved hectare, 1961-1971
14	percent of farm capital in land and buildings, 1961
15	percent of farms with less than \$5,000 worth of agricultural produce sold, 1971
16 <sup>2</sup>	percent of farmland improved, 1961
17	percent change in tractor numbers, 1961-1971
18	percent change in combine numbers, 1961-1971
19	percent change in horse numbers, 1961-1971
20 <sup>2</sup>	percent change in total cattle numbers, 1961-1971
21	percent change in milk cow numbers, 1961-1971
22	percent change in pig numbers, 1961-1971
23	percent change in vegetable acreage, 1961-1971
24	percent change in summer fallow acreage, 1961-1971
25 <sup>2</sup>	percent change in silage corn acreage, 1961-1971
26	percent change in tame hay acreage, 1961-1971
27	absolute change in silage corn acreage, 1961-1971
28 <sup>2</sup>	absolute change in grain corn acreage, 1961-1971
29 <sup>2</sup>	absolute change in area rented, 1961-1971

<sup>1</sup> The population of incorporated villages, towns and cities have been added into the surrounding or adjacent subdivision.

<sup>2</sup> Indicates those variables submitted to the principal components analysis.

Source: DBS, Census of Canada 1961: Population Volume 1; Agriculture Volume 5.2, and xeroxed unpublished census data; and Statistics Canada, Census of Canada 1971: Population Volume 1; Agriculture Volume 4.

## The results

From the correlation analysis (Table 3)<sup>3</sup>, three broad sets of interrelationships are commented upon. First, relative population change (variable 1) is associated negatively with farm size (variable 5), and positively with measures of intensity and absolute change in the acreage of grain corn and rented farmland (respectively variables 10, 11, 14, 28 and 29), implying that population increases tended to occur in areas of higher agricultural intensity, where grain corn and farmland rental had been increasing.

Secondly, the changing acreage of grain corn (variable 28) is linked positively with farmland rental (variables 7 and 29); and both of these are related positively to population increase, farm size change and measures of intensity (respectively variables 1, 6, 10 and 11). The implication here is that areas of population increase tended to coincide

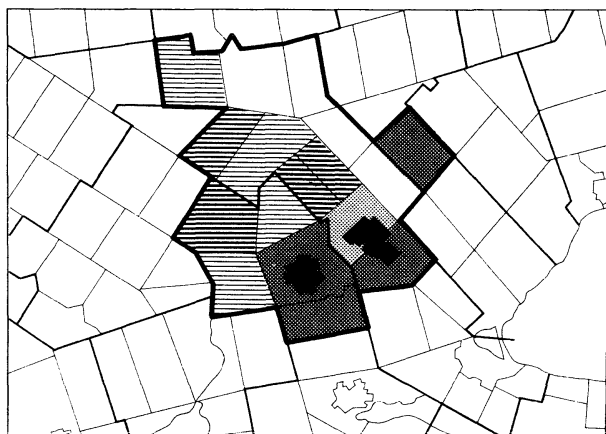
with expansion of the farmland rental base (see also Table 1) and that this was associated with expansion of farm business size and grain corn acreage. For example, in the Waterloo subdivision, there was an increase in grain corn acreage of 5 298 ha and an increase of 6 142 ha in the rented farmland base, 1961 to 1971. Thirdly, the interrelationships between relative changes in numbers of cattle, milk cows and pigs (respectively variables 20, 21 and 22) are all positive; increases in cattle and pigs, and stability in milk cows, thus appeared to have a tendency to occur where small-scale farms were unimportant (variable 15), farm numbers quite stable (variable 4), acreage of silage corn increasing (variable 27) and improved land very important (variable 16). This set of relationships does not appear to bear any obvious link to metropolitan forces.

A principal components analysis on thirteen of the agricultural variables (Table 2) produced four factors which synthesize the interrelationships (Figure 5)<sup>4</sup>. First, the defining variables on factor 1 are the relative importance of improved land, and the per cent change in improved land acreage, farm numbers, cattle, silage corn acreage and the value of land and buildings per improved hectare (respectively, variables 16, 3, 4, 20, 25 and 12). The direction of relationships between these variables on factor 1 implies for example, that one would expect to find large decreases in farm acreage and numbers where substantial increases in farm real estate values and relatively small increases (or even decreases) in cattle and silage corn acreage had been experienced. Thus, it is not surprising that the factor scores indicative of this situation include Waterloo, North Dumfries, Erin and Puslinch, all areas where urban pressures have led to the removal of land from agriculture (Table 1 and Figure 5). The other extreme, one of relative stability in agriculture, is indicated in places such as Maryborough, Pilkington and Wellesley. The stability indicated in Wellesley might seem surprising given its close proximity to the expanding urban area of Waterloo, but this is related to the large numbers of Mennonite farmers in this township whose cultural values have resisted the temptations of selling farmland. This factor can thus be related, at least at the extremes, to urbanisation pressures.

