LANDS AND INTEGRATED PROGRAMS DIRECTORATE

DIRECTION GÉNÉRALE DES TERRES
ET DES PROGRAMMES INTÉGRÉS

CANADA LAND USE MONITORING PROGRAM

TOTAL LAND USE CHANGE IN URBAN CENTRED REGIONS

ST. JOHN'S
1966–1977

Atlantic Region

Région de L'Atlantique

Environment Canada Environnement Canada

Canada

CANADA LAND USE MONITORING PROGRAM

Total Land Use Change in Urban Centred Regions

St. John's

1966 - 1977

David A. Wilson

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Lands & Integrated Programs Directorate
Atlantic Region
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FOREWORD

The objective of the Urban Centred Region component of the Canada Land Use Monitoring Program is to provide a national perspective on land use change for the rural-urban fringe areas of Canada. All urban centred regions with populations of over 25 000 are included in this component. The land use information is collected and analyzed for each individual urban centred region on the basis of five year cycles coincident with census years.

This report focusses on land use change in one urban centred region. The publication of such a series of reports by the Lands and Integrated Programs Directorate will provide information on land use change to users as quickly as possible. Once data for a particular cycle year are available for all urban centred regions, a national perspective report will be published, containing comparative information on land use change in urban centred regions across Canada.

R. J. McCormack
Director General
Lands and Integrated Programs Directorate

REGIONAL FOREWORD

The Atlantic Regional office of the Lands and Integrated Programs Directorate is producing a limited number of Urban Centred Region reports as an aid to federal, provincial and municipal governments in the planning and management of the land resources of Atlantic Canada. The reports will also inform the public about major trends and changes in land use in the Region.

These reports cover the collection and analysis of land use change information in urban areas using the Canada Land Inventory and other land use information up to the end of the 1976 monitoring cycle. Thereafter, a more detailed land activity/land cover classification is to be used, beginning with the 1981 cycle. The additional land use data provided by this new classification should make the resulting products a more useful tool for planners and managers alike.

Any comments or feedback pertaining to these reports would be appreciated by the Lands and Integrated Programs Directorate. Further information about this and other programs may be obtained by contacting the Atlantic Regional Director, Lands and Integrated Programs Directorate, Environment Canada, 3rd Floor, 45 Alderney Drive, Dartmouth, Nova Scotia (B2Y 2N6).

R. M. Beardmore
Regional Director
Lands and Integrated Programs Directorate

ABSTRACT

This report analyses land use changes in the St. John's Urban Centred Region for the period 1966 to 1977. The data base is derived from the Canada Land Inventory and updated land use information from air photo interpretation. The data are stored, processed, and manipulated by the Canada Land Data System. The St. John's Urban Centred Region covers an area of approximately 1 040 km^2.

This report focusses on rural to urban land use changes, on land use changes between various rural land uses, and on the relationship of these changes to agricultural and recreational capability. An attempt is made to identify land that is suitable for urbanization but that does not conflict with good quality agricultural land or existing recreational use.

RÉSUMÉ

Ce rapport analyse les changements d'utilisation des terres dans la région urbaine de St. John's pour la période de 1966 à 1977. La base des données est tirée de l'inventaire des terres du Canada et d'information sur le mode d'utilisation des terres mis à jour à l'aide de la photo-interprétation. Les données sont traitées et fournies par le Système de données sur les terres du Canada. La région urbaine de St. John's couvre environ 1 040 km^2.

Ce rapport étudie les différents changements d'utilisation, d'une utilisation rurale à urbaine, d'une utilisation rurale à rurale, et la relation de ces changements par rapport aux potentiels agricoles et récréatifs. Vous trouverez aussi une brève description de données potentielles pour fin de planification est aussi disponible afin d'identifier les terres où l'expansion urbaine pourrait prendre place afin d'éviter certains conflits avec les meilleures terres agricoles ou avec d'autres activités récréatives déjà existantes.

ACKNOWLEDGEMENTS

The author wishes to thank those individuals in the Canada Land Data System Division for processing the land use maps and generating the standard statistical and map selections. Gratefully acknowledged is the valuable advice provided by David Gierman, and also Joseph Arbour for relaying his insight into the application of the Canada Land Data System. Graphics tasks were accomplished by Ronald Howatt of the Inland Waters Directorate. Dawn Allen and James Moyes completed the cartographic responsibilities. Also appreciated is the co-operation given by officers of various provincial agencies, in particular, Alan Lidstone formerly of the Development Division, Department of Rural Agricultural and Northern Development.

The contribution of constructive editorial comments by Roger Beardmore, Atlantic Regional Director, Lands Directorate has enhanced this report.

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1. INTRODUCTION

Incorporated as a city in 1888, St. John's is the main centre of service, distribution, finance, and as the Provincial capital, the chief administrative seat of Newfoundland and Labrador. St. John's is also the focal point for the Island's limited agricultural sector having approximately one-quarter of the province's farmers located within the urban centred region.

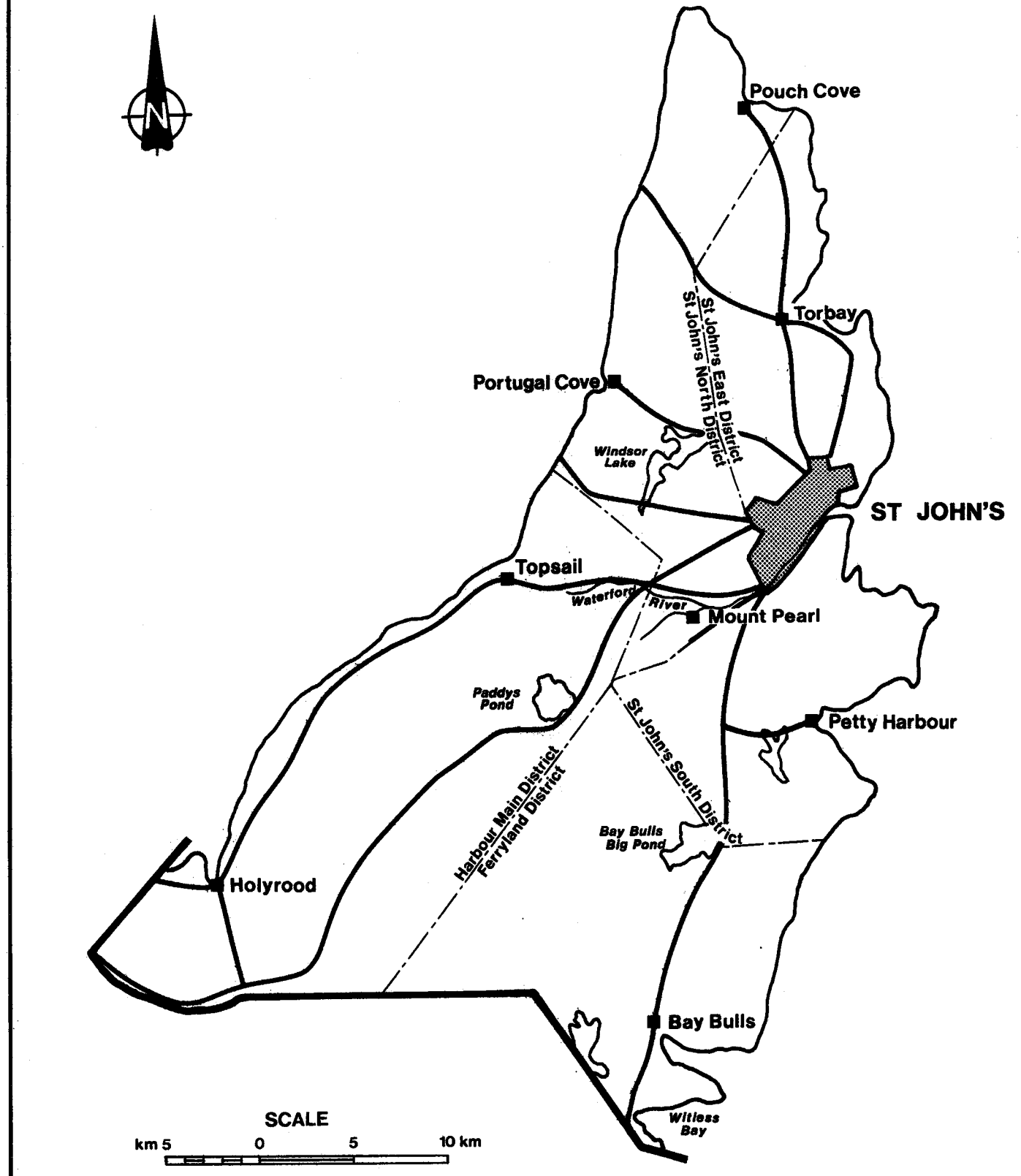
The influence which St. John's exerts on the province as a whole is illustrated by the Census Metropolitan Area (CMA) statistics for 1976: one-quarter of the total provincial population is located in this CMA. The magnetic influence of this large urban mass, in a province with an otherwise low population density, would seem to ensure that much of Newfoundland's future urban expansion will occur in the area surrounding the City of St. John's. The historical settlement pattern of Newfoundland, consisting mainly of small communities dispersed linearly along the coast, tends to project this city as the provincial focal point for future urban growth. The demographic growth from 117 533 in 1966 to 143 390 in 1976, representing a net gain of 22 percent, further supports the above projection.

Expansion options beyond the present urban core are limited by physical constraints: the Atlantic Ocean to the east; the White Hills to the north; and, in the opposite direction, the South Side Hills. Possibilities are further reduced by designated watershed protection areas; Windsor Lake to the west and lakes to the south associated with Petty Harbour Long Pond and Bay Bulls Big Pond. The desirability of preserving agricultural land poses another limitation to urban expansion. The area south of Kilbride towards the Goulds, represents a large portion of the very limited arable land in the province.

This report deals with the dynamics of land use changes in the St. John's Urban Centred Region (UCR), located in the northern portion of the Avalon Peninsula (see Map 1). The discussion is based upon 1966, 1971, and 1977 data which represent two 5-year monitoring cycles. St. John's is one of the major centres included within the Urban Centred Region component of the Canada Land Use Monitoring Program. This program is carried out by the Lands and Integrated Programs Directorate of Environment Canada as part of its mandate to provide information to the public on the land resource and its use. A national perspective report on total land use change with comparative data for urban centred regions having populations greater than 25 000 will be published following compilation of the work for all UCR's.

MAP 1 ST. JOHN'S

URBAN CENTRED REGION BOUNDARY



2. DATA BASE

The St. John's Urban Centred Region includes parts of the 1:50 000 National Topographic System (NTS) map sheets 1 N/6, 1 N/7, 1 N/10, 1 N/11, and 1 N/15. The total study area is 103 969 hectares (Map 1) which is larger than the Census Metropolitan Area for St. John's designated by Statistics Canada. Conversely, the study area is smaller than the area covered by the Regional Plan produced in 1976 by the Provincial Planning Office owing mainly to the exclusion of Bell Island.

The criteria used to delineate an urban centred region are flexible due to the varied nature of the Canadian landscape. Generally, an attempt is made to include the region around an urban core which is presently undergoing relatively dynamic changes in land use or may be expected to do so in the near future. Some of the factors considered in defining the St. John's Urban Centred Region include road and settlement patterns, natural barriers, municipal limits, Census Metropolitan Area boundaries as used by Statistics Canada, and provincial plans.

Of the six land use capability classifications of the Canada Land Inventory (CLI), agricultural capability and recreational capability were selected for analysis. In addition, land uses in 1966, 1971, and 1977 were identified and the changes analysed. These five coverages (listed below) are of common interest to all Urban Centred Regions across Canada and will be used in a national perspective report as well as this report.

1. Land use 1966
2. Land use 1971
3. Land use 1977
4. Agricultural capability
5. Recreational capability

3. METHODOLOGY

3.1 Air Photo Interpretation

The original 1966 CLI land use maps served as the base year data. Identification of 1971 land use was determined by interpretation of 1:25 000 stereo pairs under contract. Some use of 1973, 1:54 000 scale photos was made where 1971 photos were not available. Lands and Integrated Programs Directorate, Atlantic Region staff identified 1977 land use by using 1977, 1:50 000 photos. These were supplemented in the core area by 1976, 1:25 000 photos and along the southern portion of the UCR, where 1977 photos were not available, by 1978, 1:50 000 photos. All prints were black and white. These

coverages, along with census material for 1971 and 1976, provincial forest inventory maps, urban and municipal planning reports, and topographic, geologic and soils maps provided the required monitoring information for the production of land use change maps and the following discussion. The minimum sized rectangle or polygon to be mapped was at least 160 metres to a side.

For air photo interpretation purposes the Canada Land Inventory (CLI) classification was employed as follows:

Land Use

Group Name	Land Use Classes	Map Symbol
Urban and associated uses	Urban built-up areas	B,X
	Mines, quarries, sand and gravel pits	E
	Outdoor recreation areas	O
Improved agriculture	Horticulture, poultry and fur farms	H
	Cropland, improved pasture and forage crops	A,P
Unimproved pasture and rangeland	Unimproved pasture, rangeland and idle grassland	K
Natural cover	Productive woodland	T
	Unproductive woodland	U
	Swamps, marshes, bogs, and fens	M
Water	Water	Z

3.2 Transfer of Air Photo Information to Map

A transfer device was used to convert the land use information delineated on aerial photographs of various scales to a stable base material at a map scale of 1:50 000. Section 3.6 expands upon this step in the CLUMP process.

3.3 Preparation for Input to the Canada Land Data System (CLDS)

The final manual step prior to CLDS entry was scribing of the inked maps. The constant line width required by the line scanner (part of the Gerber drum plotter) was thereby assured. The three land use coverages were then entered through the data input and reproduction subsystems of CLDS located in Ottawa, and the data base was stored on computer tapes and discs.

3.4 Data Analysis

Data analysis was carried out for five major coverages as listed on page 3.

In addition, agricultural limitations (subclasses 1 and 2) and primary recreational features were included for analysis and discussion. With the inclusion of shorelines for geographical reference purposes, there was a total of nine variables considered for the St. John's UCR. (See list below).

1. Present land use in 1966 (PLU66)
2. Present land use in 1971 (PLU71)
3. Present land use in 1977 (PLU77)
4. Agricultural capability class (AGRCL)
5. Agricultural limitations - subclass 1 (AGRS1)
6. Agricultural limitions - subclass 2 (AGRS2)
7. Recreational capability class (RECCL)
8. Recreational primary features - subclass (RECSC)
9. Shoreline (SHRLN)

Within each variable, a number of classes are possible. A description of all CLI variables and the map symbols for their identification are outlined in the appendices of this report. Agricultural classes which occurred in the St. John's UCR are presented below:

Agricultural Capability

Group Name	Capability	Map Symbol
Prime agriculture land	Class 3	3
Low capability land for agriculture	Class 4	4
	Class 5	5
	Class 6	6
No capability for agriculture	Class 7	7
Unclassified	Class 8	8
Organic soils	Class 0	0

The computer analysed this information and standard sets of data were selected which were produced in tabular format. In addition, the on-line interactive graphic system terminal, the regional link to the Ottawa main-frame computer, allowed the production of additional output or the modification of standard data. Maps - the last production format - were produced on the interactive graphics subsystem using a Tektronix colour graphics hard copy device (in Ottawa). See Figures 1 and 2 for an illustration of this process. The option of using the Gerber drum plotter for black and white larger format map products is noted in the second figure.

