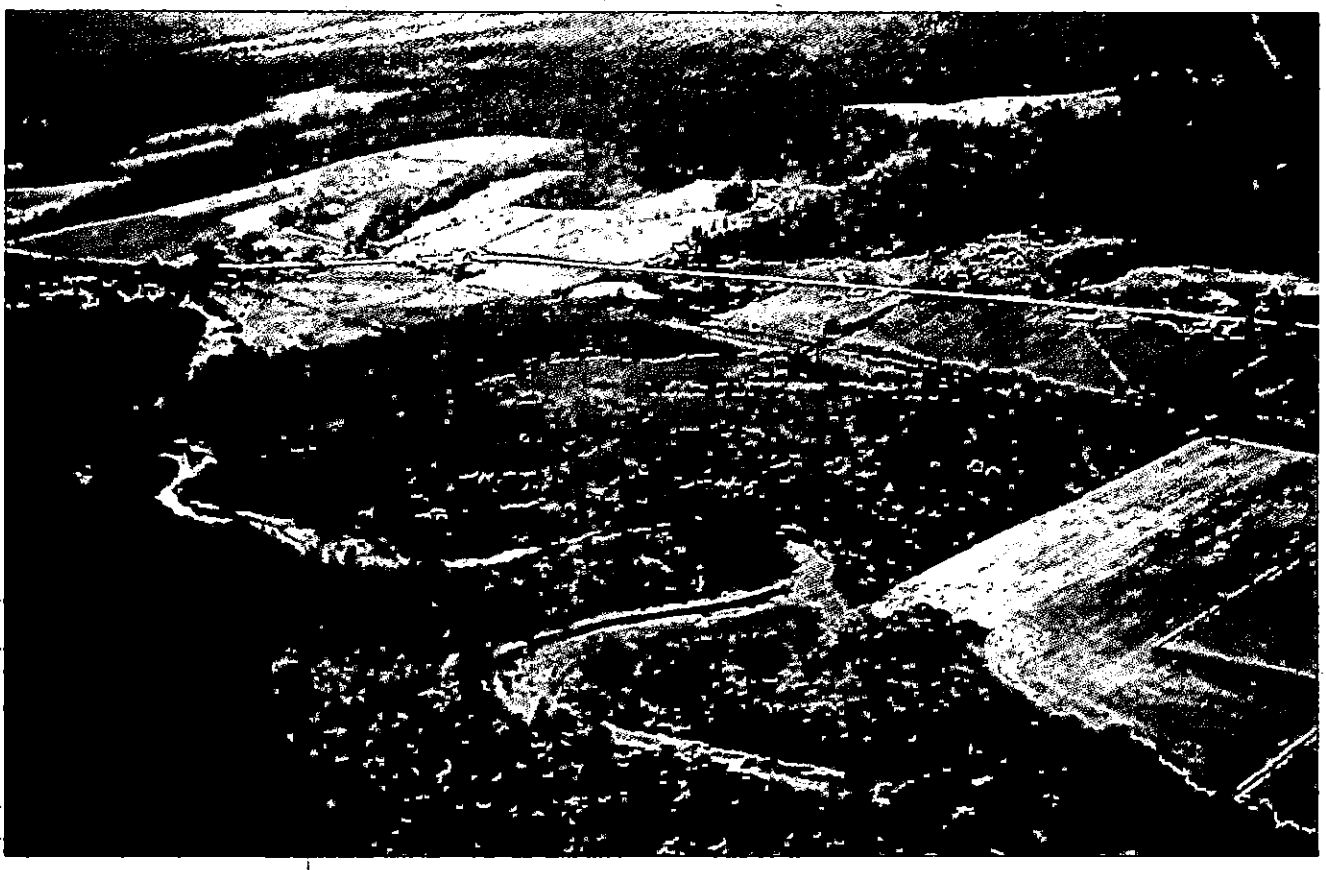
GEOGRAPHICAL PAPER No. 55

Landowners and Land Use in the Musquodoboit Valley Nova Scotia



Environment Canada
Lands Directorate

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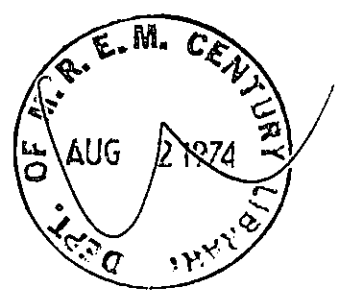
Direction generale des Terres