Factor 2 is defined principally by relative change in farm size, area rented and farm numbers, and by absolute change in both the area devoted to grain corn and of land rented (respectively variables 6, 7, 4, 28 and 29). In terms of our objectives, the most interesting extreme on the factor score scale is where decreases in farm numbers and increases in farm size are associated with increases in rented land and land devoted to grain corn. This is so of Waterloo subdivision (Figure 5), followed by Wilmot, Pilkington, North Dumfries and Guelph, while Wellesley, Woolwich, Erin and Puslinch are at the other extreme. For Waterloo, the analysis suggests very strongly that increases in farm business size have been related to the increased rental of farmland; we know from other evidence (Ferguson, 1975) that this subdivision experienced considerable land purchasing by realtors, development companies and nonfarmers generally in the latter part of the 1960's. The implication is that much of this land owned by nonfarmers was made available for farming nonetheless. At least part of the associations contained in this factor can therefore be interpreted as representing a potentially beneficial interaction between urban pressures and agriculture.

Factor 3 is defined mainly by 1961 farm size, change in the value of machinery and equipment per improved acre, the 1961 value of farm real estate, and change in area rented (both relatively and absolutely) and in the area of grain corn (respectively variables 5, 13, 10, 7, 29 and 28). One extreme of the factor score scale would be characterised by small "initial" farm sizes and relatively high farm real estate values, with significant increases in farmland rental and grain corn acreages and relatively small increases in the level of capital tied up in machinery and equipment. The Census Division of

## FACTOR SCORE PATTERNS FOR THE WATERLOO-WELLINGTON STUDY AREA

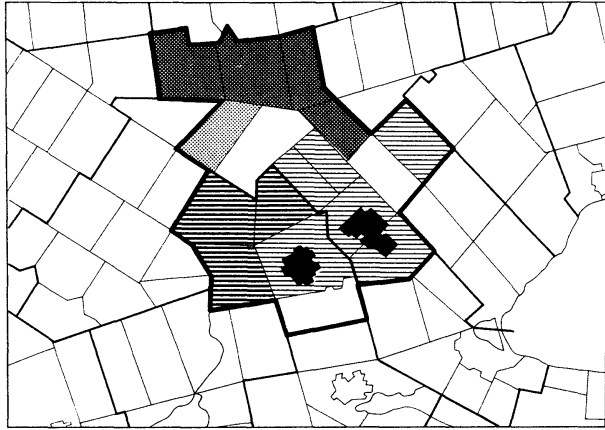


### FACTOR 1

	LOADINGS *
% CHANGE IN IMPROVED FARM ACREAGE 1961 - 1971	+0.88
% CHANGE IN TOTAL CATTLE NUMBERS, 1961 - 1971	+0.83
% CHANGE IN SILAGE CORN ACREAGE, 1961 - 1971	+0.79
% OF FARMLAND IMPROVED, 1961	+0.79
% CHANGE IN FARM NUMBERS, 1961 - 1971	+0.70
\$ VALUE OF LAND AND BUILDINGS PER IMPROVED HECTARE, 1961	-0.35
% CHANGE IN THE \$ VALUE OF LAND AND BUILDINGS PER IMPROVED HECTARE, 1961 - 1971	-0.72

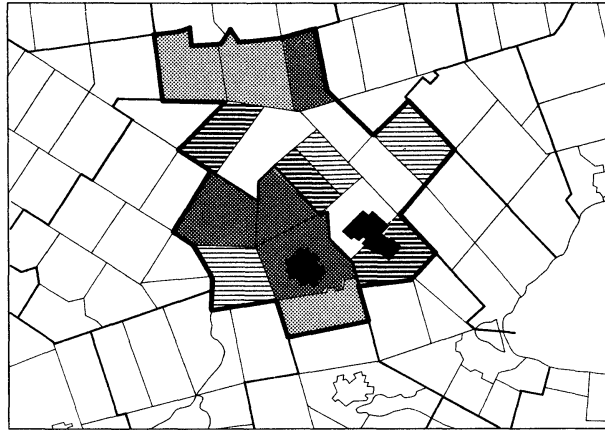
### FACTOR 2

	LOADINGS *
% CHANGE IN AVERAGE FARM SIZE, 1961 - 1971	+0.93
ABSOLUTE CHANGE IN AREA RENTED, 1961 - 1971	+0.86
ABSOLUTE CHANGE IN GRAIN CORN ACREAGE, 1961 - 1971	+0.71
% CHANGE IN THE AREA OF FARMLAND RENTED, 1961 - 1971	+0.63
\$ VALUE OF LAND AND BUILDINGS PER IMPROVED HECTARE 1961	+0.36
% CHANGE IN TOTAL CATTLE NUMBERS, 1961 - 1971	-0.32
% CHANGE IN FARM NUMBERS, 1961 - 1971	-0.63