3.5 Presentation of Results

Results of the data analysis are presented in tabular, graphic and map form. The data are grouped into classes and groups of classes to facilitate the presentation of information. Of note are the capability classes not present in the St. John's Urban Centred Region. For example there is a lack of land in agricultural capability classes 1 and 2.

The tabular data deals with the land area of the St. John's UCR. Only if there is a change in the land-water interface, such as construction of a large pier, will water be mentioned on the statistical output.

Graphic data is presented occasionally to synthesize tabular data, or to illustrate particular land use change phenomena.

Maps presented in this report illustrate standard data selections and other desired

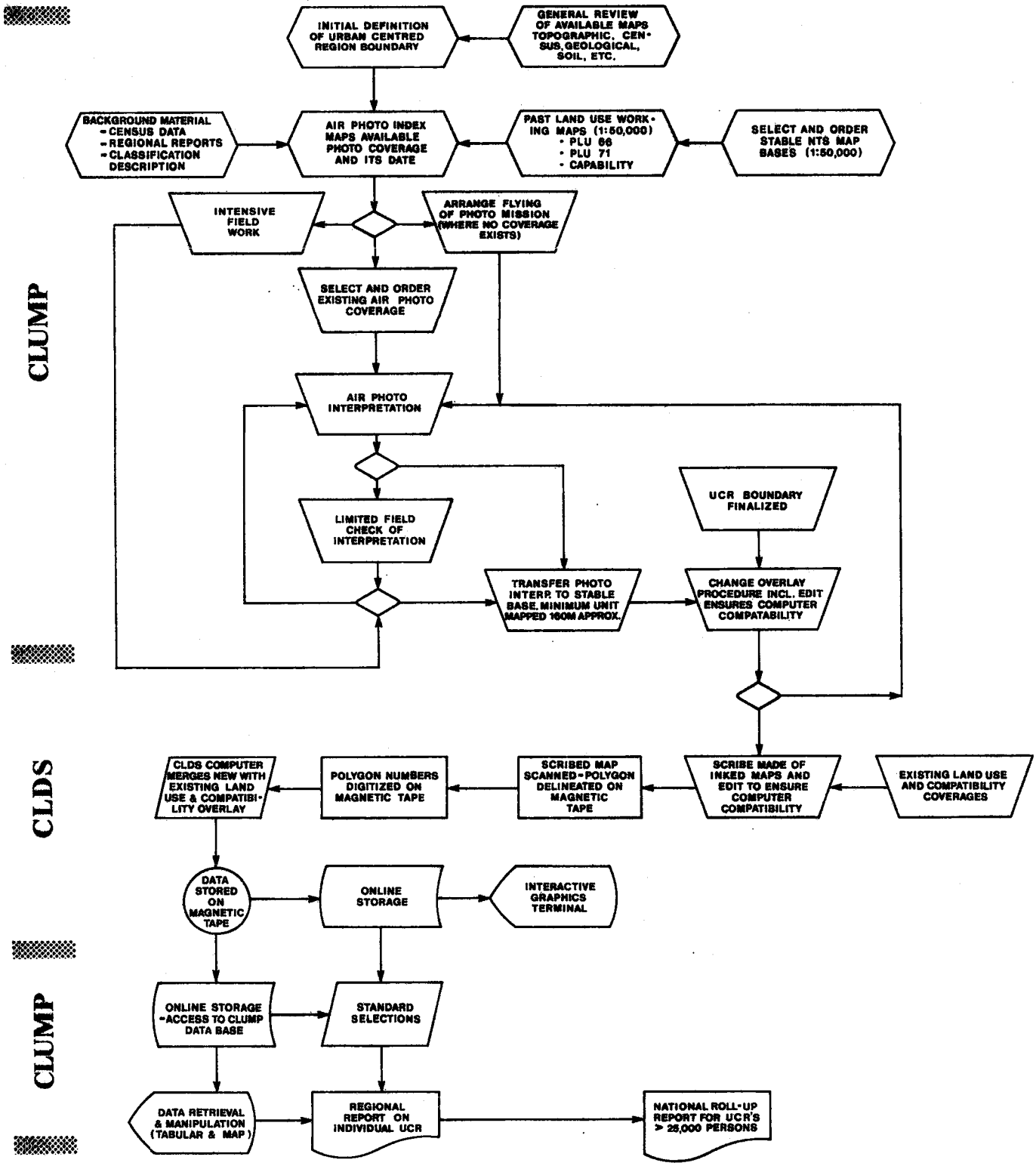


FIGURE 1. Flow chart of CLUMP data acquisition and processing steps.

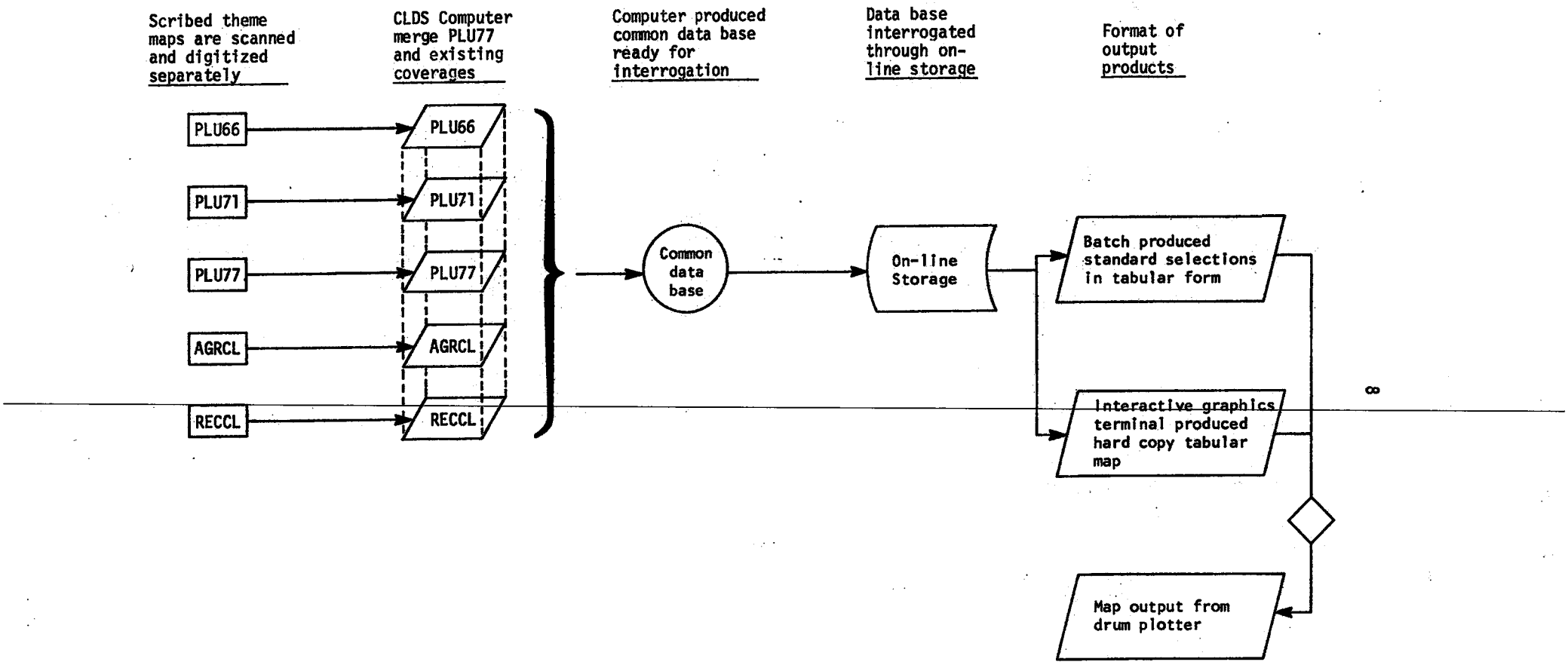


FIGURE 2. Computer Merge of Scribed Map Overlays

information. The second group were produced by making selections of desired variables from the data base and printing the results on the hard-copy (Tektronix) printer.

3.6 Accuracy of the Data

Tabular and map data reliability has been affected by several factors. During the 1966 stage of this multi-dated inventory, fieldwork was emphasized to a greater extent than during the latter two inventories. These relied more heavily on air photo interpretation as the chief source of information. In all stages the scale of the available aerial photography varied considerably as did the dates flown within a given cycle. Different personnel were used who may have had varying degrees of knowledge and understanding of the class definitions, interpretation skills, and local knowledge of the study area.

Somewhat more control was exercised in the data transfer stage. Through an ongoing process, errors related to the transfer of mapped information were reduced or eliminated by recording only land use change from one map coverage to the next. Thereby, the computer was presented with one 'change overlay' rather than two separate overlays for each cycle.

The use of the land use change overlay method eliminated transferring problems such as polygon location errors and the drawing of the same line in the exact location twice. As well, most distorted polygon shapes were corrected along with obvious interpretation errors through the editing function of the change-overlay procedure. The result was the adoption of a consistent classification interpretation system and a similar level of generalization for each land use monitoring cycle.

4. LAND USE AND LAND CAPABILITY

4.1 Land Use in 1966, 1971, and 1977

The percentage distribution of land use classes in the St. John's Urban Centred Region for the years 1966, 1971, and 1977 are found in Table 1. This table demonstrates the following changes in land use as a percentage of the St. John's Urban Centred Region: urban-related land uses increased to 12 percent from 7.5 percent; improved agriculture fell to 2.7 percent from 4.1 percent; unimproved agriculture increased to 4.5 percent from 3.2 percent; and, natural cover dropped to 80.8 percent from 85.2 percent. Figure 3 illustrates the net change which occurred in the four major land use groups between 1966 and 1977. During this period urban related uses increased by 59 percent in area. Improved agriculture areas decreased by 35 percent, unimproved agriculture gained 41 percent, and natural cover decreased by 5 percent.

The addition of 4 623 hectares in urban-related land uses indicates this class experienced the greatest actual, and an even greater proportional, change. An area of 4 475 hectares of natural cover shifted to other uses between 1966 and 1977.

Although Table 1 and Figure 3 testify to the growth of urbanization, it is not evident where, or at the expense of what other individual land use classes, this growth occurred. It cannot be assumed, in most cases, that the loss of land in one class was automatically followed by a direct gain in another on the basis of the apparent quantitative differences in land areas. The Land Use Dynamics Section (5) discusses this point in more detail.

4.2 Agricultural Capability

The agricultural capability classification is based on mineral soils information. An expanded soils classification is provided in Appendix II. Table 2 indicates that only 0.3 percent of the St. John's study area is capable of sustained production of common cultivated crops (class 3). Classes 1 and 2 are not present. Three and one-half percent of the study area is considered marginal for sustained annual field crops (class 4). Permanent pasture and hay (class 5) make up 9.8 percent. A further 25.8 percent falls into the category of unimproved agricultural capability (Class 6). The largest portion, 52.7 percent of the study area, falls within Class 7 which has no agricultural capability. Organic soils comprise 6.6 percent. The unclassified figure of 1.3 percent generally coincides with the 1966 urban core.

TABLE 1: LAND USE IN 1966, 1971, AND 1977

	1966		1971		1977	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Urban built-up areas	5 644	5.4	6 460	6.2	8 738	8.4
Mines, quarries, sand and gravel pits	231	0.2	299	0.3	523	0.5
Outdoor recreational areas	1 974	1.9	2 099	2.0	3 211	3.1
SUBTOTAL - urban and related uses	7 849	7.5	8 858	8.5	12 472	12.0
Horticulture, poultry, and fur farms	15	0.0	11	0.0	15	0.0
Cropland, improved pasture and forage crops	4 254	4.1	3 894	3.8	2 760	2.7
SUBTOTAL - improved agricultural uses	4 269	4.1	3 905	3.8	2775	2.7
Unimproved pasture and rangeland	3 313	3.2	3 359	3.2	4 659	4.5
SUBTOTAL	3 313	3.2	3 359	3.2	4 659	4.5
Productive woodland	49 469	47.6	49 818	47.9	45 850	44.1
Unproductive woodland	32 128	30.9	30 939	29.8	28 951	27.8
Swamps, marshes, bogs, & fens	5 800	5.6	6 187	6.0	7 977	7.7
Bare sand	--	--	12	0.0	52	0.0
Bare rocks	1 141	1.1	891	0.8	1 232	1.2
Water	--	--	--	--	1	0.0
SUBTOTAL - natural cover	88 538	85.2	87 847	84.5	84 063	80.8
TOTAL STUDY AREA	103 969 ha	100 %	103 969 ha	100 %	103 969 ha	100 %

ST. JOHN'S URBAN CENTRED REGION
LAND USES 1966, 1971 AND 1977
INDICATING NET CHANGE (1966 – 1977)

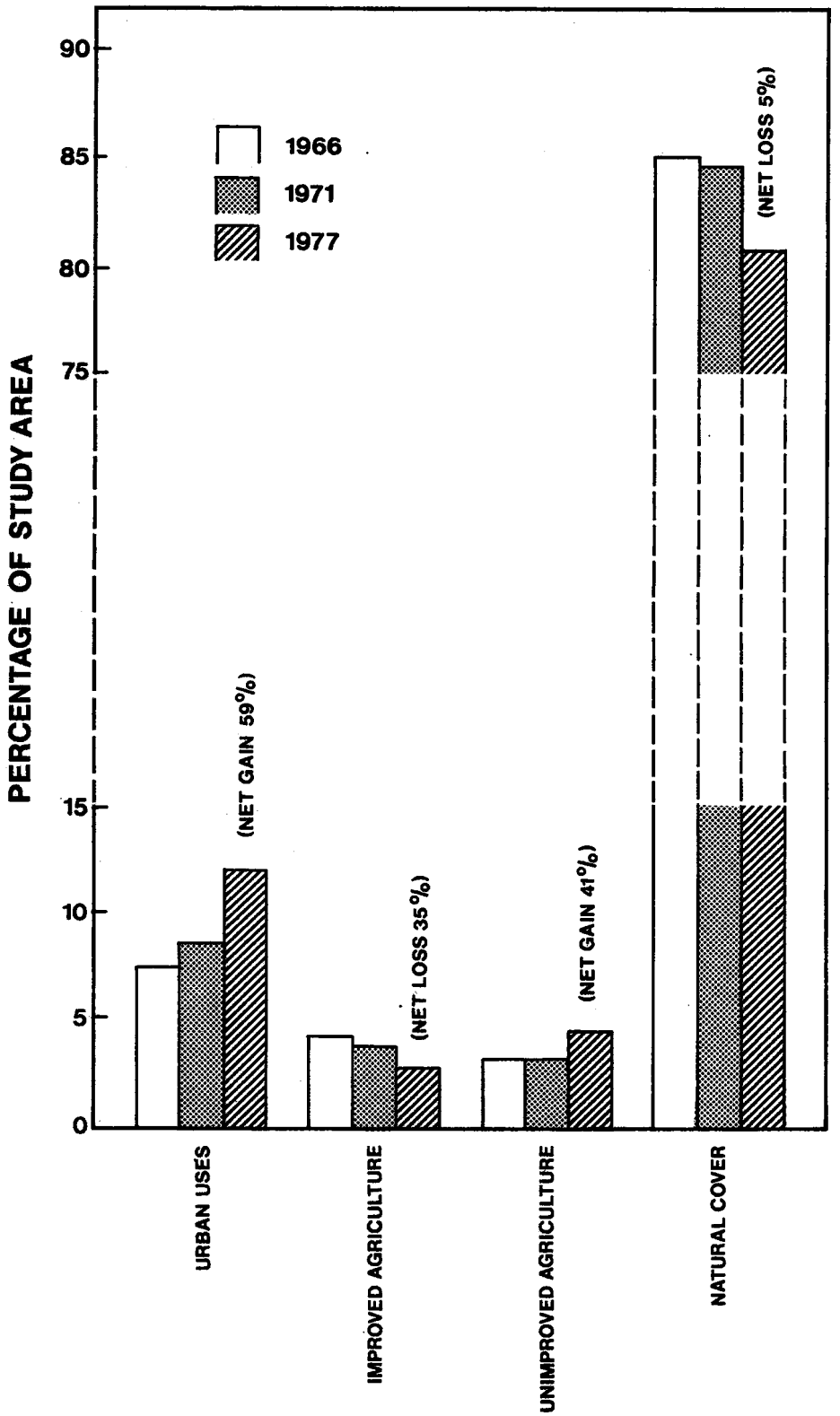


FIGURE 3

TABLE 2: AGRICULTURAL CAPABILITY

Class	Area (Hectares)	Study Area (%)	
3	315	0.3	
4	3 619	3.5	13.6
5	10 235	9.8	
6	26 778	25.8	25.8
7	54 798	52.7	
Organic soil	6 872	6.6	60.6
Unclass.	1 352	1.3	
TOTAL AREA	103 969 ha	100 %	