Landowners and Land Use in the Musquodoboit Valley, Nova Scotia

A study of land utilization and land-development possibilities in part of Halifax County, Nova Scotia

Prepared by D.K. Redpath



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Preface

The Canada Land Inventory (CLI) is a cooperative federal-provincial program designed to provide basic information on land capability and use for the "settled portions" of Canada—an area of approximately one million square miles. It was launched in 1963 under the authority of the Agricultural Rehabilitation and Development Act (ARDA) as one of several ARDA programs initiated to facilitate the planning and implementation of land-use adjustment projects. The Inventory includes the mapping of land use, and land capability assessments for agriculture, forestry, recreation and wildlife.

In November, 1967, the Inventory was broadened to permit the allocation of federal funds to the provinces for pilot scale land-use planning studies based on the CLI data. The Province of Nova Scotia utilized this pilot planning program to undertake the preparation of a land-use plan for the Musquodoboit River watershed. The report presented in this volume describes the methodology employed in the Musquodoboit planning study, outlines the analyses undertaken, and presents the principal findings and recommendations. It is being published, not only to provide information of interest to persons concerned with the Musquodoboit valley and similar rural areas, but also to demonstrate one means of integrating data on an area's physical characteristics with socio-economic information in the preparation of a land-use plan.

R. J. McCormack
Director General
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Préface

L'Inventaire des terres du Canada est un programme coopératif fédéral-provincial destiné à fournir des renseignements de base sur les possibilités et les utilisations du territoire des «zones habitées» du Canada, qui occupent environ un million de milles carrés. Il a été lancé en 1963 en vertu de la Loi sur la remise en valeur et l'aménagement des terres agricoles (ARDA), parmi plusieurs autres programmes de l'ARDA visant à faciliter la planification et l'exécution de projets de modification de l'utilisation des terres. L'Inventaire comprend l'établissement de cartes sur l'utilisation des terres et l'évaluation de leurs possibilités des points de vue de l'agriculture, de la forêt, de la récréation et de la faune.

En novembre 1967, l'Inventaire a été élargi pour permettre le versement de capitaux fédéraux aux provinces pour qu'elles effectuent des études pilotes, fondées sur les données de l'Inventaire des terres du Canada, sur la planification de l'utilisation des terres. La province de Nouvelle-Écosse a profité de ce programme pilote de planification pour entreprendre la préparation d'un programme d'utilisation des terres pour le bassin de la rivière Musquodoboit. Le rapport présenté dans le présent volume décrit la méthodologie qui a été employée dans l'étude de planification de la Musquodoboit, donne un aperçu des analyses entreprises et présente les principales conclusions et recommandations. Il est publié non seulement pour renseigner ceux qui s'intéressent à la vallée de la Musquodoboit et aux régions rurales similaires, mais aussi pour donner un exemple d'un moyen de combiner des données sur les caractéristiques physiques d'une région avec des renseignements socio-économiques pour préparer un plan d'utilisation des terres.

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Acknowledgements

Although many individuals participated in and contributed to the study on which this report is based, the contributions of the following persons should be particularly noted: C. Raymond, A. Connor, and T. Kovacs, all formerly of the Department of Energy, Mines and Resources; N. Williams and P. Dean, formerly of the Department of Regional Economic Expansion; J. Nowland, Canada Department of Agriculture; J. MacNeil, G. Crowe and L. Palmer of the Nova Scotia Department of Agriculture and Marketing; R. Bulmer of the Nova Scotia Department of Lands and Forests, and K. Verburg formerly of that Department; J. Fowler of the Nova Scotia Department of Mines.