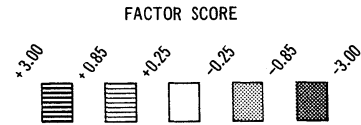
**FACTOR 3**

	LOADINGS *
\$ VALUE OF LAND AND BUILDINGS PER IMPROVED HECTARE, 1961	+0.73
ABSOLUTE CHANGE IN GRAIN CORN ACREAGE, 1961 - 1971	+0.61
% CHANGE IN THE AREA OF FARMLAND RENTED, 1961 - 1971	+0.38
ABSOLUTE CHANGE IN AREA RENTED, 1961 - 1971	+0.34
% CHANGE IN THE \$ VALUE OF MACHINERY AND EQUIPMENT PER IMPROVED HECTARE, 1961 - 1971	-0.34
AVERAGE FARM SIZE (HECTARES), 1961	-0.93



**FACTOR 4**

	LOADINGS *
% CHANGE IN THE \$ VALUE OF MACHINERY AND EQUIPMENT PER IMPROVED HECTARE, 1961 - 1971	+0.80
% CHANGE IN THE \$ VALUE OF LAND AND BUILDINGS PER IMPROVED HECTARE, 1961 - 1971	+0.61
% CHANGE IN IMPROVED FARM ACREAGE, 1961 - 1971	-0.40