* * *

Also from Table 2 (above) the lack of suitable areas with any capability for agriculture (Classes 3, 4, and 5) is evident. Only 14 169 hectares (13.6 percent of the study area) fall into these three classes. Nearly 61 percent of the St. John's UCR is rated as having no agricultural capability.

Table 3 shows a breakdown of the UCR by primary agricultural limitations. All soils in the St. John's UCR have primary limiting factors for agriculture with the most common being stoniness (55.9 percent) and bedrock near the surface (20.9 percent). With the addition of the topographic limitation (5.7 percent), the area affected totals 82.5 percent. CLI map symbols are included in Table 3 to assist the reader who has access to the published 1:250 000 CLI maps and to the unpublished field maps at 1:50 000 scale.

Table 4 indicates all but 12.1 percent of the St. John's study area faces a secondary agricultural limitation. Again, bedrock, topography and stoniness are the most significant limitations totalling 66.5 percent of the study area. Low natural fertility limits a further 8.4 percent.

It is apparent from Tables 3 and 4 that there is a very small amount of land without serious limitations for agriculture in the study area. However, the St. John's UCR contains a large proportion (3.1 percent of class 6 or better) of the provincial total of land capable of agricultural production, in relation to its small area (0.28 percent of province).

TABLE 3: PRIMARY AGRICULTURAL LIMITATIONS (Subclass 1)

	CLI Map Symbol	Area (Hectares)	Study Area (%)	
Stoniness	P	58 167	55.9	
				76.8
Consolidated bedrock near surface	R	21 707	20.9	
Topography	T	5 966	5.7	
Excess water	W	5 356	5.2	15.3
Low natural fertility	F	4 550	4.4	
Organic soil	-	6 871	6.6	
				7.9
Urban core unclassified	B	1 352	1.3	
UCR TOTAL AREA		103 969 ha	100 %	

TABLE 4: SECONDARY AGRICULTURAL LIMITATIONS (Subclass 2)

	CLI Map Symbol	Area (Hectares)	Study Area (%)	
Consolidated bedrock near surface	R	30 607	29.4	
Topography	T	21 922	21.1	66.5
Stoniness	P	16 649	16.0	
Low natural fertility	F	8 755	8.4	
Undesirable soil structure	D	5 982	5.8	17.8
Adverse soil characteristics in general	S	3 835	3.6	
Excess water	W	3 076	3.0	3.0
Moisture limitation usually soil related	M	280	0.3	
Erosion	E	265	0.3	0.6
Subclass not present		12 598	12.1	12.1
UCR TOTAL AREA		103 969 ha		100 %

Therefore, the importance of this resource to agricultural production in the province should not be underestimated.

4.3 Land Capability for Outdoor Recreation

The capability for outdoor recreational use is divided into seven classes. (See Appendix IV for class definitions.) Table 5 illustrates the recreational capability for the St. John's UCR. While 7.4 percent of the UCR is rated as having a moderate to moderately high capability (Classes 3 and 4), by far the largest class group, representing over three-quarters of the UCR, falls within the low recreational capability category (Class 6). There is a complete absence of the two highest capability classes.

The unclassified figure of 10 percent represents the urban core primarily and to a lesser degree, water bodies, such as protected waters, not considered in the recreational rating.

TABLE 5: OUTDOOR RECREATION CAPABILITY

Class	Area (Hectares)	Study Area (%)	
3 - Moderately High	1 449	1.4	7.4
4 - Moderate	6 288	6.0	
5 - Moderately Low	5 696	5.4	82.1
6 - Low	79 737	76.7	
7 - Practically No Capability	509	0.5	10.5
8 - Unclassified areas & water	10 290	10.0	
TOTAL AREA	103 969 ha	100 %	

* * *

Table 6 presents the primary recreational feature subclasses for the St. John's UCR. Small surface waters, topographic variety and

TABLE 6: PRIMARY RECREATION FEATURES (Subclass)

	CLI Map Symbol	Area (Hectares)	Study Area (%)	
Small surface waters	M	41 457	39.9	
Topographic variety, land and water relationships	Q	32 707	31.4	82.4
Shoreline, family beach activities	B	11 532	11.1	
Water access for fishing	A	5 437	5.2	10.3
Land with vegetation possessing recreational value	E	5 280	5.1	
Recreational lodging	N	1 917	1.8	
Shoreline, access to family boating	Y	1 234	1.2	
Vantage point to viewing opportunities	V	1 103	1.1	
Opportune area for gathering and collecting	J	1 012	1.0	7.3
Interesting rock formations	R	898	.9	
Cultural landscape	P	814	.7	
Non-urban man-made structures	Z	431	.4	
Waterfalls or rapids	F	99	0.1	
Historic and prehistoric site	H	48	0.1	
TOTAL AREA		103 969 ha		100 %

shoreline activities combine to provide 82.4 percent of primary recreational features in the UCR. A considerable variety of other types comprise the remaining 17.6 percent of the UCR.

There are a variety of provincial and federal recreational areas within the St. John's UCR. Butter Pot Provincial Park, encompassing 1 752 hectares, is the second largest provincial camping park in the province. Public beaches are located at Middle Cove and Topsail Beach. The Topsail Beach area is not fully developed. Cochrane Pond Day Use Park receives heavy visitor use. Marine Drive, situated north of Bauline, is presently being constructed as a recreation area. Access for fishing has been provided by the Province to Soldier's Pond. Numerous small municipal parks meet local recreational demands.

Federal recreational facilities within the UCR include Signal Hill and Cape Spear Historic Parks.

A large number of residents of the St. John's UCR are drawn to provincial camping parks just outside the UCR boundary. La Marche, 7 km south of Witless Bay and Gushue's, 8 km west of Holyrood are major attractions.

Other more distant recreation areas which are often visited by St. John's residents include Fitzgerald Pond located between Whitborne and Argentia, Freshwater Pond Provincial Park, Frenchman's Cove Provincial Park and Terra Nova National Park.

5. LAND USE DYNAMICS

Land use dynamics are defined as changes in land use through time. The analysis of land use dynamics includes both the quantity and nature of that change. In Section 4, land use change was expressed in quantitative terms of net gain or loss. In the sections to follow, land use relationships will be expressed through the use of proportional comparisons. In this section the nature of these changes, the transfer of land between uses, and the location of the changes will be discussed.

5.1 Urbanization

Urbanization and the problems associated with it have become a major issue for governments and people concerned with the quality of our environment. Direct repercussions of urban encroachment on agricultural land such as decreasing cropland, are readily apparent. Effects beyond the urban agricultural interface may be harder to determine, yet are significant nevertheless. For example, an additional price is placed on food products as a result of the

increased transportation costs associated with imported foods.

Uses of land in 1966, subsequently urbanized, are listed in Table 7. From this table, 815 hectares, or 0.9 percent of the St. John's Urban Centred Region, were converted to urban uses between 1966 and 1971. Much of the converted land had been within a natural cover class. From the same table, the 1971 to 1976 figures indicate a more rapid conversion as 2 278 hectares or 2.2 percent of the study area was classed as built-up by 1977.

The conversion rate for 1966 - 1971 is 163 ha/yr, while the 1971 - 1977 period averages 380 ha/yr*. Although improved agricultural land has not replaced natural cover as the largest donor to urban expansion, the loss of 666 hectares or 30 percent of the total area converted to urban uses is significant.

Rates of urbanization can be found in Table 8. This table indicates the rates of conversion to urban uses for land with agricultural capability. It is evident that areas of natural cover and agricultural capabilities 4 to 6 are most susceptible to urbanization (also note Map 3).

The location of the urban growth in both periods is shown on Map 2. During the 1966 to 1971 period, infilling occurred along the Trans-Canada Highway from St. John's southwest to Kilbride and Mount Pearl. Growth of the core towards Torbay Airport and the development of the power generating plant at Indian Pond are evident.

Much more change outside of the urban core is evident in the 1971 to 1977 cycle. Mount Pearl-New Town, the ribbon development along Highway 3 from St. John's to Topsail and Seal Cove, and the enlargement of the settlements of St. Phillips and St. Thomas are the primary growth areas. A computer plot produced by the Lands and Integrated Programs Directorate's regional interactive graphics terminal, has been included in the appendices to illustrate the development of a linear settlement pattern along the established road network and coastline. Development between Goulds and Bay Bulls has been restricted by proximity to a water supply protection zone.

Urban Land Use Selection Preference

Table 9 and Figure 4 illustrate another aspect of land conversion. By examining the non-urban land use available** for conversion to urban purposes and the actual land urbanized, those

* The annual conversion rates noted in Table 8 are smaller amounts; the result of the addition of the agricultural capability parameter.

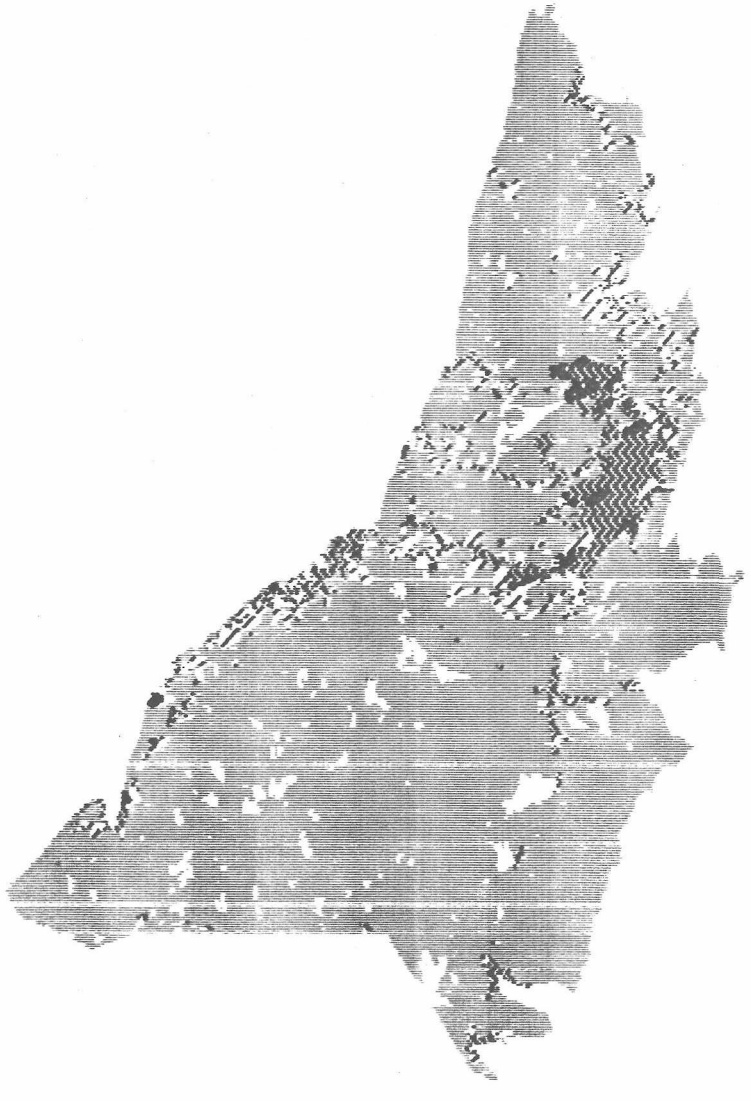
** "Available" land in this context simply means all non-urban land. The land is not necessarily available due to development restrictions, etc.