The contribution of J. Maxwell, Environment Canada, to all aspects of the preparation of the report is gratefully acknowledged as is the assistance of C. I. Jackson, Ministry of State for Urban Affairs.

Abstract

This report discusses landowners, land use, and land capability in the Musquodoboit valley, Halifax County, Nova Scotia. Analyses providing basic information on the land-ownership structure, the socio-economic characteristics of landowners and land use in the watershed area are presented. These analyses are based on data obtained in a landowner-interview program, a property mapping exercise and a survey of present land use. The physical capability of the watershed's lands is summarized on the basis of the Canada Land Inventory (CLI) capability assessments for agriculture, forestry, outdoor recreation and wildlife.

The report begins with an introduction to some of the problems of the Musquodoboit valley and an outline of the actions taken by local residents in their quest for solutions. Included in the introductory section is the plan and survey methodology of the study on which the report is based. The next section of the report deals with the results of the property mapping and landowner-interview program and examines land use and ownership in the valley in the context of a socio-economic classification of landowners. In the third section, the bases for future development in the resource sectors—agriculture, wildlife, recreation, forestry and mining—are assessed and the effect of urban development is examined. In the initial part of the fourth section, an analysis of the physical capability of the watershed's lands is presented followed by a discussion of the land-development possibilities in the valley. Identified on the basis of an assessment of the physical, economic and social factors affecting the area, these possibilities are outlined in an indicative land-use plan. The report concludes with a summary of the principal findings and a series of recommendations.

Résumé

Le présent rapport traite des propriétaires, de l'utilisation des terres et des possibilités du territoire de la vallée de la Musquodoboit, du comté de Halifax (Nouvelle-Écosse). Il présente des analyses offrant des renseignements de base sur la structure de la propriété des terres, les caractéristiques socio-économiques des propriétaires et l'utilisation des terres dans la zone du bassin. Ces analyses se fondent sur les données obtenues au cours d'un programme d'interview des propriétaires des terres, de l'exécution de cartes des propriétés et d'une enquête sur l'utilisation actuelle des terres. Les possibilités physiques des terres du bassin sont résumées d'après l'évaluation des possibilités dans les domaines de l'agriculture, de la forêt, de la récréation en plein air et de la faune de l'Inventaire des terres du Canada.

Le rapport débute par une introduction à certains des problèmes de la vallée de la Musquodoboit et un aperçu des mesures prises par les résidents pour trouver des solutions. On trouvera aussi dans l'introduction le plan et la méthodologie de l'étude sur laquelle le rapport se fonde. Le chapitre suivant traite des résultats obtenus lors des programmes de cartographie des propriétés et d'interview des propriétaires et étudie l'utilisation des terres et leur propriété en fonction du niveau socio-économique des propriétaires. Dans le troisième chapitre, on évalue les bases pour la mise en valeur future des secteurs des ressources (agriculture, faune, récréation, forêts et mines) et on étudie l'effet du développement urbain. Dans la première partie du quatrième chapitre, on présente une analyse des possibilités physiques des terres du bassin, suivie d'une discussion des possibilités de mise en valeur des terres de la vallée. Identifiées en fonction d'une évaluation des facteurs physiques, économiques et sociaux touchant la région, ces possibilités sont esquissées dans un plan indicatif de l'utilisation des terres. Le rapport se termine avec un résumé des principales conclusions et une série de recommandations.