\* ONLY VARIABLES WITH FACTOR LOADINGS GREATER THAN |0.30| ARE NOTED

Table 3  
Matrix of Simple Correlation Coefficients

Variable identification number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	1.00																												
2	<i>-0.28</i> <sup>1</sup>	1.00																											
3	-0.11	<i>0.97</i>	1.00																										
4	-0.40	<i>0.78</i>	<i>0.70</i>	1.00																									
5	-0.61	<i>0.02</i>	-0.08	<i>0.10</i>	1.00																								
6	<i>0.32</i>	<i>0.06</i>	<i>0.17</i>	-0.57	-0.23	1.00																							
7	<i>0.51</i>	<i>0.13</i>	<i>0.22</i>	-0.17	-0.42	<i>0.46</i>	1.00																						
8	<i>0.03</i>	-0.47	-0.49	-0.50	<i>0.36</i>	<i>0.13</i>	<i>0.10</i>	1.00																					
9	-0.58	<i>0.39</i>	<i>0.23</i>	<i>0.60</i>	<i>0.35</i>	-0.49	-0.17	-0.23	1.00																				
10	<i>0.77</i>	-0.38	-0.26	-0.57	-0.68	<i>0.45</i>	<i>0.28</i>	<i>0.05</i>	-0.59	1.00																			
11	<i>0.77</i>	-0.20	-0.04	-0.47	-0.73	<i>0.53</i>	<i>0.50</i>	-0.10	-0.62	<i>0.88</i>	1.00																		
12	<i>0.02</i>	-0.80	-0.87	-0.51	<i>0.07</i>	-0.26	-0.08	<i>0.67</i>	<i>0.01</i>	<i>0.12</i>	-0.08	1.00																	
13	-0.37	-0.14	-0.30	<i>0.04</i>	<i>0.43</i>	-0.33	-0.31	<i>0.33</i>	<i>0.36</i>	-0.37	-0.62	<i>0.43</i>	1.00																
14	<i>0.59</i>	-0.59	-0.53	-0.58	-0.42	<i>0.17</i>	<i>0.13</i>	<i>0.36</i>	-0.45	<i>0.85</i>	<i>0.55</i>	<i>0.49</i>	-0.01	1.00															
15	<i>0.01</i>	-0.63	-0.67	-0.39	<i>0.34</i>	-0.22	<i>0.01</i>	<i>0.76</i>	<i>0.14</i>	-0.02	-0.23	<i>0.79</i>	<i>0.28</i>	<i>0.37</i>	1.00														
16	<i>0.17</i>	<i>0.70</i>	<i>0.71</i>	<i>0.46</i>	-0.29	<i>0.21</i>	<i>0.30</i>	-0.63	<i>0.20</i>	-0.04	<i>0.08</i>	-0.67	-0.08	-0.36	-0.68	1.00													
17	-0.51	<i>0.69</i>	<i>0.58</i>	<i>0.84</i>	<i>0.38</i>	-0.47	-0.18	-0.19	<i>0.63</i>	-0.73	-0.69	-0.36	<i>0.44</i>	-0.63	-0.23	<i>0.38</i>	1.00												
18	-0.73	<i>0.28</i>	<i>0.15</i>	<i>0.43</i>	<i>0.36</i>	-0.34	-0.44	-0.04	<i>0.45</i>	-0.80	-0.75	-0.01	<i>0.31</i>	-0.68	-0.03	<i>0.00</i>	<i>0.55</i>	1.00											
19	<i>0.33</i>	-0.22	-0.22	-0.11	-0.34	-0.08	<i>0.47</i>	<i>0.51</i>	-0.06	<i>0.28</i>	<i>0.24</i>	<i>0.45</i>	<i>0.01</i>	<i>0.41</i>	<i>0.52</i>	-0.32	-0.14	-0.25	1.00										
20	-0.24	<i>0.65</i>	<i>0.58</i>	<i>0.66</i>	-0.23	-0.23	<i>0.13</i>	-0.58	<i>0.26</i>	-0.26	-0.11	-0.47	<i>0.08</i>	-0.34	-0.67	<i>0.50</i>	<i>0.57</i>	<i>0.22</i>	-0.18	1.00									
21	-0.22	<i>0.84</i>	<i>0.80</i>	<i>0.84</i>	-0.01	-0.26	-0.05	-0.45	<i>0.30</i>	-0.40	-0.32	-0.62	<i>0.17</i>	-0.52	-0.61	<i>0.64</i>	<i>0.81</i>	<i>0.34</i>	-0.17	<i>0.69</i>	1.00								
22	-0.31	<i>0.73</i>	<i>0.70</i>	<i>0.72</i>	<i>0.09</i>	-0.17	-0.00	-0.55	<i>0.36</i>	-0.53	-0.41	-0.54	<i>0.13</i>	-0.60	-0.57	<i>0.70</i>	<i>0.67</i>	<i>0.32</i>	-0.35	<i>0.59</i>	<i>0.79</i>	1.00							
23	-0.13	<i>0.27</i>	<i>0.26</i>	<i>0.14</i>	<i>0.02</i>	<i>0.11</i>	-0.12	-0.06	-0.08	-0.11	<i>0.01</i>	-0.36	-0.08	-0.30	-0.30	-0.09	<i>0.26</i>	<i>0.12</i>	<i>0.06</i>	<i>0.18</i>	<i>0.21</i>	-0.08	1.00						
24	-0.63	<i>0.28</i>	<i>0.19</i>	<i>0.28</i>	<i>0.67</i>	-0.09	-0.36	<i>0.16</i>	<i>0.58</i>	-0.66	-0.73	-0.04	<i>0.24</i>	-0.50	<i>0.28</i>	-0.06	<i>0.47</i>	<i>0.60</i>	-0.22	-0.20	<i>0.09</i>	<i>0.26</i>	<i>0.08</i>	1.00					
25	-0.27	<i>0.64</i>	<i>0.61</i>	<i>0.49</i>	<i>0.08</i>	<i>0.02</i>	<i>0.07</i>	-0.19	<i>0.07</i>	-0.47	-0.28	-0.41	<i>0.15</i>	-0.53	-0.52	<i>0.40</i>	<i>0.62</i>	<i>0.50</i>	-0.29	<i>0.67</i>	<i>0.71</i>	<i>0.59</i>	<i>0.24</i>	<i>0.13</i>	1.00				
26	-0.56	<i>0.68</i>	<i>0.62</i>	<i>0.85</i>	<i>0.27</i>	-0.47	-0.30	-0.24	<i>0.47</i>	-0.66	-0.58	-0.47	<i>0.05</i>	-0.63	-0.27	<i>0.20</i>	<i>0.82</i>	<i>0.60</i>	-0.13	<i>0.43</i>	<i>0.73</i>	<i>0.54</i>	<i>0.35</i>	<i>0.45</i>	<i>0.48</i>	1.00			
27	<i>0.08</i>	<i>0.49</i>	<i>0.53</i>	<i>0.40</i>	-0.59	<i>0.02</i>	<i>0.21</i>	-0.76	-0.04	<i>0.06</i>	<i>0.31</i>	-0.55	-0.29	-0.28	-0.85	<i>0.59</i>	<i>0.21</i>	<i>0.05</i>	-0.25	<i>0.79</i>	<i>0.50</i>	<i>0.44</i>	<i>0.22</i>	-0.46	<i>0.40</i>	<i>0.24</i>	1.00		
28	<i>0.68</i>	-0.20	-0.05	-0.58	-0.71	<i>0.71</i>	<i>0.56</i>	-0.07	-0.49	<i>0.77</i>	<i>0.87</i>	-0.04	-0.49	<i>0.43</i>	-0.15	<i>0.18</i>	-0.70	-0.58	<i>0.23</i>	-0.25	-0.35	-0.34	-0.06	-0.51	-0.31	-0.63	<i>0.29</i>	1.00	
29	<i>0.62</i>	-0.21	-0.08	-0.62	-0.50	<i>0.78</i>	<i>0.63</i>	<i>0.15</i>	-0.49	<i>0.56</i>	<i>0.66</i>	<i>0.01</i>	-0.48	<i>0.30</i>	<i>0.05</i>	<i>0.13</i>	-0.62	-0.39	<i>0.21</i>	-0.41	-0.43	-0.36	-0.04	-0.25	-0.23	-0.53	<i>0.02</i>	<i>0.85</i>	1.00

<sup>1</sup> Values italicised are significant at the 0.01 level. Coefficients are rounded to two decimal places. See Table 2 for variable identification.

Source: Bryant, 1976, Table IV, p. 171.

Waterloo, excepting North Dumfries, falls at this extreme together with Guelph, while the subdivisions in Wellington most remote from the urban areas are at the opposite end of the scale (Figure 5). Once again, at least at the extremes of this scale, interpretation may be based partially on an urban-induced set of forces interacting positively with agricultural change. Finally, factor 4 has a very simple structure being defined mainly by the two variables relating to change in capital values per improved hectare, and change in farm area (respectively variables 12, 13 and 3).