TABLE 7: 1966 USE OF LAND CONVERTED TO URBAN BUILT-UP USE FOR PERIODS 1966 TO 1971 AND 1971 TO 1977

	1966 - 1971		1971 - 1977	
Land Use Class	Area (Hectares)	Selected Area	Area (Hectares)	Selected Area
Mines, quarries, sand and gravel pits	7	0.9	7	0.3
Cropland, improved pasture, forage crops and horticulture	125	15.3	666	29.2
Unimproved pasture and rangeland	30	3.7	213	9.4
Productive woodland	297	36.4	909	39.9
Unproductive woodland	316	38.8	472	20.7
Swamps, marshes, bogs and fens	13	1.6	8	0.4
Unvegetated surfaces	27	3.3	3	0.1
TOTAL AREA CONVERTED	815 ha	100 %	2278 ha	100 %
TOTAL OF UCR		0.8 %		2.2 %

TABLE 8: AVERAGE ANNUAL RATES OF URBANIZATION FOR LAND WITH AGRICULTURAL CAPABILITY

	1966 - 1971 Ha/yr	1971 - 1977 Ha/yr	Percent Change (from 1966)
Improved agriculture	23.9	120.7	+ 405
Unimproved agriculture	4.6	34.1	+ 641
Natural cover (woodland, marsh)	93.6	200.2	+ 114
Excavation	1.4	1.3	- 7
Area converted to urban uses of land with agricultural capability rating - 3	-	3.7	-
- 4	4.3	70.9	+ 1 549
- 5	38.1	157.0	+ 312
- 6	81.1	124.7	+ 54
All land uses (Agricultural capability classes 3 - 6, incl.)	123.5	356.3	+ 188



ST JOHNS URBAN CENTRED REGION

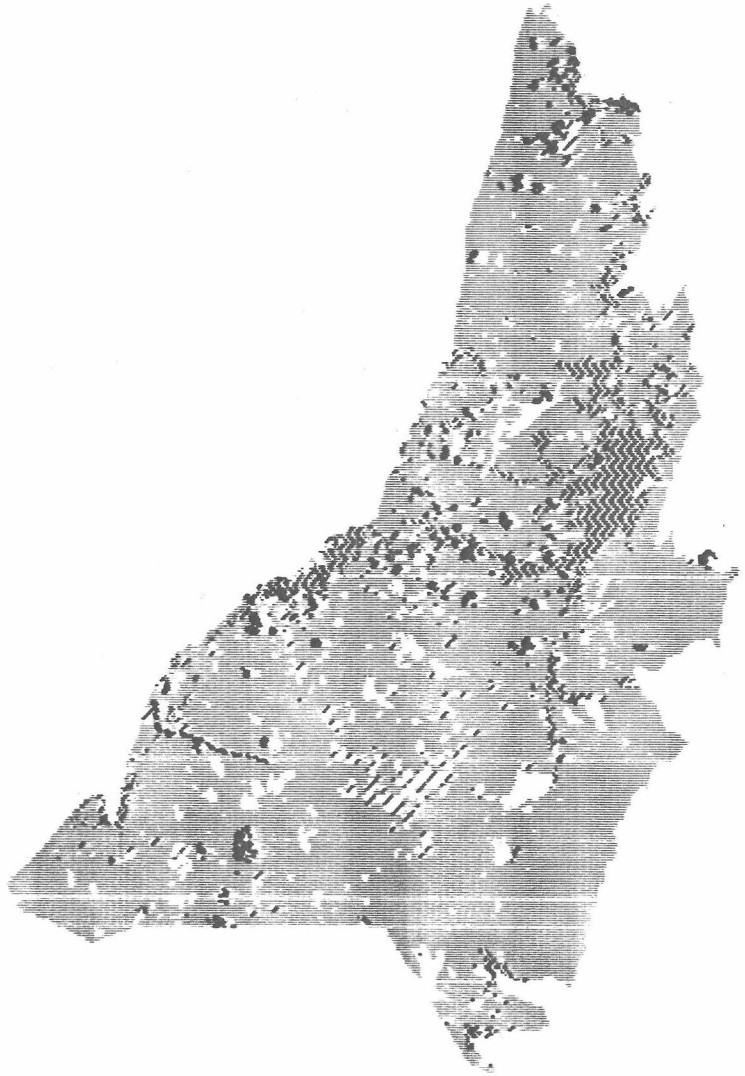
Land Converted to Urban Uses
1966 to 1977

Urban uses 1966

Land converted to urban uses 1966 to 1971

Land converted to urban uses 1971 to 1977

MAP 2



ST JOHNS URBAN CENTRED REGION

Land Converted to Unimproved Pasture 1966 to 1977

Urban uses 1966

Land converted to unimproved pasture 1966 to 1971

Land converted to unimproved pasture 1971 to 1977

MAP 3

TABLE 9: NON-URBAN LAND USE AVAILABLE* FOR URBANIZATION

Land Use Class	Area (Hectares) 1966	1971	% Available for Urban Use 1966		1971	
Mines, quarries, sand and gravel pits	231	299	0.2		0.3	
				2.2		2.5
Outdoor recreation areas	1 974	2 099	2.0		2.2	
Horticulture, poultry and fur farms	15	11	0.0		0.0	
				4.3		3.8
Cropland, improved pasture and	4 254	3 894	4.3		3.8	
Unimproved pasture and rangeland	3 313	3 359	3.4	3.4	3.5	3.5
Productive woodland	49 469	49 817	50.3		51.2	
Unproductive woodland	32 128	30 940	32.7		31.8	
				90.1		90.2
Swamps, marshes, bogs, & fens	5 800	6 187	5.9		6.3	
Unvegetated surfaces	1 141	903	1.2		0.9	
TOTAL AREA AVAILABLE - NOT URBANIZED	98 325	97 509 ha	100 %			100 %
TOTAL OF UCR	94.6 %	93.8 %				

* Development restrictions are not considered in this table.

ST. JOHN'S URBAN CENTRED REGION
LAND USE AVAILABILITY FOR/AND ACTUAL CONVERSION TO URBAN USE

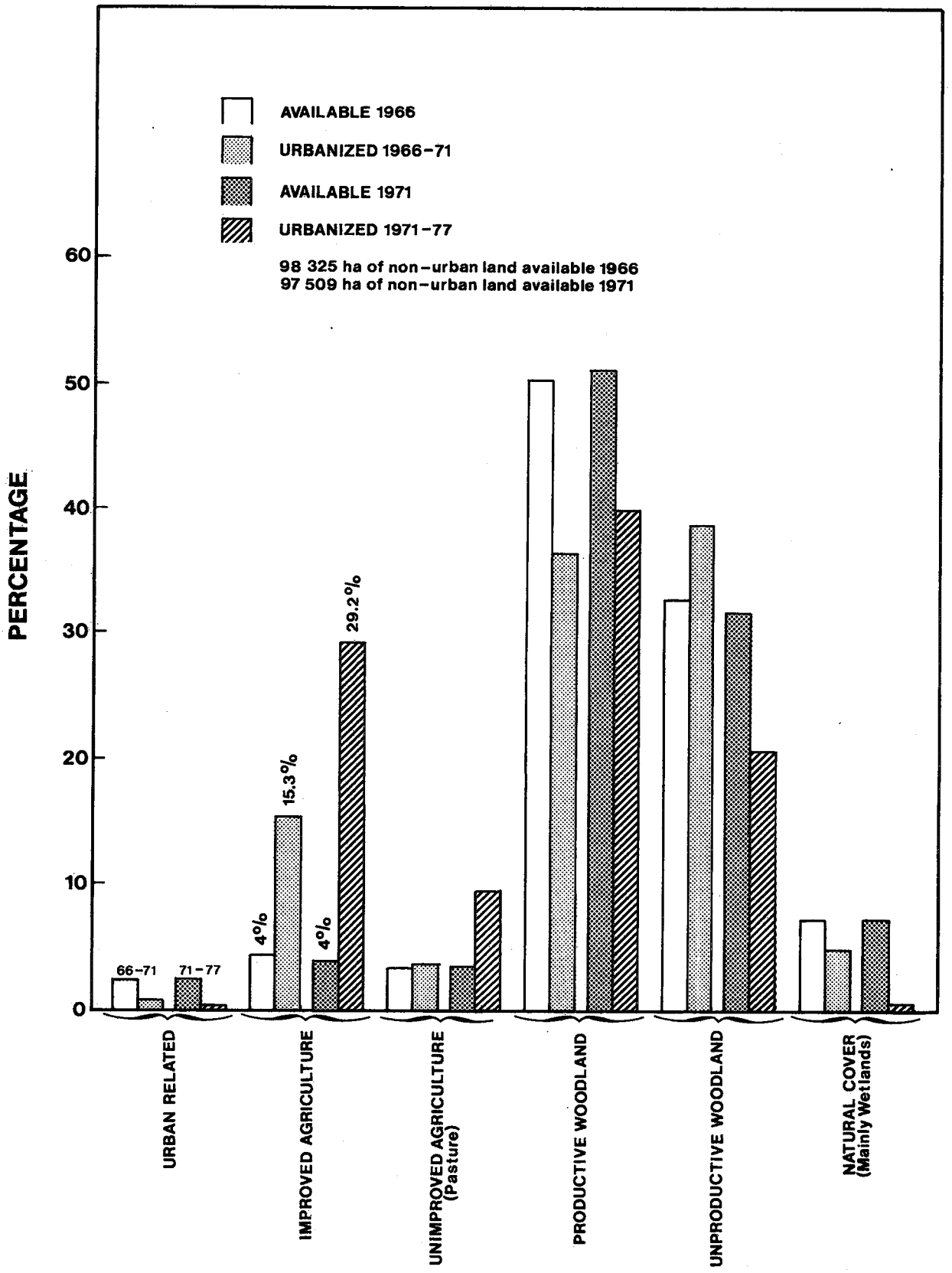


FIGURE 4

land uses selected in preference to others can be determined. Urban land use selection preference can be defined as land area converted to urban use, divided by area of land use(s) available for urban conversion at a specific time. The larger this ratio, the greater is the utilization of an available land use class. A smaller ratio indicates a lower utilization of an available source of non-urban land for urban purposes.

A startling fact illustrated by Figure 4 is the large ratio (29.2:4) of the improved agricultural class that has been urbanized between 1971 and 1977. To a lesser extent a similar disproportionate conversion holds true for the previous cycle (15.3:4). By the same comparison, the utilization of productive woodland as a source of land for urban expansion is proportionately low. With regard to unproductive woodland, a reversal in ratios occurred during the two monitoring cycles. Between 1966 and 1971 the ratio was 1.2:1, whereas the ratio between 1971 and 1977 was 0.6:1. This indicates a lower utilization of unproductive woodland for urban purposes during the latter period.

The physical capability of land which was converted to urban use is another factor of land use dynamics to be considered. A direct correlation between high agricultural capability and ease of servicing urban development, along with the usual attractiveness of this type of land, results in potential land use conflicts between urbanization and agricultural pursuits.

Table 10 indicates that there is a small amount of high capability agricultural land available for conversion to urban uses. However, there remains a tendency towards the use of higher quality agricultural land for conversion to urban use. Capability classes 1 and 2 are absent - only 139 hectares of class 3 is present. No conversion to urban uses took place in the 1966 to 1971 period and only 1 percent or 19 hectares of the land converted by 1977, was in class 3. However, this small class underwent the greatest proportional change in the 1971 to 1977 period. In that same time span class 4 land had the next highest proportional conversion rate to urban purposes. From this there appeared to be a trend towards the conversion of land having higher agricultural capability ratings in the 1971 to 1977 cycle. This was not noted in the 1966 to 1971 cycle. This trend is further substantiated by the fact that in the 1966 to 1971 period, 65.6 percent of the land converted to urban uses was in class 6 whereas there was only 35.0 percent in the 1971 to 1977 period.

TABLE 10. COMPARISON BETWEEN AVAILABILITY OF LAND WITH AGRICULTURAL CAPABILITY AND ITS SELECTION FOR URBAN PURPOSES

Agricultural Capability	Available Non Urban Land (A)				Land Converted to Urban Use (U)				Land Use Selection Preference Ratio*	
	1966		1971		1966 to 1971		1971 to 1977			
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	1966 to 1971	1971 to 1977
Class 3	139	0.4	139	0.4	-	-	19	1.0	U:A; 0.0:0.4; 0.0:1	U:A: 1.0:0.4; 2.5:1**
Class 4	3 133	8.4	3 111	8.5	21	3.4	354	19.9	U:A; 3.4:8.4; 0.4:1	U:A; 19.9:8.5; 2.3:1
Class 5	8 748	23.5	8 558	23.3	191	31.0	785	44.1	U:A; 31.0:23.5; 1.3:1	U:A; 44.1:23.3; 1.9:1
Class 6	25 235	67.7	24 830	67.8	405	65.6	623	35.0	U:A; 65.6:67.7; 0.9:1	U:A; 35.0:67.8; 0.5:1
TOTAL STUDY SELECTED	37 255	100 %	36 638	100 %	617	100 %	1 781	100 %		
TOTAL OF UCR	35.8 %		35.2 %		0.6 %		1.7 %			

* U:A Urbanized land with agricultural capability as a ratio of land available with the same agricultural capability rating.

** The greater the ratio the larger the conversion to urban uses, of land having an agricultural capability.

NOTE: Class 4 - the 1966-1971 monitoring cycle ratio of 0.4:1 indicates a significant tendency toward the urbanization of this particular agricultural capability class.

The following points summarize the urbanization process in the St. John's UCR:

1. Conversion of land to urban use constitutes a major land use change in the St. John's UCR;

2. A proportionally greater amount of urbanization is taking place at the expense of agricultural land rather than land of natural cover types;

3. There is an increasing tendency toward the use of class 4 agricultural land for urbanization during the monitoring period;

4. Generally, improved and unimproved agricultural land uses are changing directly to urban use without conversion to a temporary land use in the interim period;

5. For the period 1971 - 1977 a considerable increase in the annual rate of urbanization occurred, compared to the 1966 - 1971 time period;

6. Urban development was concentrated along a road network linking Torbay with St. John's, St. Phillips with St. John's, and the latter to Holyrood via Mount Pearl and Topsail. Other areas of urban growth include the Goulds - Petty Harbour, Bay Bulls, Witless Bay, Portugal Cove Road, Flat Rock, Pouch Cove, and in the vicinity of the Torbay airport.

5.2 Rural Land Uses

5.2.1 All Rural Land Uses

Rural land uses are defined as all land uses excluding urban and urban-associated land uses. They can be divided into three general land use types: improved agricultural land; unimproved pasture and rangeland; and, natural cover.

Table 11 indicates that of the 96 120 ha of rural land in 1966, 1.1 percent had converted to urban use by 1971 and 4.8 percent by 1977. The remainder stayed in rural use. However, this gives no indication of which rural uses converted to which new uses for either period, illustrated in Figure 5 are the general trends in four land use categories. Urban related uses and unimproved agriculture are increasingly making use of 1966 rural land, at the expense of improved agriculture and natural cover classes which are decreasing.

By comparing use in 1977 with previous use as presented in Table 12, the land use change information in Table 11 is simplified, because 4 623 hectares of land urbanized between 1966 and 1977 are not considered. Of note is the relatively stable amount of unimproved pasture and natural cover classes for the 1966 to 1971 monitoring cycle. Each of these land use types are to be investigated in greater detail in the following sections.

5.2.2 Improved Agricultural Land

Improved agricultural land represents all land that is in improved pasture, horticulture, cash and forage crops. Most of this class of land includes the significant concentration* of dairy farms located in Kilbride, Goulds and the area to the north of St. John's. In 1966, 4 269 ha of land was in improved agricultural use (Table 13 and Figure 6). By 1971, 16.4 percent of this land was converted to other uses while 83.6 percent or 3 570 ha remained unchanged. By 1977, 50.3 percent was converted to other (mainly urban-associated) uses and 20.4 percent to unimproved pasture; while 8.8 percent of the land reverted to natural cover. Hence, there was a marked acceleration in the loss of good agricultural land in the second monitoring period.

This is indicative of a severe decline in the amount of improved agricultural land between

* 78.1 percent of provincial milk production in 1978 originated from within the St. John's Urban Region. Source: St. John's Agricultural Development Area Status Report, p. 10.