Tables and Illustrations

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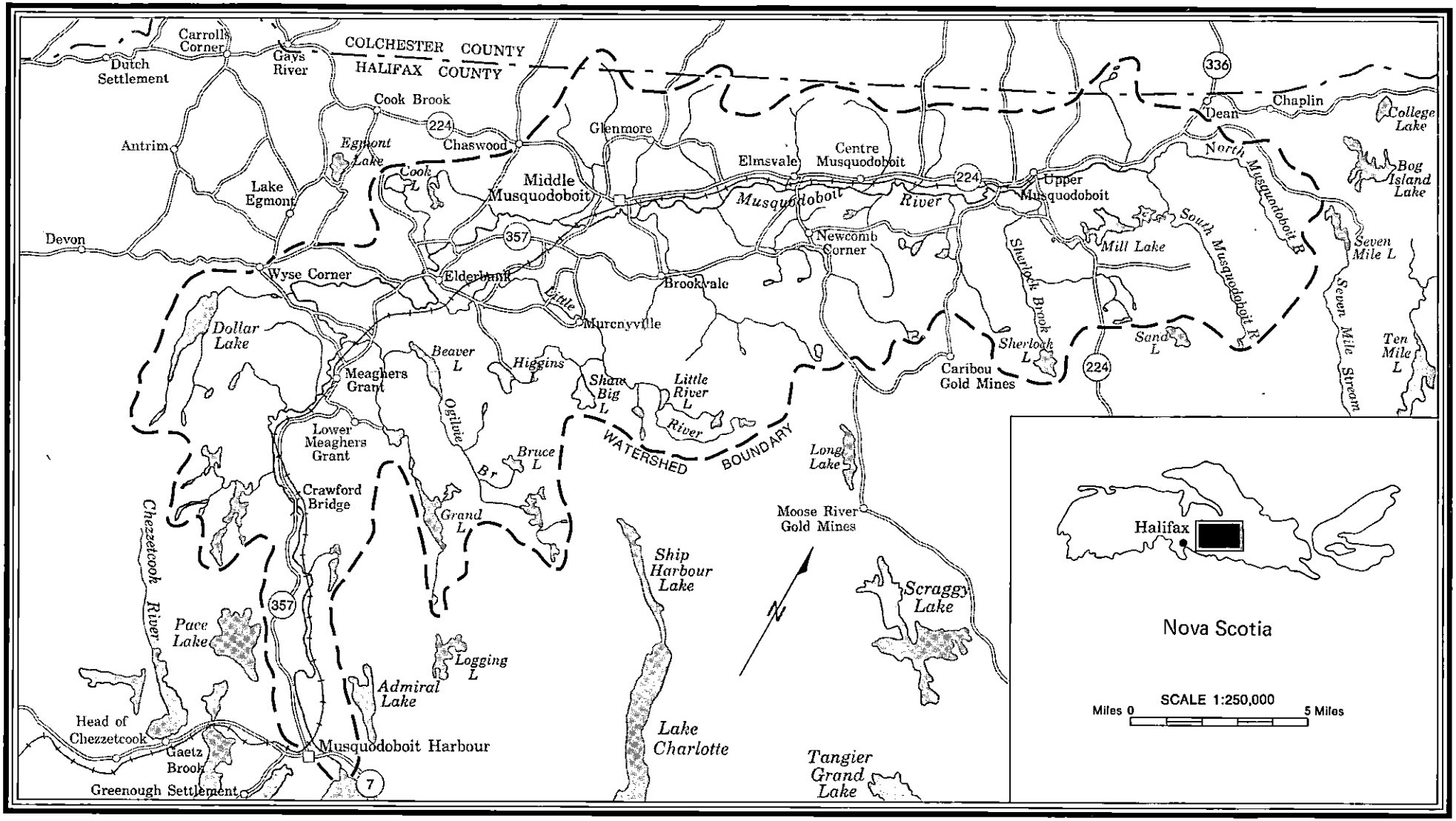

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FIGURE 1. The Musquodoboit River watershed.