Thus, while *part* of the actual decrease in the size of the land base (factor 1) can be attributed to some of the more *direct* impacts of urban pressure on agriculture, it is clear that some of the changes identified for factors 2 and 3 relate to agricultural forces interacting in a potentially beneficial way with urban pressures. The importance of changes in grain corn acreage in two of the rotated factors points to the significance of overall agricultural change in the region. Yet, at the same time, there appears to be an interesting relationship that had developed between this, other aspects of agricultural change and urbanisation. The areas with the highest levels of urbanisation (Waterloo, Guelph, North Dumfries and Wilmot subdivisions) are also the areas that experienced large increases in farm size and rented farmland (see for instance Figures 1 and 2).

In the case of Waterloo, the analysis suggests that rental land available from non-farm land owners enabled farmers to enlarge their farms in the 1960's and to engage in a substantial way in grain corn production, an enterprise which is facilitated by being able to spread the lumpy capital investment needed under some systems of grain corn production over larger acreages (Keddie, 1975). Not all urbanising areas can be expected to show this symbiotic relationship between farm size expansion and farmland rental over a given time period, because at high levels of farmland renting, the opportunities for further activity in this regard are more and more limited. Hence, in a more general geographic analysis at the Census Division level for the area south and west of Lake Ontario, roughly between Peterborough, London and Niagara Falls, areas with very high levels of urban development such as York, Peel, Halton and Wentworth counties, stand out as having experienced little expansion in rented land over the 1960's (Bryant, 1976). Their rented land base was already substantial by the beginning of the study period.

While the analysis conducted so far suggests potential beneficial interactions between urban pressures and agricultural change, such statistical associations are insufficient evidence themselves upon which to make inferences regarding the behaviour of farm entrepreneurs. It is for this reason, as well as to answer questions that census data provide no key to, that attention is turned in the final analytic section to a survey of individual farms in the former township of Waterloo.

#### URBANISATION, AGRICULTURE CHANGE AND FARMLAND RENTAL: THE FORMER TOWNSHIP OF WATERLOO

The former township of Waterloo area was selected in 1978 to pursue the investigation of farmland rental because of the relationships identified above. A list of farmers was first established. In order to eliminate consideration of the smallest units, all land-owners or tenants who controlled 10 or more ha of land were identified from tax assessment rolls. Then, from this list, only those that could be identified as bona fide full-time or part-time farmers were retained; this was accomplished with the aid of known farmers in the area. A total of 87 farmers were thus identified to be contacted by telephone for their consent to an interview, leading to 72 interviews. Farmers whose home base was outside the study area boundaries were not contacted.



To place this sample into context, the Agricultural Census indicates 355 census farms in Waterloo township in 1971 with a total census farm area of 20 295 ha of which 17 139 ha were improved. Census farms include some very small operations, and in 1971 close to 40 per cent of the census farms in this subdivision included less than 28 ha of improved or unimproved land in their operations. Unfortunately, it is not possible to compare the sample with 1976 Census of Agriculture data because the Waterloo subdivision was split up between several adjacent subdivisions prior to 1976 following municipal reorganisation in 1973. However, of the 72 farmers interviewed in 1978, 68 had been actively farming in 1971 when they worked a total of 7 968 ha or close to half of the improved census farm area reported in 1971. By 1978, these same 68 farmers worked a total of 10 646 ha (the whole sample of 72 worked 10 987 ha in 1978).

It is thus reasonable to assume that the 87 farmers identified on the sampling frame accounted for a major portion of the total agricultural base in the area in 1978 that was worked by resident farmers who worked over 10 ha and whose headquarters were within the study area. This view is reinforced if we can assume 1) a further substantial decrease in farms in this area between 1971 and 1978, which seems in order given that the Waterloo subdivision experienced the largest decrease (39 per cent) in census farm numbers in the Waterloo-Wellington area between 1961 and 1971, 2) a further increase in non-resident farms, which stood already at 11 per cent of all census farms in the subdivision in 1971 and 3) an increase in the area of land worked by farmers whose headquarters were located outside of the study area, a phenomenon that has been recently identified as important on the agricultural land immediately adjacent to the built-up areas of Kitchener and Waterloo (Currie, 1978).

The interview questionnaire contained questions designed to elicit information on several issues. How extensive is farmland rental in this urbanising environment and how has it developed? What types of farmers rent farmland and from whom do they rent? How important is farmland rental in the farm expansion process in an urbanising environment? Is the pattern of farm investment affected by the inclusion of rented farmland in the farm operation? The time frame used in the collection of the interview data in relation to major changes on the farm was the 1971 to 1978 period.