TABLE 11: 1966 RURAL LAND USE AND ITS SUBSEQUENT USE IN 1971 AND 1977

Land Use Class	1966 Area (ha)	1966 %		1971 Area (ha)	1971 %		1977 Area (ha)	1977 %	
Urban built-up areas				809	0.9		3 080	3.2	
Mines, quarries, sand and gravel pits				77	0.1	1.1	318	0.3	4.8
Outdoor recreational areas				124	0.1		1 236	1.3	
Horticulture, poultry, and fur farms	15	0.0		11	0.0		15	0.0	
			4.4			4.1			2.9
Cropland, improved pasture and forage crops	4 254	4.4		3 894	4.1		2 758	2.9	
Unimproved pasture and rangeland	3 313	3.5	3.5	3 359	3.5	3.5	4 653	4.8	4.8
Productive woodland	49 469	51.5		49 817	51.8		45 851	47.7	
Unproductive woodland	32 128	33.4		30 939	32.2		28 948	30.1	
			92.1			91.3			89.5
Swamps, marshes, bogs, fens	5 800	6.0		6 187	6.4		7 977	8.3	
Bare sand	—	—		12	0.0		52	0.1	
Bare rocks	1 141	1.2		891	0.9		1 232	1.3	
TOTAL STUDY SELECTED	96 120 ha	100 %		96 120 ha	100 %		96 120 ha	100 %	

TOTAL OF UCR - 92.4 %

ST. JOHN'S URBAN CENTRED REGION
USE OF 1966 RURAL LAND
IN 1971 AND 1977

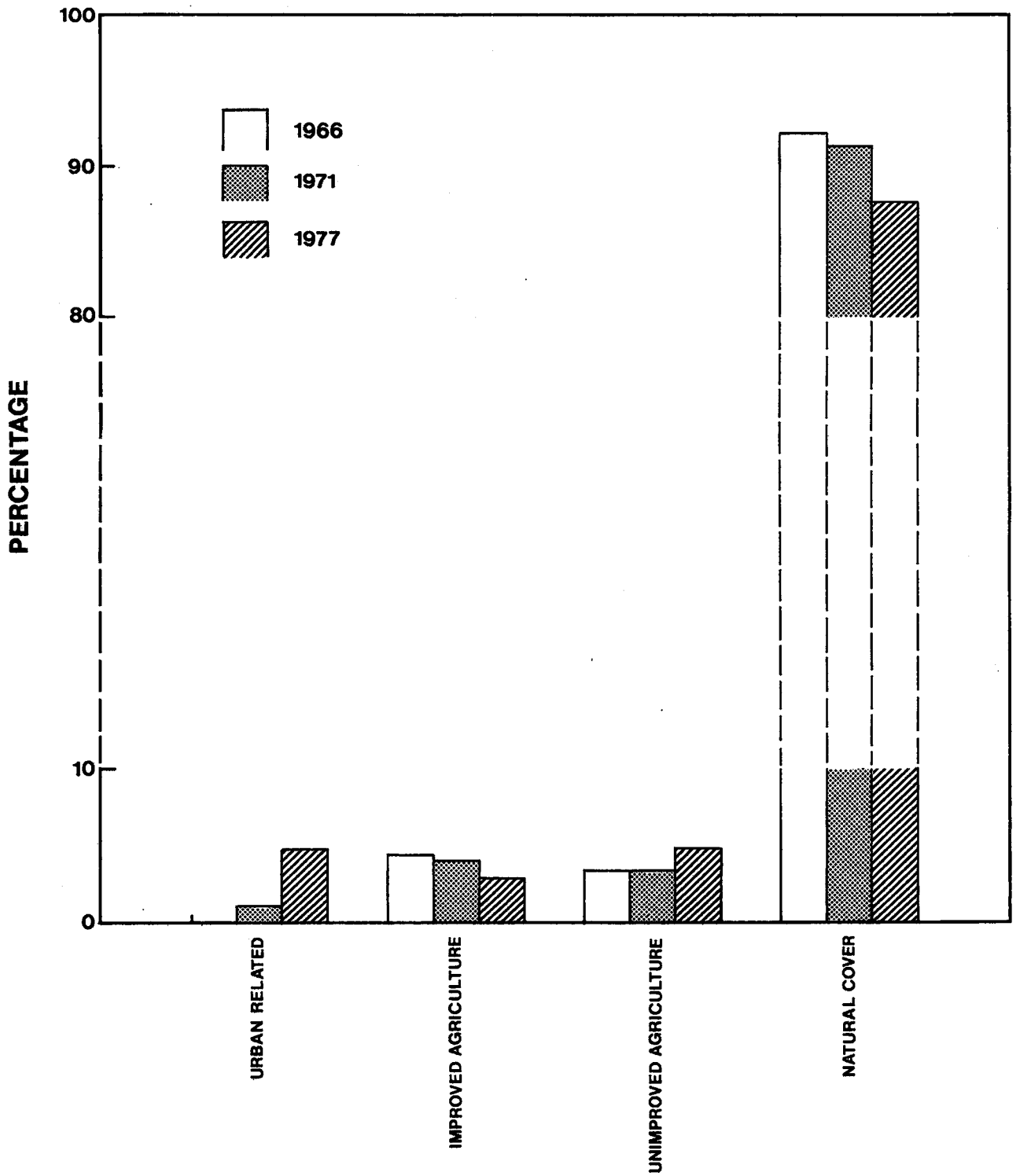


FIGURE 5

TABLE 12: 1977 RURAL LAND USE AND ITS PREVIOUS USE IN 1971 AND 1966

Land Use Class	1977 Area (ha)	1977 %		1971 Area (ha)	1971 %		1966 Area (ha)	1966 %	
Mines, quarries, sand and gravel pits				10	0.0		12	0.0	
Horticulture, poultry, and fur farms	15	0.0	3.0	8	0.0	3.5	12	0.0	3.7
Cropland, improved pasture and forage crops	2 760	3.0		3 190	3.5		3 355	3.7	
Unimproved pasture and rangeland	4 659	5.1	5.1	3 071	3.3	3.3	3 032	3.3	3.3
Productive woodland	45 851	50.1		48 051	52.5		47 396	51.8	
Unproductive woodland	28 951	31.7	91.9	30 093	32.9	93.2	30 849	33.7	93.0
Swamps, marshes, bogs, fens	7 977	8.7		6 180	6.8		5 770	6.3	
Bare rock	1 232	1.3		884	1.0		1 071	1.2	
Bare sand	52	0.1		10	0.0		—	—	
TOTAL STUDY SELECTED	91 497 ha	100 %		91 497 ha	100 %		91 497 ha	100 %	

TOTAL OF UCR - 88.0 %

TABLE 13: 1966 IMPROVED AGRICULTURAL LAND - ITS SUBSEQUENT USES IN 1971 AND 1977

	1971				1977			
	Area (ha)	%	%		Area (ha)	%	%	
Urban built-up areas	125	2.9			841	19.7		
Mines, quarries, sand and gravel pits	4	0.1	3.4	3.4	24	0.6	21.1	21.1
Outdoor recreation areas	16	0.4			36	0.8		
Horticulture, poultry and fur farms	11	0.2			6	0.1		
Cropland, improved pasture and forage crops	3 559	83.4	83.6		2 117	49.6	49.7	
Unimproved pasture and rangeland	306	7.2	7.2	7.2	870	20.4	20.4	20.4
Productive woodland	166	3.9			201	4.7		
Unproductive woodland	82	1.9			145	3.4		
Swamps, marshes, bogs, fens	-	-	5.8	5.8	5	0.1	8.8	8.8
Bare rock	-	-			8	0.2		
Bare sand	-	-			16	0.4		
Converted to other than improved agriculture or remaining in class		Subtotal		16.4		Subtotal		50.3
TOTAL AREA SELECTED	4 269 ha		100 %		4 269 ha		100 %	

TOTAL OF UCR - 4.1 percent.

ST. JOHN'S URBAN CENTRED REGION
USE OF 1966 IMPROVED AGRICULTURAL LAND
IN 1971 AND 1977

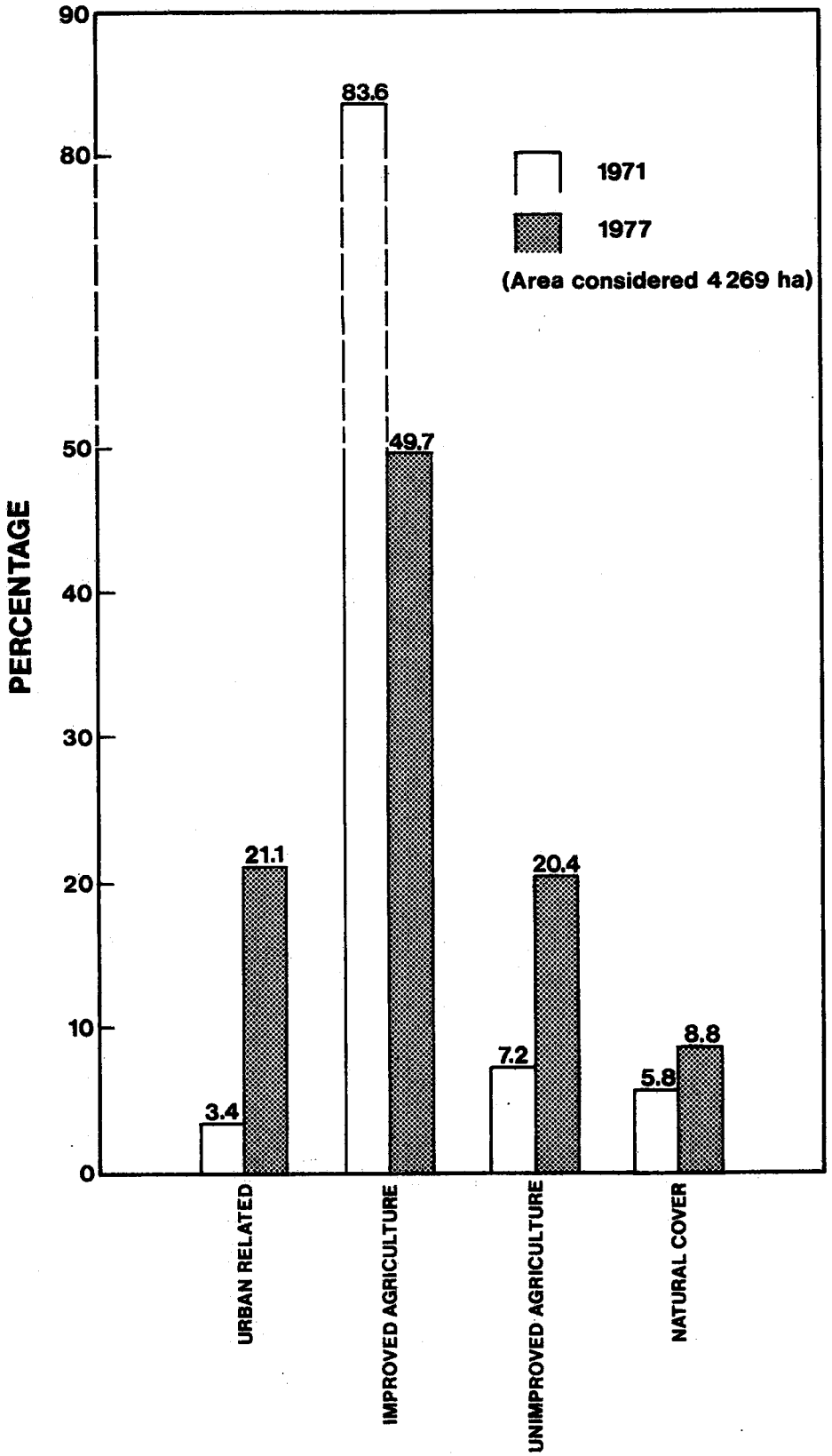


FIGURE 6

1966 and 1977, and a substantial increase in urban use (See Figure 6).

Examination of the prior use of 1977 improved agricultural land (Table 14) indicates 87.0 percent in 1971 and 76.5 percent in 1966 remained within this land use class. The chief donor to this class in both 1966 and 1971 was productive woodland at 11.6 and 8.4 percent respectively. This fact indicates forest land is being cleared for agricultural purposes.

The relationship between agricultural capability, rural land use in general (i.e., non-urban land available for conversion) and improved agriculture in particular is shown in Table 15. The improved agricultural class appears to occupy a relatively stable portion of the higher capability classes at the 1966 and 1977 monitoring benchmarks. As one would expect, the higher capability land (3 & 4) saw a proportional increase in the intensity of use. The inverse in the case when class 5 is considered.

A summary of the dynamics of improved agricultural land in the St. John's Urban Centred Region follows:

1. Improved agricultural land was the rural land type having undergone the greatest proportional loss over the study period. This class suffered a net decline of over 35 percent between 1966 and 1977; by 1977 it constituted only 2.7 percent of the study area.

2. Urban-related land use was the largest recipient of improved agricultural land between 1966 and 1977. The second most common conversion of improved agricultural land was to unimproved agriculture in both time periods monitored.

3. Although there has been an overall decline in the amount of the improved agricultural land, there has been a small increase in the intensity of use of the higher capability lands (classes 3 and 4) for improved agriculture. This trend has been paralleled by a minor move away from the use of lower capability land (class 5 and 6) for improved agriculture.

5.2.3 Unimproved Pasture and Rangeland

Unimproved pasture and rangeland is characterized by land that is in grass cover but is not improved, usually due to physical limitations. This category, when located adjacent to population centres, is a transitional land use which may be an indicator of future urbanization and present land speculation.

TABLE 14: 1966 AND 1971 LAND USE OF 1977 IMPROVED AGRICULTURAL LAND

	1966			1971		
	Area (ha)	%		Area (ha)	%	
Mines, quarries, sand, and gravel pits	2	0.1	0.1	0	0.0	
Horticulture, poultry and fur farms	5	0.2		6	0.1	
			76.5			87.0
Cropland, improved pasture and forage crops	2 117	76.3		2 407	86.9	
Unimproved pasture and rangeland	127	4.6	4.6	24	0.9	0.9
Productive woodland	321	11.6		234	8.4	
Unproductive woodland	193	6.9		100	3.6	
			18.8			12.1
Swamps, marshes, bogs and fens	9	0.3		0	0.0	
Bare sand	1	0.0		4	0.1	
TOTAL AREA SELECTED	2 775 ha	100 %		2 775 ha	100 %	

TOTAL OF UCR - 2.7 percent.

TABLE 15: AGRICULTURAL CAPABILITY OF ALL RURAL LAND COMPARED TO IMPROVED AGRICULTURAL LAND

Agricultural Capability Class	1966 Rural Land Use Area (ha)	%		1966 Improved Agriculture Area (ha)	%		1977 Improved Agriculture Area (ha)	%	
3	137	0.1		62	1.4		29	1.0	
			3.4			29.6			32.2
4	3 116	3.3		1 204	28.2		866	31.2	
5	8 624	9.0		1 166	27.3		640	23.1	
			34.9			56.5			53.1
6	24 931	25.9		1 248	29.2		833	30.0	
7	52 408	54.5		464	10.9		305	11.0	
Organic Soils	6 779	7.1	61.7	122	2.9	13.9	102	3.7	14.7
Unclassified Area	125	0.1		3	0.1		0	0.0	
TOTAL AREA SELECTED	96 120 ha		100 %	4 269 ha		100 %	2 775 ha		100 %
TOTAL OF UCR	92.4 %			4.1 %			2.7 %		

Between the years 1966 and 1977 unimproved pasture and rangeland increased in size from 3 313 ha or 3.2 percent of the study area to 4 659 ha. or 4.5 percent, (Table 1). Again, the net values do not give a full insight into the dynamics of this change in land use. Figure 7 isolates the interaction of the unimproved agricultural uses with other land use groups. In this diagram conversion of unimproved agriculture ("K") is related to other land uses. It should be remembered that a similar conversion exists between "B" and "A", "A" and "NC" and "NC" and "B" (the dotted lines in the illustration). Table 16 demonstrates the reduction in the amount of 1966 unimproved pasture and rangeland through its loss by conversion to other uses. The 3 313 hectares of unimproved pasture and rangeland in 1966 decreased to 1 999 ha. or 60.4 percent of the original area by 1971. More than one-third of this area (34.6 percent) entered the natural cover class. By 1977, only 41.4 percent of the original area remained in unimproved pasture. During the period from 1971 to 1977, 8.5 percent of the area classed as unimproved agriculture converted to urban and related purposes. Again, a large percentage (46.3 percent) shifted to natural cover types, particularly unproductive woodland.