Introduction

The Musquodoboit[2] River drains approximately 275 square miles during its 60 mile course across the central part of Halifax County before entering the Atlantic at Musquodoboit Harbour (Figure 1). It is estimated that about 80 per cent of the total watershed area is forested.[3] Of the population of about 4,500 (Census of Canada, 1966), most live in small hamlets or in the open country adjacent to the river's narrow floodplain. The cleared area forms a pastoral landscape which reflects nearly two centuries of settlement. This landscape stands in marked contrast to the rock and forest Appalachian upland which characterizes most of Halifax County and which contributes to a sense of isolation in the valley, despite a distance of only 25 miles to the Halifax-Dartmouth metropolitan area.

Farming, forestry and limestone quarrying have been the mainstays of the local economy. Like many other rural communities dependent on these primary activities, the Musquodoboit valley has felt the impact of technological and economic changes affecting farming and forestry in the form of reduced job opportunities and low incomes for many of its people.

From the time of initial settlement, the flooding of the Musquodoboit River has been a problem. The profile of the river bed from Upper Musquodoboit to Crawford Bridge can be divided into three: the bed is fairly flat in the upstream and lower reaches, while in the central section the gradient is steeper. The carrying capacity of the river is about 10 cubic feet per second (cfs) per square mile of watershed, approximately half the expected high-summer flows. Natural rock ledges occur at several points in the river channel and the flow is obstructed by these and by gravel deposits in the flatter section where most of the flooding occurs. Some relief from the flooding was gained during the period when logging operations in the valley relied on river transport for moving logs. Dams constructed to facilitate log driving controlled the waters to some extent; however, when log transport was shifted to the highways, the dams fell into disrepair and eventually rotted and flooding became serious once again.[4] Between 1930 and the enactment of the Agricultural Rehabilitation and Development Act (ARDA) in 1961, resolutions requesting financial assistance to control the river were passed almost annually by organized farm groups in the valley, and one local and two provincial surveys were presented to provincial and federal authorities on the problem.[4] Despite these efforts, no major flood-control program was implemented.

Musquodoboit Rural Development Board

The residents of the valley are aware that their problems are common to thousands of other rural inhabitants elsewhere in the Maritime Provinces and across Canada. In seeking solutions to their problems, the people of the valley have, in recent years, relied on two policies: self-help through community organization and participation—sometimes with the invited help of outside experts—and the use of national and provincial policies and programs which appear to be relevant to the problems of the Musquodoboit valley.

In the early 1960s, as the outcome of efforts by local farmers to obtain federal assistance under the ARDA legislation to deal with the flooding, a new and vigorous community organization was created named the Musquodoboit Rural Development Board (MRDB). The components of the new Board were to be committees on agriculture, industry, tourism, business, human resources, forestry, clergy, fisheries and recreation.

The objectives specified for the Board were:

> "(*a*) to make the best use of Federal and Provincial legislation and the monetary assistance that is being offered to the organized committee at the present time, and (*b*) to establish long range plans, and coordinate existing organization so that it will have a unified program of development for the betterment of all citizens in the area..."[4]

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[1] Research Officer, Lands Directorate, Department of the Environment, Ottawa, Ontario, K1A 0H3.

[2] Pronounced "Muskadawbit".

[3] "*Forest Inventory Summary Report: Musquodoboit Valley Watershed, Field Work 1967*", Inventory Section, Nova Scotia Department of Lands and Forests, Truro, Nova Scotia, March 25, 1969, (unpublished).

[4] Musquodoboit Rural Development Board, *Green Grass and Busy People: Rural Development at Work in the Musquodoboit Valley, Halifax County, Nova Scotia*, (unpublished).