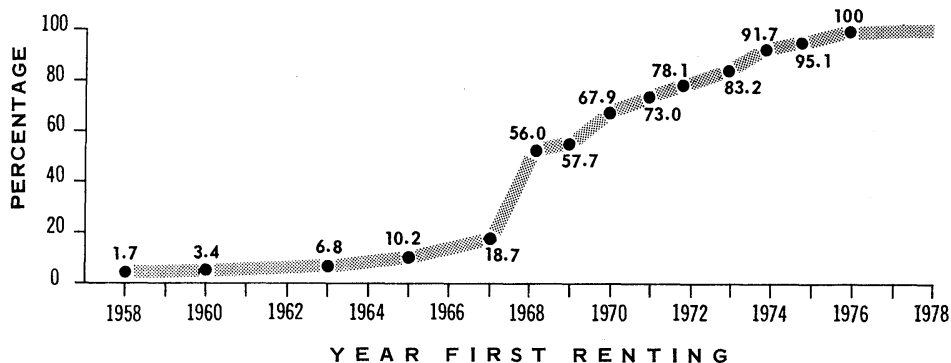
## **The results**

The extent and development of farmland renting.

The 68 continuing farmers worked a total of 7 968 ha in 1971, of which 57 per cent were owned and 43 per cent rented. By 1978, these same farmers worked a total of 10 646 ha, with 43 per cent being owned and 57 per cent rented. There was thus a substantial increase (77 per cent) in the area rented by these continuing farmers, 1971 to 1978, a rate of expansion that was much faster than for Ontario as a whole (for the roughly comparable intercensal period 1971 to 1976, the area of farmland rented in Ontario increased by 23 per cent). The four farmers who commenced operations after 1971 worked a total of 340 ha in 1978, all of which was rented.

The phenomenon of rented farmland thus appears to be a recent one, a point confirmed by the distribution of the farmers who actually rented land in 1978 by the year in which they first rented land (Figure 6). The significant increase which occurred in 1968 reflects partially a specific local situation after the Ontario Housing Corporation purchased just over 1 200 ha of land in a land assembly in the south-eastern section of Waterloo township, subsequently leased back to farmers. However, the

**Figure 6**  
**CUMULATIVE DISTRIBUTION OF THE RENTERS BY THE FIRST YEAR**  
**IN WHICH THEY RENTED: WATERLOO TOWNSHIP AREA**



pattern of overall increase in farmland rental is clear, and the source of the rented farmland is unambiguously associated with urbanisation pressures, with 52 per cent of the renters surveyed renting land from a company with a development, commercial or industrial orientation, and 25 per cent renting land from rural nonfarm residents (Table 4).

*Farmland rental and farm enlargement*

Major changes in farm size occurred in the study area between 1971 and 1978 (Table 5). The average size of those present in 1971 was 117 ha while the average size in 1978 for the whole sample was 153 ha; the change in the number of ha rented per farm was even more dramatic, increasing from 50 ha per farm to 89 ha per farm. Over 55 per cent of the respondents present in both 1971 and 1978 increased the physical land base of their operations, about 33 per cent recorded no change in farm size, and only about 10 per cent registered a decrease in farm size.

The surveyed farmers were asked to identify their main enterprise and from these data, the farms were classified as livestock, dairy, cash crop, mixed cash crop/livestock farm units and "other". Of the continuing units, 83 per cent of the mixed units, 54 per cent of cash cropping units, 73 per cent of the dairy units and only 38 per cent of the livestock units increased their farm land base.

Of the farms increasing their land base, 37 per cent experienced an increase in farm size of over 100 per cent, and another 16 per cent experienced an increase of between 50 and 100 per cent. In this farm enlargement process, the rental of land has played a very important role and all but one of the farms that had expanded the physical land base contained rented land in the operation by 1978 (Table 5 and Figure 6). The expand-



**Table 5**  
**Farm size change and farm type: the surveyed farmers<sup>1</sup>**

Farm size change since 1971	Farm type (1978)					Total	Renter	Non renter
	Livestock	Dairy	Cash crop	Cash crop/ livestock mix	Other			
Increase .....	8	11	7	10	2	38	37	1
Decrease .....	5	—	—	—	2	7	4	3
Stable .....	8	4	6	2	3	23	14	9
Did not farm in 1971 .....	—	2	1	1	—	4	4	—
<b>TOTAL</b>	<b>21</b>	<b>17</b>	<b>14</b>	<b>13</b>	<b>7</b>	<b>72</b>	<b>59</b>	<b>13</b>
Number of farms reporting rented land .....	14	16	11	13	5			

<sup>1</sup> Units in the Table are numbers of respondent farmers.

ing farmers cited the following reasons for expansion: i) the need to increase farm income (63 per cent); ii) full utilisation of machinery capacity (50 per cent); and iii) achieving scale economies (15 per cent). In relation to expansion by rental rather than by land purchase, the 1978 renters as a group identified factors pertaining to cost as most important: i) 56 per cent said renting was cheaper than purchase; ii) 54 per cent noted renting was the best way to increase farm size with a minimal investment; and iii) 7 per cent noted that rental land provided large profits when commodity prices were high (a speculative motive). An interesting additional factor for some farmers was evidently the flexibility that rented land afforded them in being able to review the scale of their operations annually (noted by 12 per cent of the renters), a point reinforced by some of Ironside's findings (Ironside, 1979).