However, by 1977 (Table 17) the actual area in unimproved pasture increased to 4.5 percent of the total UCR or 4 659 ha. This indicates that there was a good deal of conversion to unimproved pasture from other uses between 1966 and 1977. The main source in this regard was natural cover, in particular unproductive woodland (23.9 percent) and improved agriculture (13.7 percent). By 1971 just over one-half of unimproved agricultural land use was already occupied, increasing from a 29.4 percent total in 1966. Other main 1966 sources converted to unimproved agriculture by 1977 were natural cover (51.8 percent) and improved agriculture, (18.6 percent). One-third of the 1977 land which converted to unimproved agricultural use came from natural cover. Maps 3 and 4 delineate the location of land converted to unimproved pasture. One item of interest is the change recorded in the Pouch Cove vicinity as the result of land clearing operations prior to 1976.

In the unimproved pasture and rangeland, category one might assume that only low quality agricultural land would be found. However, when comparing unimproved pasture (Table 18) with all rural land available within the same capability classes in 1966 (Table 15) it is evident that there is a greater proportion of higher capability land (classes 3 and 4) used for unimproved agriculture (7.0 percent) than for all rural uses (3.4 percent). These proportions remain stable through the monitoring period.

FIGURE 7. INTERACTION BETWEEN UNIMPROVED AGRICULTURE (K) AND OTHER LAND USES 1966 TO 1977

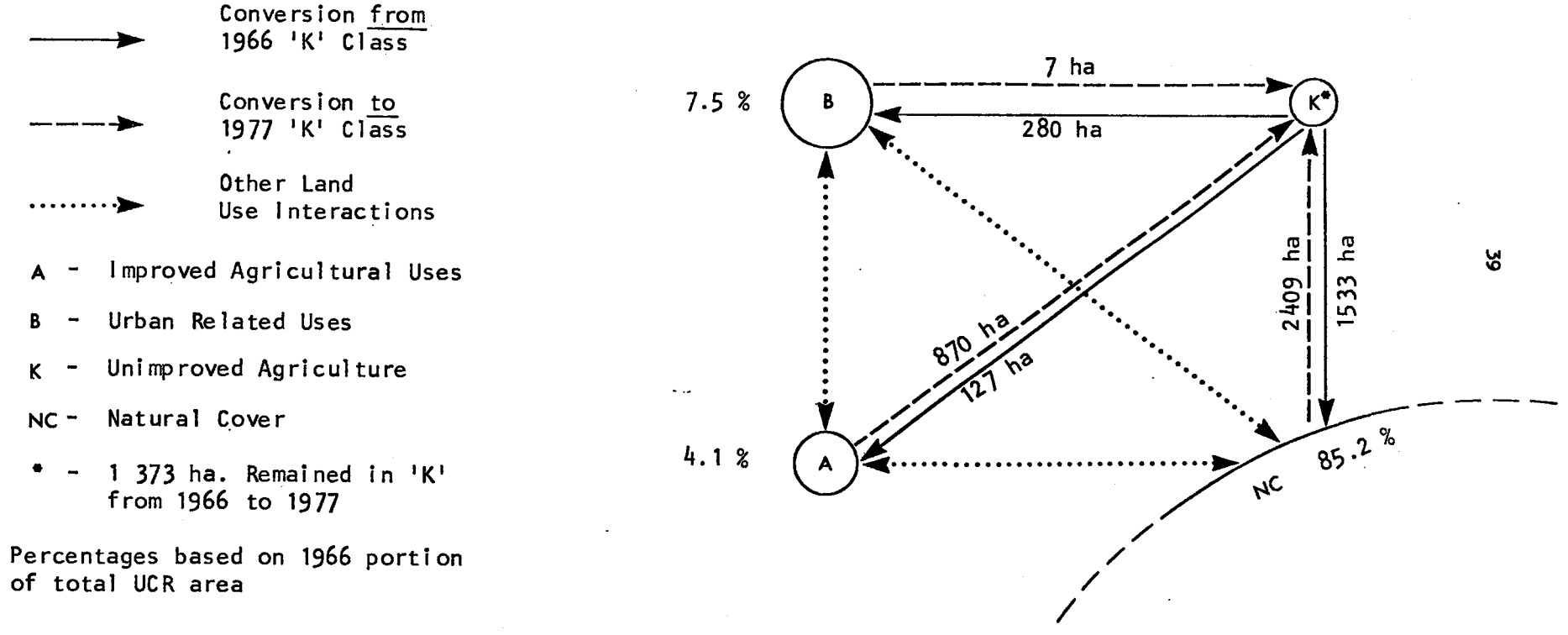


TABLE 16: 1971 AND 1977 USE OF 1966 UNIMPROVED PASTURE AND RANGELAND (K)

(Remaining In/or Converted From "K" by 1977)

	1971				1977			
	Area (ha)		%		Area (ha)		%	
Urban built-up areas	30		0.9		214		6.5	
Mines, quarries, sand and gravel pits	2	64	0.1	1.9	16	280	0.5	8.5
Outdoor recreation areas	32		0.9		50		1.5	
Horticulture, poultry and fur farms	0		0.0		0		0.0	
		104		3.1		127		3.8
Cropland, improved pasture and forage crops	104		3.1		127		3.8	
Unimproved pasture and rangeland	1 999	1 999	60.4	60.4	1 373	1 373	41.4	41.4
Productive woodland	79		2.4		114		3.4	
Unproductive woodland	700		21.1		853		25.8	
Swamps, marshes, bogs	248	1 146	7.5	34.6	308	1 533	9.3	46.3
Bare rock	116		3.5		257		7.8	
Bare sand	3		0.1		1		0.0	
TOTAL AREA SELECTED	3 313 ha		100 %		3 313 ha		100 %	

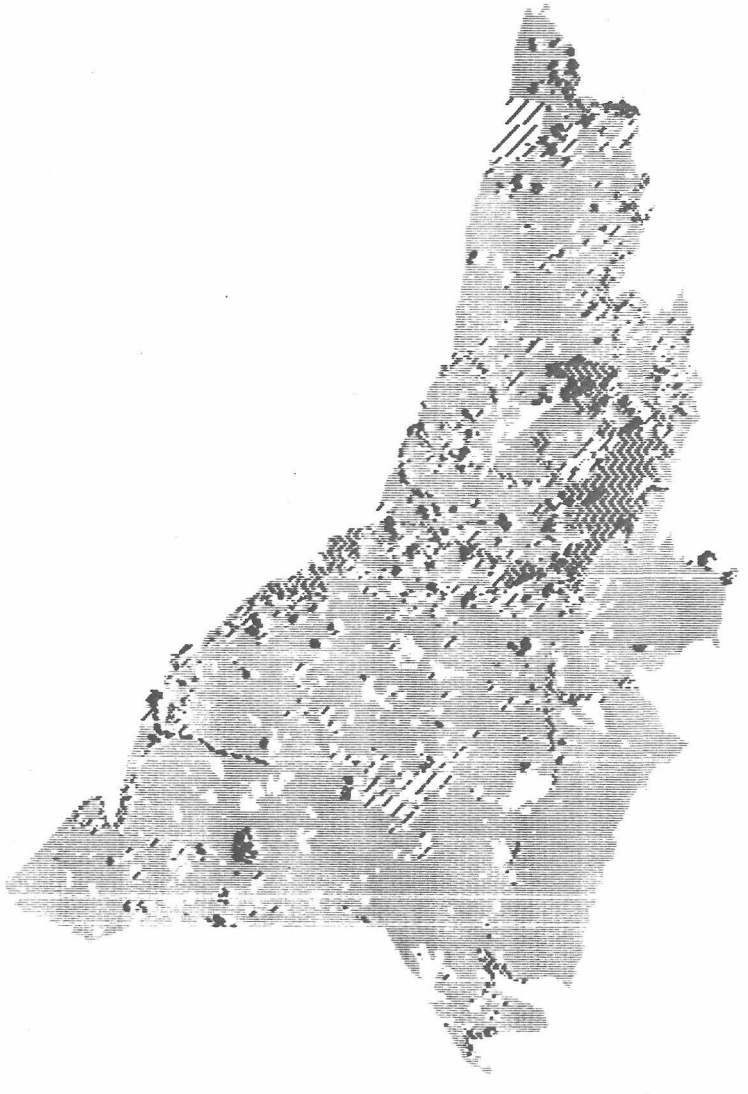
TOTAL OF UCR - 3.2 percent.

TABLE 17: 1966 AND 1971 USE OF 1977 UNIMPROVED PASTURE AND RANGELAND (K)

(Remaining in, or Converted to "K" by 1977)

	1966			1971		
	Area (ha)	%		Area (ha)	%	
Mines, quarries, sand, and gravel pits	7	0.2	0.2	7	0.2	0.2
Horticulture, poultry and fur farms	2	0.0		2	0.0	
			18.6			13.7
Cropland, improved pasture and forage crops	868	18.6		639	13.7	
Unimproved pasture and rangeland	1 373	29.4	29.4	2 445	52.5	52.5
Productive woodland	492	10.6		333	7.1	
Unproductive woodland	1 612	34.6		1 113	23.9	
			51.8			33.6
Swamps, marshes, bogs	213	4.6		80	1.7	
Bare rock	92	2.0		40	0.9	
TOTAL AREA SELECTED	4 659 ha	100 %		4 659 ha	100 %	

TOTAL OF UCR - 4.5 percent.



ST JOHNS URBAN CENTRED REGION

Natural Cover Converted to
Other Uses 1966 to1977

Urban uses 1966

Natural cover in 1966
Other uses by 1971

Natural cover in 1971
Other uses by 1977

MAP 4

TABLE 18: AGRICULTURAL CAPABILITY RELATED TO UNIMPROVED PASTURE AND RANGELAND

Agricultural Capability Class	1966 Unimproved Pasture & Rangeland			1977 Unimproved Pasture & Rangeland			Land Converted From Unimproved Pasture & Rangeland 1966 - 1977			Land Converted To Unimproved Pasture & Rangeland 1966 - 1977			In Interim Year 1971		
	Area (ha)	%		Area (ha)	%		Area (ha)	%		Area (ha)	%		Area (ha)	%	
Class 3	34	1.0	7.0	52	1.1	6.9	9	0.5	6.2	26	0.8	6.4	0	0.0	7.0
Class 4	199	6.0		271	5.8		110	5.7		182	5.6		20	7.0	
Class 5	442	13.3	26.4	663	14.2	37.1	199	10.2	19.3	419	12.7	37.3	27	9.5	50.5
Class 6	433	13.1		1 066	22.9		177	9.1		810	24.6		117	41.0	
Class 7	2 095	63.3		2 098	45.1		1 374	70.8		1 380	42.0		108	37.9	
Organic Soil	94	2.8	66.6	500	10.7	56.0	62	3.2	74.5	468	14.2	56.3	11	3.9	42.5
Unclassified	16	0.5		9	0.2		9	0.5		2	0.1		2	0.7	
TOTAL SELECTED AREA	3 313 ha	100 %		4 659 ha	100 %		1 940 ha	100 %		3 287 ha	100 %		285 ha	100 %	
TOTAL OF UCR	3.2 %			4.5 %			1.9 %			3.2 %			0.3 %		

NOTE: In Interim Year 1971, virtually no land was converted from the unimproved pasture and rangeland class.

There was a smaller proportion of lower capability land (classes 5 and 6) used for unimproved agriculture (26.4 percent) than for all rural uses (34.9 percent) in 1966. However, by 1977 a trend towards increasing use of class 5 and 6 land for unimproved agriculture was evident.

Between 1966 and 1977, the actual area of unimproved pasture increased from 3 313 ha. to 4 659 ha. At the same time the amount of improved agricultural land decreased from 4 269 ha. to 2 775 ha. These trends could indicate that either improved agricultural land reverted to unimproved agricultural land use, or through the clearing of natural cover, more unimproved agricultural land was created. A combination of both kinds of land use change could also have occurred.

To ascertain which alternative is the case in the preceding statement an examination of the capability of land converted to and from unimproved agriculture follows. From Table 18, it is apparent that proportionally more land has been converted to unimproved agriculture than has left this class group. This was especially so with class 6 land. From the data associated with Table 16 it is interesting to note that 280 ha. of 1966 unimproved agricultural land was converted to urban uses by 1977. Also of note is the relatively small amount of unimproved pasture which changed to urban uses (64 ha.) between 1966 and 1971, the interim monitoring period. In fact, this class, which is often a transitional stage prior to urbanization, was a recipient from other uses during this period.

The dynamics of unimproved pasture and rangeland for the 1966 to 1977 period can be summarized as follows for the St. John's Urban Centred Region:

1. Unimproved pasture and rangeland underwent a net increase in size from 3 313 ha. to 4 659 ha. due to the conversion of other land uses to it between 1966 and 1977.

2. Conversion from 1966 unimproved agriculture to other uses was a dynamic process which saw almost 60 percent converted to other uses by 1977; yet it still showed a net increase in area (See 1 above).

3. There was little change either from or to unimproved agriculture within land of higher agricultural capability (classes 3 and 4) during the monitoring period.

4. There was a greater proportion of class 5 and 6 land converted to unimproved agriculture than converted from this class.

5. During the monitoring period improved

agriculture land use was a large net contributor to the transitional unimproved agricultural class.

6. Land uses associated with urbanization are increasingly being contributed by unimproved agriculture.

5.2.4 Natural Cover Classes: (Woodland, Swamps, Marshes, Bogs, Fens and unvegetated surfaces)

Under the CLI classification natural cover classes are included as land uses. However, delineation of these classes from aerial photography was based on the type of natural ground cover.

Although natural cover comprised over 80.8 percent of the St. John's Urban Centred Region in 1977, this was a reduction from 85.2 percent in 1966. As noted in Table 1, the largest component of the natural cover group was productive forest which occupied 47.6 and 44.1 percent of the study area in 1966 and 1977 respectively. Unproductive woodland followed, encompassing 30.9 percent of the study area in 1966 and 27.8 percent in 1977. Wetlands made up the third largest land use class in the natural cover group. Map 4 illustrates a considerable amount of change in what is generally considered a relatively stable group of classes. This change was found throughout the UCR. The outline of the provincial park which was under construction north of Bauline is evident near the northern tip of the Avalon Peninsula. This area formed a major part of the area which converted to urban related land uses as shown on Figure 8. New urban related developments south of Mount Pearl and a transmission line from the Indian Pond power generating plant (Map 4) point to the general location of urban development. The conversion between natural cover and other land classes is shown in net terms by Figure 8. A net loss of the productive and unproductive woodland cover types, caused primarily by the increase in urban-related uses, is evident.