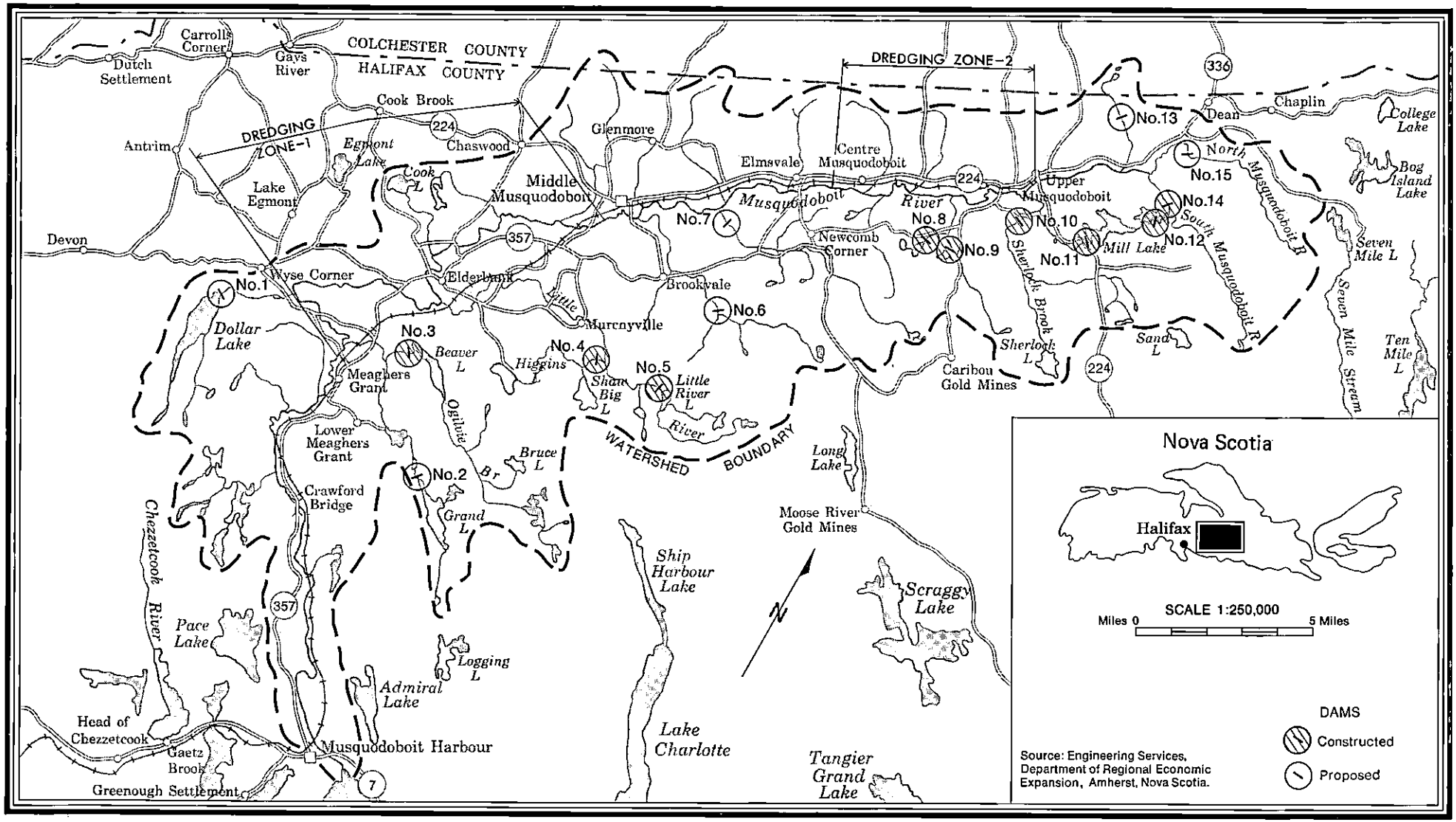

FIGURE 2. Flood control program: Musquodoboit River watershed.

The Board has been remarkably successful in involving research workers and others in the study of the valley's problems. Through its efforts, professional assistance was obtained for carrying out engineering and pollution surveys of the Musquodoboit River, a socio-economic survey of farming, a study of the educational levels and needs, and a study of the waterfowl potential, as well as studies of specific agricultural and forestry problems including a soil survey of the floodplain. In addition, numerous studies of local problems were carried out by the committee members themselves.