It is clear that the ease of renting land in this urbanising environment has facilitated farm enlargement for many farmers. Given the need for farm enlargement, the increased price of land in the study area and the increased numbers of nonfarm landowners have both dictated and facilitated farm expansion through rental. We turn now to a brief consideration of the impact of renting on the farm operation.

#### Farmland rental and its relationship to selected aspects of the farm operation

It might be expected that the conditions under which land is rented might influence the extent to which farmers viewed rental as precarious or relatively long term. We have already noted earlier (Table 4) that much of the rented land is owned by non-farmers, particularly those that might be expected to have an ultimate interest in seeing the land converted to another use. Rental agreements spell out the control of the resources being used—the consideration or rent, the term or time-frame of the arrangement and any restrictive agreements; risk and profit for the landlord and tenant is thus partly determined by the lease.

The majority of the renters surveyed (46 per cent) had established written rental agreements with their landlords, 25 per cent had a combination of written and verbal rental arrangements and 29 per cent had no written rental agreement. The leases were dominated by short terms, 71 per cent of the renters having leases running for a one year period, and 29 per cent having leases from two years to four years in

length; there were, however, some of considerably longer length, 25 per cent of the renters having leases of five years in length and 2 per cent with leases exceeding five years.

The short one year lease was characteristic of all suppliers of rental land, and it is interesting to note that retired farmers and rural resident nonfarm land owners were associated with a greater proportion of one year leases than the development, commercial or industrial companies (Table 4).

Thus, the rental situation here is dominated by nonfarm land owners and short-term leases, a situation which is potentially precarious. Against this must be set the rents paid for the land; cash rents were the rule in all but two cases and in the latter instances, share and kind payment was involved. The rents paid by the surveyed renters were generally judged moderate by them, with 70 per cent of the renters reporting average rents per hectare of between \$62 and \$124 in 1978. The surveyed farmers noted a number of "problems" related to renting land; when asked to identify disadvantages associated with renting, 47 per cent of all respondents noted lack of security and uncertainty, 28 per cent noted that they could not benefit from land value appreciations when renting, 13 per cent suggested problems of long range planning due to lack of security, 11 per cent noted potential losses if commodity prices fell substantially and one farmer only noted problems of noncontiguity of rented land. However, despite these disadvantages and despite the shortness of many leases, 54 per cent of the renters expressed complete satisfaction with the renting of farmland and 86 per cent of the renters stated they felt secure in their leasing arrangement.

This general level of satisfaction expressed by the farmers finds support in the extent of other farm changes that the farmers felt able to make in association with renting land. Twenty-two per cent of the surveyed farmers made changes in their cropping patterns over the study period and in each instance the change was associated with an increase in farm size through rental. The shift from mixed grains to grain corn for livestock feed and cash cropping represented the major change in land utilisation. This frequently meant that rented farmland was put to a different use than owned land, so that in 37 per cent of the reported instances of renting, the rented land was used strictly for cash cropping purposes, especially grain corn production. This reflects partly the reason for expanding the physical land base in the first place and partly the fact that the rented land was frequently further from the farmstead than the owned land so that use of such rented land for pasturing would be less likely. Nonetheless, the renters as a whole (92 per cent) indicated that they practised conventional farming methods on rented land as on owned land, a finding which again accords with Ironside's (1979).

Furthermore, a significant number of the surveyed farmers (44 per cent) made changes resulting in an increase in the fixed capital of their operations; and 77 per cent of these farmers attributed these changes in fixed capital to the rental of additional land and consequent farm size increase. Similarly, 40 per cent of the respondent farmers acquired new machinery between 1971 and 1978 (i.e. acquisitions representing an addition to their existing stock and not simply replacement machinery) and 90 per cent of these acknowledged that this was the result of increased farm size through rental. One indication, however, that the expansion of investment may not have been pushed to its maximum was the frequent use of the custom operator by the respondent farmers; 57 per cent used custom operators for some operation—planting, spraying or harvesting—and 63 per cent of these noted they began using the custom operator after having acquired tracts of rented land.

## CONCLUSIONS

This paper has addressed itself to the problem of the nature of the interactions between urbanisation and agriculture. It was suggested that patterns of agricultural change in urban regions need not always be related to urbanisation factors and even where they are, such interaction need not be negative for agriculture.

The results of two interrelated studies from an area containing medium-sized urban communities, which have experienced relatively rapid growth, were used to illustrate these points. The factor analytic results of agricultural change for the Waterloo-Wellington area identified several patterns of change. First, it is evident that some gross changes such as decrease in farm area reflected the incidence of urban expansion pressures, thus falling into the commonly held negative perspective of urbanisation-agricultural interactions; second, another pattern of change involving increase in farm size, farmland rental and grain corn production suggested a potentially beneficial interaction between certain urbanisation factors and agricultural change. This phenomenon was confirmed by a survey of farms in one of the urbanising areas of this broader region. The changes which have occurred in farm structure, management and investment in the former Township of Waterloo reflect a positive association between agricultural and urban-based forces, as well as more general technological and managerial changes in agriculture.