As the largest land use class in the study area, natural cover has been the greatest potential source of land for agricultural and/or urban developments. In 1966, 3.8 percent (or less than 4 000 ha.) of the Urban Centred Region was classified as being in the two highest agricultural capability ratings (classes 3 and 4). Table 19 shows a slight decrease in natural cover from 1966 to 1977, but the decrease of natural cover on agricultural capability classes 3 to 6 inclusive is indicative of more intensive land use, i.e. the clearing of natural cover areas with some agricultural capability. More land has been removed from, than added to, the natural cover classes. Map 4 defines an area

FIGURE 8. INTERACTION BETWEEN NATURAL COVER AND OTHER LAND USE CLASSES 1966 TO 1977

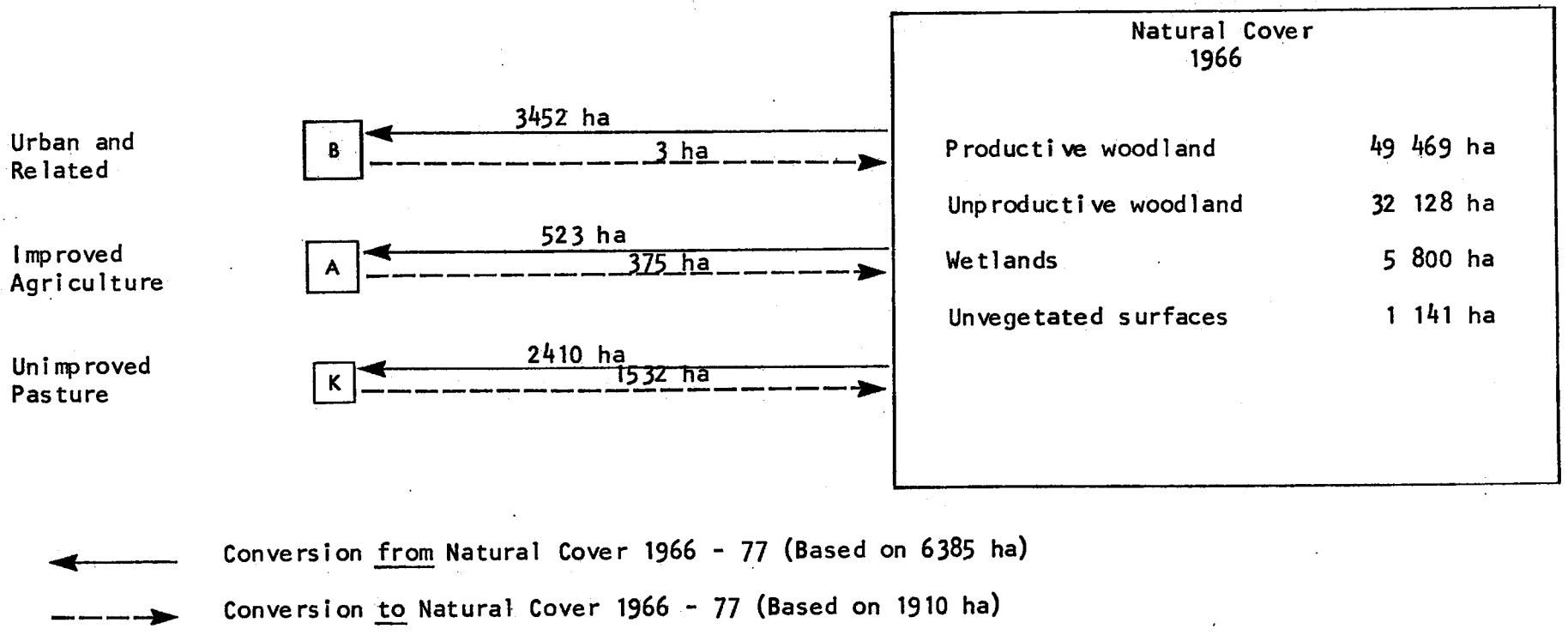


TABLE 19: AGRICULTURAL CAPABILITY RELATED TO NATURAL COVER

Agricultural Capability Class	Available Land by Agriculture Capability Rating			1966 Natural Cover			1977 Natural Cover			Land Converted From Natural Cover 1966 - 1977			Land Converted To Natural Cover 1966 - 1977		
	Area (ha)	%		Area (ha)	%		Area (ha)	%		Area (ha)	%		Area (ha)	%	
Class 3	315	0.3		41	0.1		37	0.0		7	0.1		2	0.1	
Class 4	3 619	3.5		1 713	1.9		1 550	1.8		247	3.9		83	4.3	
			39.4			36.2			35.0			48.2			25.9
Class 5	10 235	9.8		7 016	7.9		6 295	7.5		937	14.7		216	11.3	
Class 6	26 778	25.8		23 249	26.3		21 560	25.7		1 884	29.5		195	10.2	
Class 7	54 798	52.7		49 851	56.3		48 470	57.7		2 726	42.7		1 344	70.4	
Organic Soil	6 872	6.6	60.6	6 563	7.4	63.8	6 093	7.2	65.0	539	8.4	51.8	70	3.7	74.1
Unclassified	1 352	1.3		105	0.1		58	0.1		46	0.7		-	-	
TOTAL SELECTED AREA	103 969 ha	100 %		88 538 ha	100 %		84 063	100 %		6 386 ha	100 %		1 910 ha	100 %	
PERCENT OF UCR TOTAL	100 %			85.2 %			80.8 %			6.1 %			1.8 %		

new agricultural use centred to the west of Bay Bulls Big Pond and south of Paddys Pond. The cutting of natural grasses for hay appeared to be the main harvest method employed.

The dynamics of land in natural cover from 1966 to 1977 can be summarized as follows:

1. Natural cover, the largest land use group in the St. John's UCR, has had its greatest conversion interaction with unimproved pasture and rangeland.
2. Urban and related land uses, followed by unimproved agricultural land, have been the main benefactors of conversion from natural cover.
3. Conversion data indicates that land leaving the natural cover group was usually of a higher agricultural capability than that joining it.
4. Natural cover types were the classes most likely to undergo the greatest absolute land use change.

5.3 Outdoor Recreation

Although outdoor recreation is a relatively small land use class, its importance is likely to increase as indicated by a reference in the St. John's 1976 Regional Plan (page 7) which states:

> "An increasing part of the Region's economy in the foreseeable future will be related to the tourist industry."

Some examples of land included in the recreational class are: the total area within the boundaries of national, provincial, municipal parks; historic sites, race tracks, golf courses, drive-in theatres, marinas, tourist camping grounds, summer cottages with adjacent beaches and developed beaches.

In the case of several of the above types, many are excluded from land use mapping as these constitute less than the minimum size necessary for identification. This is especially true of narrow linear features such as beaches.

Outdoor recreational land increased from 1.9 percent or 1 974 ha. of the study area in 1966, to 3.1 percent or 3 211 ha. in 1977 (Table 1). Much of the increase was attributable to the delineation of the (703 ha.) provincial park under development north of Bauline. It is apparent from Table 5 that recreational capability classes 1 and 2 are not present and the combination of moderately high and moderate recreational capability classes 3 and 4 make up but 7.4 percent (7 737 ha.) of the St. John's Urban Centred Region. The majority of land falls in the lower recreational classes; 76.7 percent falls in class 6 alone indicating a lack in the region of good physical capability for outdoor recreation. See Appendix IV and V

for the complete CLI land capability for outdoor recreation.

From Table 6 the three most prevalent primary recreation features are: small surface waters (Map 4); topographic variety; and shoreline having associated beach activities. These features characterize 82.4 percent of the study area.

Between 1966 and 1971, only 125 hectares of land were converted from other uses to outdoor recreational use. Former uses were, in order: productive forest (36 percent); unimproved pasture (26 percent); unproductive woodland (24 percent); improved agricultural land (12 percent); and bare surface (2 percent).

Further conversion to recreational use occurred from 1971 to 1977, much of it due to the park development north of Bauline. Again, however, the greatest addition to recreational use came from lands classified as having little or no recreational capability. The chief "donor" land use during this period was again productive forest (70.6 percent), while the second largest source of recreational land came from unproductive woodland.

Listed in the left column of the following table are the 1966 percentages of available recreational land by capability class for the study area as a whole (103 969 ha). Recorded on the right are the percentages representing the actual recreational lands by class (3 211 ha) in 1977.

1966 Available land for recreation use (103 969 ha)	Recreation Capability Class	1977 Actual Recreational Use (3 211 ha)
1.4 %	3	8.2 %
6.0 %	4	6.6 %
5.4 %	5	9.2 %
76.7 %	6	61.0 %
0.5 %	7	0.7 %
10.0 %	8	14.3 %
100 %		100 %

Generally, there was a tendency for a proportionally greater recreational use of the higher capability lands - especially class 3 - in 1977, as indicated by the fact that 8.2 percent of the activity took place on the 1.4 percent of available class 3 land. The main area of land having class 3 recreational capability is located in the southwest corner of the St. John's UCR. This CLI rating is based on access to water and varied topography. For a general discussion on

recreational sites in and around the St. John's UCR, see Section 4.3.

Although land may be classified as having a high recreational capability, uses of a higher priority may be given precedence. A case in point is the area indicated by the arrow on Map 5. This area adjacent to Windsor Lake is excluded from direct forms of recreational use for the protection of part of the St. John's water supply. Map 5 indicates that the land is rated as recreational capability classes 3 and 4. The park development north of Bauline is utilizing much of this high capability land.

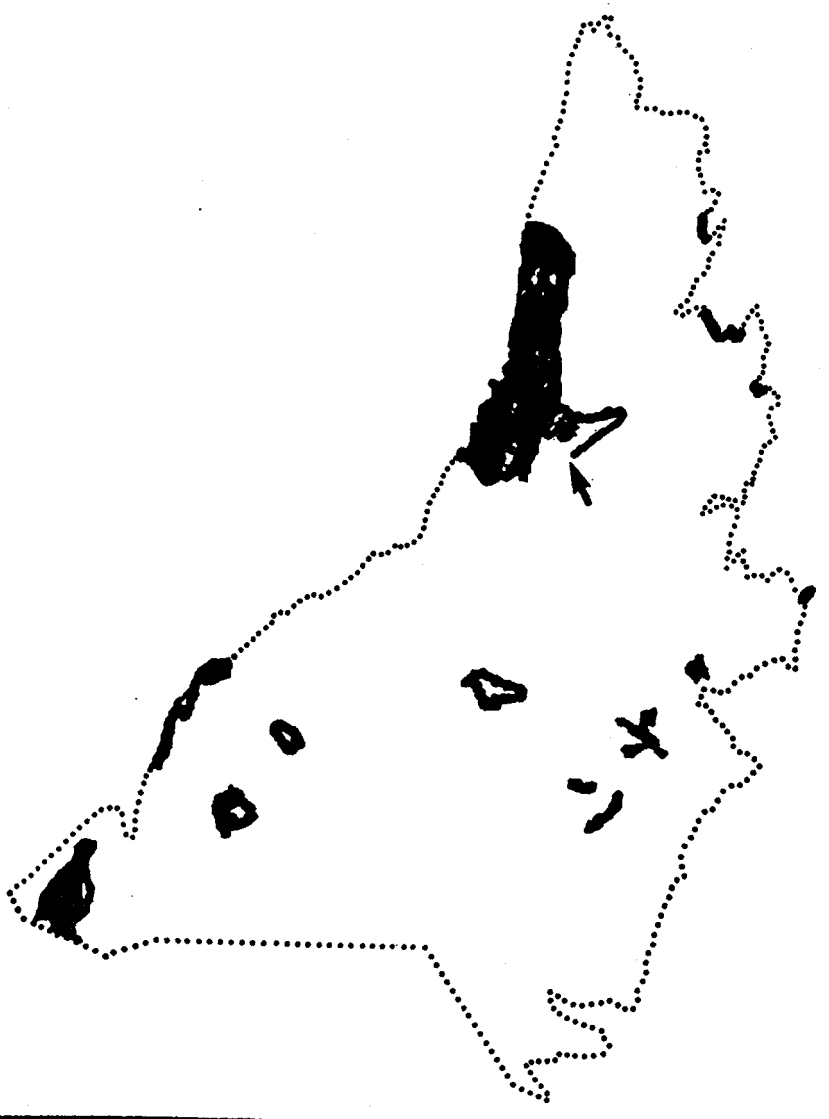
Changes in outdoor recreational land use between 1966 and 1977 can be summarized as follows:

1. Outdoor recreational land is increasing and by 1977 occupied 3.1 percent of the St. John's Urban Centred Region.

2. The majority of the St. John's area falls in the lower recreational capability classes, mainly class 6.

3. There has been a trend towards the greater utilization of land in the higher recreational capability classes, especially class 3.

4. Some high recreational capability land has been excluded from recreational use for the protection of the urban water supply for the City of St. John's.



MAP 5
RECREATION CLASSES 3 AND 4

LEGEND

■ CLASS 3 AND 4

6 LAND USE PLANNING

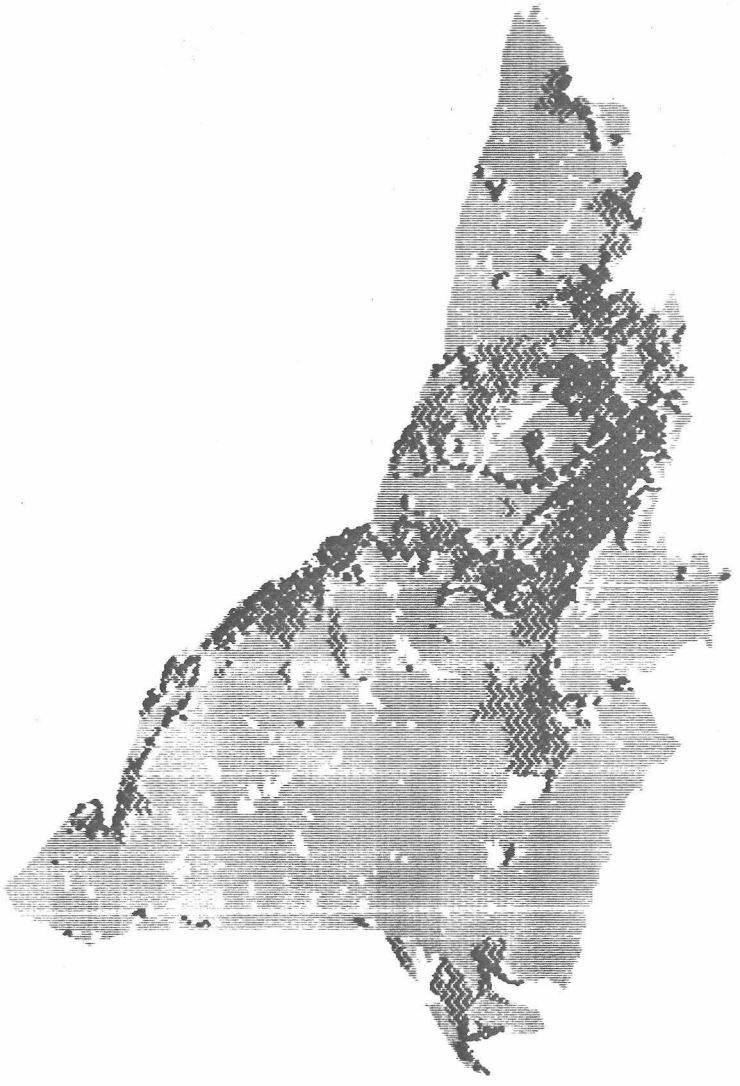
Sound land use planning is a process which rationalizes land use with land capability to aid in the efficient and appropriate allocation of land for different purposes. Land use allocation also involves socio-economic and political factors, however. While the following discussion concentrates on the physical capability of the land for land use planning purposes, it recognizes the fact that other physical parameters of land along with socio-economic and political factors can, and usually do, temper the decision-making process.