Even though much of the rented land is held by owners in expectation, presumably, of some future nonfarm land use development, this has not prevented many of the farmers from taking advantage of this supply of rental land for farm enlargement purposes. Even though it was not uncommon for farmers to relinquish or have to drop specific rented parcels from time to time, the general attitude that seemed to prevail was that other parcels could be acquired to compensate. Hence, this undoubtedly has contributed to the overall feeling of satisfaction with, and relative permanency of, renting. Many farmers thus seem to have been able to adapt to the changing environment within which they have found themselves. The result of this process has been, so far, to make it difficult to identify any significant area of land around these cities which is unambiguously undergoing degeneration of farm structure. This area thus differs from some of the largest metropolitan regions such as Vancouver, Toronto and Montreal around which definite areas undergoing general degeneration of the farm structure may be identified (Bryant, 1976; Rawson, 1976; Québec, 1973).

There is, then, a need for more regional comparisons in order to probe further the urbanisation-agriculture interaction processes. In relation to renting, there are still unanswered questions such as at what levels and rates of urban development do farmers begin to view renting as precarious, what other symptoms of the farmer's environment prompts him to think of nonagricultural futures for his land and, finally, is the farmer who rents more land the go-ahead, progressive and aggressive farmer as Sublett has suggested (Sublett, 1975). It is to be hoped that more research in this area will provide a further step forward in both recognising and understanding the complex mesh of inter-relationships of urbanisation-agriculture interaction processes.

## NOTES

<sup>1</sup> Information originally published in *Farm-Generated Determinants of Land Use Changes in the Rural-Urban Fringe in Canada 1961-1975* is reproduced by permission of the Lands Directorate, Environment Canada.

<sup>2</sup> The major reason why the statistical analysis reported on here has not been updated to incorporate 1976 Census of Agriculture data is because the Waterloo County area underwent a major municipal reorganisation in 1973 leading to the elimination of the Waterloo subdivision. This therefore prevented making the same detailed geographic analysis of the area as was possible for 1961 to 1971.

<sup>3</sup> In interpreting the relationships contained in Table 3 and Figure 5 it should be remembered that several of the agricultural change variables are composed dominantly of negative numbers. Consequently, a "high" value for, e.g., change in total farm acreage, is in fact likely to be a small decrease; similarly for changes in milk cow numbers.

<sup>4</sup> The four factors initially extracted with eigenvalues greater than 1.0 accounted for 37, 30, 9 and 8 per cent of the total variance.

## BIBLIOGRAPHY

- BRYANT, C.R. (1976) *Farm-generated determinants of land use changes in the rural-urban fringe in Canada, 1961-1975*. Ottawa, Lands Directorate, Environment Canada, Technical Report.
- BRYANT, C.R. and GREAVES, S.M. (1978) The importance of regional variation in the analysis of urbanisation-agriculture interactions. *Cahiers de géographie de Québec*, 22 (57) 329-348.
- CURRIE, J. (1978) *Viability of agriculture on the urban fringe—a case study*. Waterloo, University of Waterloo, School of Urban and Regional Planning, unpublished M.A. thesis.
- FERGUSON, M., (1975) *The pre-development land market and the initiation of the rural-urban land conversion process: a case study in the former Township of Waterloo, 1966-1971*. Waterloo, University of Waterloo, Department of Geography, unpublished M.A. thesis.
- FIELDING, J.A. (1979) *Farmland rental in an urbanising environment: the fringes of Kitchener, Waterloo and Cambridge, 1971-1978*. Waterloo, University of Waterloo, Department of Geography, unpublished M.A. thesis.
- IRONSIDE, R.G. (1979) Land tenure, farm income and farm practice in southern Ontario, Canada. *Ontario Geography*, (14): 21-39.
- KEDDIE, P.D. (1975) *The post-adoptive behaviour of grain corn producers in the mid-western Ontario area*. Waterloo, University of Waterloo, Department of Geography, unpublished Ph.D. thesis.
- KELSEY, M.P. (1959) *Economic effects of field renting on resource use on central Indiana farms*. West Lafayette, Indiana, Purdue University, unpublished Ph.D. thesis.
- MANNING, E.W. and MCCUAIG, J.D. (1977) *Agricultural land and urban centres*. Ottawa, Environment Canada, Lands Directorate, Report No. 11.
- MUNTON, R.J.C. (1974) Farming on the urban fringe. In J.H. Johnson (Ed.) *Suburban Growth*, London, Wiley and Sons, p. 201-223.
- QUEBEC, Université du Québec (1973) *Région sud: l'agriculture*. Montréal, Institut national de la recherche scientifique and the Office de planification et de développement du Québec.
- RAWSON, M. (1976) *Ill fares the land*. Ottawa, Ministry of State for Urban Affairs, Urban Prospects.
- SUBLETT, M.D. (1975) *Farmers on the road*. Chicago, University of Chicago, Department of Geography, Research Paper No. 168.
- WIBBERLEY, G.P. (1960) *Agriculture and urban growth: a study of the competition for rural land*. London, Michael Joseph Ltd.