Urbanization exerts one of the greatest forces for land use change in Canada today. In the St. John's Urban Centred Region, one of, if not the most significant change has been the conversion of a very limited provincial resource - improved agricultural land - to urban uses. It should be stressed that this Region contained approximately one-fifth of all farm units in the Province in the late 1970's. These farms produced 78.1 percent of the total provincial milk production in 1978. (Development Division 1980). The economic importance to the Province's agricultural sector as a whole, and more specifically to the St. John's market place, is readily apparent.

Map 6 illustrates the close proximity of the remaining high capability agricultural land (red) to the expanding urban uses (yellow). Also evident is the limited amount of such land. As a result, this land which is extremely important to the agriculture base of the province, is also difficult to protect for the future production of food because of the continuing pressure to convert it to other uses, particularly urban-related uses.

When the severe physical limitations associated with bedrock and topography are considered, decisions regarding potential building sites often result in additional pressure on agricultural land which poses fewer construction difficulties for urban development.

In an attempt to identify areas of likely future urban development pressure, the CLDS computer system was used as a tool in developing a likely scenario. Those areas having an agricultural capability falling in classes 3, 4, and 5 without limitations for stoniness, shallowness to solid bedrock, adverse topography and excess water were selected. Organic soils were omitted from the selection process. Other exclusions were built-up areas, and water in 1977. The computer then selected the remaining areas, which had the fewest physical limitations for urban development. These areas occur:



ST JOHNS URBAN CENTRED REGION

Potential Farmland Not Improved in 1977

Urban uses 1977

Potential farmland not improved in 1977

MAP 6

1. Along an axis connecting Torbay and Holyrood.

2. Within a corridor joining the Goulds to Pouch Cove.

3. In the relatively isolated south eastern corner of the St. John's UCR, that is, in the Bay Bulls and Witless Bay areas.

Again, it must be emphasized, municipal plans and other socio-economic data were not considered, hence these locales cannot be considered as imminent for development. However, this projected scenario may serve as a useful indicator of the likely sites for urban development, or as an indicator of potential land use conflicts with agriculture. For example, Map 6 illustrates two zones of potential land use conflict between urban uses and potential farmland. These are the area around Outer Cove to the north of St. John's and Goulds to the south.

If more detailed planning is required on subjects such as urban water sources, additional information (overlays) can be input to CLDS. Variables for this selection could include information from regional studies on subjects such as granular materials, waste disposal, ground water, and urban watersheds among others. This would enhance the St. John's data base and provide even greater scope for urban planning.

Development alternatives are diminishing as the St. John's urban core expands toward areas with various physical limitations, watershed protection areas, Torbay Airport and the sea. These factors, along with the adoption of the 1976 St. John's Urban Regional Plan and other municipal plans, all constitute major influences on the future pattern of land use in the St. John's UCR.

The Regional Plan developed by the Provincial Planning Office of the Department of Municipal Affairs and Housing has stated that urban development is to take place under the concept of concentration at three levels. The focus of development will be placed upon:

1. The Regional Centre of which Mount Pearl - New Town area is a part;

2. Regional sub-centres of which the Topsail - Manuels area is an example, and

3. Local centres exemplified by Holyrood, Bay Bulls - Witless Bay, Petty Harbour, Pouch Cove and Portugal Cove.

In order to protect agricultural land adjacent to existing communities, these growth centres have been requested to follow a practice of infilling, thereby increasing population and/or structure densities within community boundaries as opposed to expanding urban development at the expense of the agricultural sector.

If the concepts of concentration and infilling are followed, the maintenance of a viable agricultural sector should result. Should sage planning practices not be followed the tragic result could be the loss of the most important agricultural land in the province.

SUMMARY AND CONCLUSIONS

1. The conversion to urban land use from other uses constitutes a major land use change in the St. John's Urban Centred Region. A marked increase in urbanization occurred in the second monitoring period, 1971 to 1977.

2. A proportionally greater amount of land conversion to urban use is taking place at the expense of agricultural land rather than natural cover types.

3. In 1977, the improved agricultural land resource was limited to only 2.7 percent of the total St. John's Urban Centred Region. However, this area encompassed 26 percent of the total number of farms in the entire Province and produced 78 percent of the provincial milk production in 1978.

4. The St. John's area is characterized by generally low capability agricultural and recreational lands. Both sectors lack entirely the two highest classes (1 and 2) in their respective CLI capability classifications.

5. Improved agricultural land suffered the greatest proportional loss over the study period of any rural land type; a net decline of 35 percent.

6. Improved agricultural land increasingly and directly contributed to land uses associated with urbanization. Similarly, improved agricultural land is a large net contributer to the unimproved agricultural class.

7. The unimproved agricultural class, although generally increasing in size, is transitional in nature. The considerable changes both to and from this class make it a prime candidate in future planning considerations.

8. Natural cover types make up the largest (81 percent) land use group in the study area. The main recipients of its conversion to other land uses are the urban and unimproved agriculture land use classes. Being the largest class, natural cover has the potential to undergo the greatest future land use change to urban uses. However, the trend during the monitoring period is that proportionally less natural cover is being used for urbanization than is available.

9. Outdoor recreational land increased to occupy 3.1 percent of the St. John's UCR in 1977. A trend toward the utilization of higher recreational capability classes especially class 3, is occurring.

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APPENDIX I. LAND USE CLASSES

Map Symbol	Description
B	Urban built-up areas, or acreage dwellings (rural sub-divisions) in which the overall character is not agricultural production or productive woodland Major military areas, highways and airport facilities.
E	Mines, quarries, sand and gravel pits
O	Outdoor recreation areas such as parks, resorts and golf courses
H	Horticulture, poultry and fur farms
G	Orchards and vineyards
A	Cropland, including grain and cash crops
P	Improved pasture and forage crops
K	Unimproved pasture, rangeland and idle grassland
T	Productive woodland
U	Unproductive woodland
M	Swamp, marsh, bog or fen
S	Unproductive land - sand bars or sand dunes
L	Unproductive land - rock and other unvegetated surfaces
Z	Water
8	Unclassified or unmapped areas

* * *

APPENDIX II. AGRICULTURAL CAPABILITY CLASSES

Map Symbol	Description
1	No significant limitation for crops
2	Moderate limitations that restrict the range of crops or require moderate conservation practices
3	Moderately severe limitations that restrict the range of crops or require special conservation practices
4	Severe limitations that restrict the range of crops or require special conservation practices, or both
5	Very severe limitations that restrict capability to produce perennial forage crops, but improvement practices are feasible
6	Capable only of producing perennial forage crops, and improvement practices are not feasible
7	No capability for arable culture or permanent pasture
0	Organic Soils
8	Unmapped or unclassified areas

The above classification indicates that soils in Classes 1 to 4 are considered capable of sustaining cultivated field crops while those in Classes 5 and 6 are capable of sustaining forage crops. Classes 7 and 0 are not considered suitable for crop production.

Note: In this report emphasis was placed on agricultural capability Classes 5 and 6 because of the general scarcity of good agricultural land in the study area.

APPENDIX III. AGRICULTURE LIMITATION SUBCLASSES

These subclasses specify the kinds of limitation that affect each major agricultural class. When there is more than one limitation, the additional factor is specified in the second subclass. With the exception of Class 1 and Class 0, for which subclasses are not applicable, the subclasses are as follows:

Map Symbol	Description
B	Urban
C	Adverse climate
D	Undesirable soil structure and/or low permeability
E	Erosion damage
F	Low natural fertility
I	Inundation by streams or lakes
M	Low moisture-holding capacity
N	Soils adversely affected by soluble salts
P	Stoniness
R	Shallowness to solid bedrock
S	Cumulative adverse soil characteristics (two or more of D, F, M, N)
T	Adverse topography
W	Excess water
X	Cumulative minor adverse characteristics which singly would not affect the major class rating
Z	Water

APPENDIX IV. RECREATION CAPABILITY CLASSES

Map Symbols	Description
1	Very high capability for outdoor recreation
2	High capability for outdoor recreation
3	Moderately high capability for outdoor recreation
4	Moderate capability for outdoor recreation
5	Moderately low capability for outdoor recreation
6	Low capability for outdoor recreation
7	Very low capability for outdoor recreation
8	Unclassified areas or water

APPENDIX V. RECREATION PRIMARY FEATURE SUBCLASSES

These subclasses indicate the kinds of feature that provide opportunities for outdoor recreation. Therefore, they are positive aspects of the land rather than limitations to its use. The subclass may or may not be specified for any given class.

A Land providing access to water and affording the opportunity for angling and viewing of sport fish

B Shoreland capable of supporting family beach activities. In high class units this will include family swimming. In Classes 4 and 5, the activities may be confined to dry land due to cold water or other limitations

C Land fronting on and providing direct access to waterways with significant capability for canoeing

D Shoreland with deeper inshore water suitable for swimming, boat mooring or boat launching

E Land with vegetation possessing recreational value

F Waterfalls or rapids

G Significant glacier view or similar experience

H Historic or prehistoric site

J Area offering particular opportunities for gathering and collecting

K Shoreland or upland suited to organized camping, usually associated with other features

L Interesting landform features other than rock formation

M Frequent small bodies or continuous streams occurring in upland areas

N Land (usually shoreland) suited to family or other recreation lodging use

O Land affording opportunity for viewing of upland wildlife

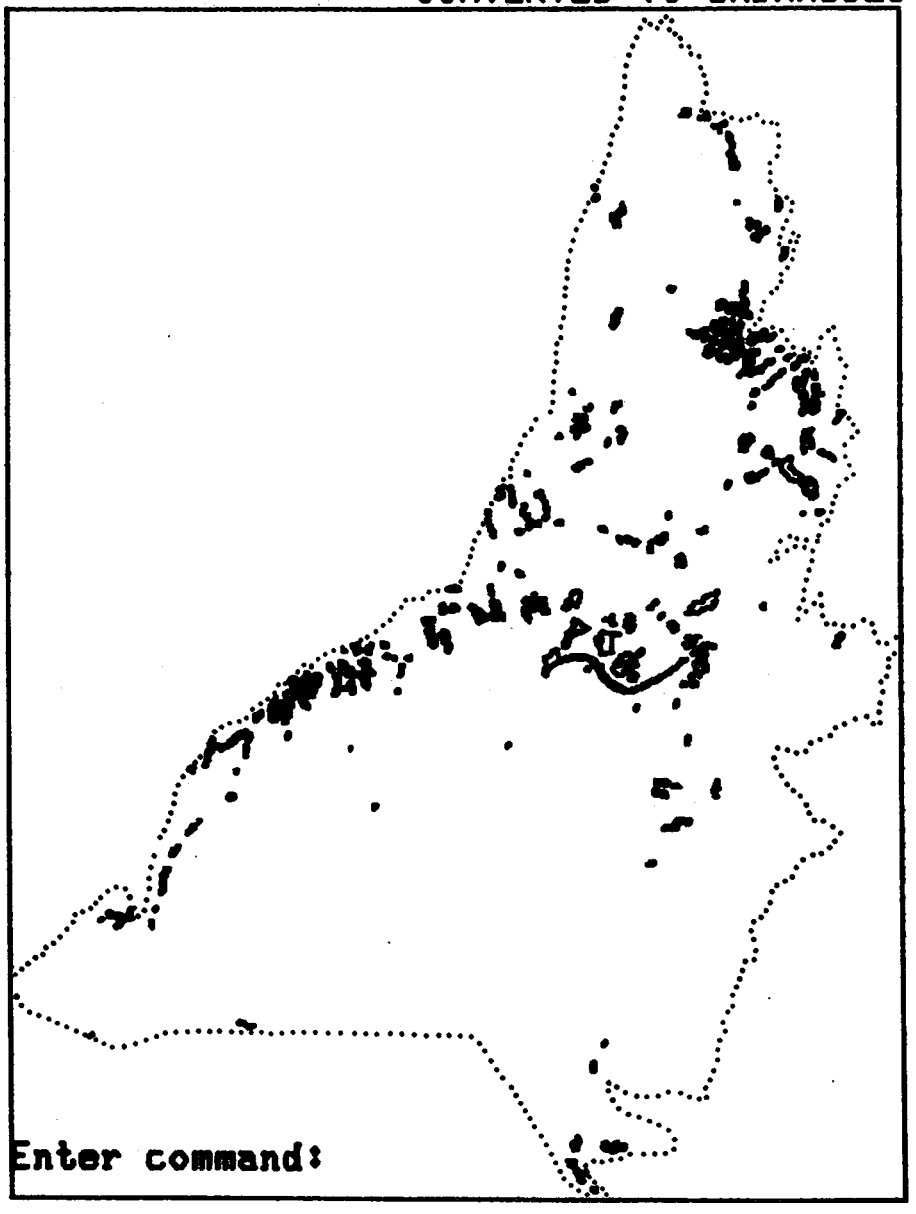
P Area exhibiting cultural landscape patterns of agriculture, industrial or social interest

Q Areas exhibiting variety, in topography or land and water relationships, which enhances opportunities for general outdoor recreation, such as hiking and nature study, or for aesthetic appreciation of the area.

Map Symbol	Description
R	Interesting rock formations
S	A combination of slopes, snow conditions, and climate providing downhill skiing opportunities
T	Thermal springs
U	Shoreland fronting water accommodating yachting or deep-water boats
V	A vantage point or area which offers a superior view relative to the class of the unit(s) that contains it, or a corridor or other area that provides frequent viewing opportunities
W	Land affording opportunity for viewing of wetland wildlife
X	Miscellaneous features with recreational capability
Y	Shoreland providing access to water suitable for popular forms of family boating
Z	Areas exhibiting major, permanent, non-urban, man-made structures of recreational interest
8B	Urban (used in combination with recreation (Class 8)
8O	National park (used in combination with recreation Class 8)
8T	Forest reserve (used in combination with recreation Class 8)
8W	Provincial park (use in combination with recreation Class 8)

PLOT 23 Appx scale - screen 1 : 232,384 Paper copy 1 : 370,164

CONVERTED TO URBANUSES 1971 TO 1977



Appendix VI. Urban settlement Pattern - A Working Computer Plot