The efforts of the Board to assemble and analyze information on their development problems were rewarded. After presenting to government well-documented proposals for development based on the special studies, a rural development officer from the Nova Scotia Department of Agriculture and Marketing was stationed in the valley. The Board was also successful in gaining approval for a flood-control program under the ARDA legislation. Many other activities were implemented through the efforts of the Board, including improvements to the transportation network and to hospital services, and these, in many ways, present a model for the type of "grass roots" involvement which is believed to be essential for change and development in the rural areas of Canada.

Musquodoboit River flood-control program

The Musquodoboit Rural Development Board's agricultural committee completed the work started by the Federation of Agriculture committee on the flood problem, and presented proposals for a water-control program to the provincial ARDA administration.

The Federation of Agriculture committee had gained approval for an engineering study which, financed under the research program of ARDA, was carried out in 1962–63 by the Engineering Services of the Department of Forestry and Rural Development.[5] It provided a plan for water control that would alleviate flooding of the floodplain (locally termed "intervale lands") during the crop growing-season—from May to October.[6]

A second study, related to the water-control program but also dealing with other aspects of valley development, was initiated by the MRDB's agricultural committee, and was financed under the ARDA research program (Connor, 1964).

By March 1964, with the results of the engineering study and the socio-economic survey in hand, the MRDB finalized its proposal for a flood-control program, and, one year later, approval for the project had been given by the county, the province and the federal ARDA administration. The agreement provided for a capital cost of $536,000 and called for the financial participation of the county, provincial and federal authorities in the respective portions of 10 per cent, 45 per cent and 45 per cent.[6] It should be noted that the engineering study was not a study for comprehensive water-resource development but was limited to the production of a plan providing for direct benefits to agriculture. However, the staff of the ARDA Engineering Services which carried out the study did attempt to take non-agricultural aspects into account in its planning work. The request for a flood-control project was made prior to the signing of the Second ARDA Agreement with the provinces in April 1965. Revised ARDA legislation in 1966 provided for a more comprehensive approach to rural development. To reflect this change, the Agricultural Rehabilitation and Development Act was renamed the Agricultural and Rural Development Act, although the acronym ARDA was retained. The Musquodoboit project was the product of the earlier agreement and was formally concerned only with the benefits to agriculture.

In 1966, the Engineering Services attempted to have the project expanded to include other resource components, fisheries, wildlife, recreation, forestry and water supply, in a comprehensive management scheme. In the agricultural sector, it suggested that programs for surface drainage, farm consolidation and soil-erosion abatement be added to the flood-control program, for a more effective development plan. However, this approach was not adopted and only the flood-control project was carried forward.

By 1968, the ARDA agency had adopted a multi-purpose approach and was anxious to ensure that engineering works already built or, like the Musquodoboit project, in progress, should yield maximum benefits without limiting these to agriculture. In addition, the Musquodoboit scheme needed review in that it had become apparent that the original cost estimates were low and that the available funds were unlikely to be sufficient to complete the project as approved.

The detailed design and construction work begun in 1965 was completed in 1970, although, because of the lack of adequate finances, only 9 of the 15 dams were constructed (Figure 2). The nine dams are likely to provide only 45 per cent flow control above Upper Musquodoboit (instead of 61 per cent) and 20 per cent at Crawford Bridge (instead of 32 per cent as calculated for the 15 dams, controlling a flood of 20 cfs per square mile of watershed). In the original scheme, two of the proposed dams were to be appraised after completion of the other thirteen as they were particularly expensive. Revised estimates for these dams (Nos. 6 and 15) show, however, total costs in each case to be more than double

[5] This department ceased to exist in April 1969 and the Engineering Group was transferred to the new Department of Regional Economic Expansion. This group has since been transferred to the Council of Maritime Premiers and is now the Maritime Resource Management Service.

[6] N. A. Williams, *Musquodoboit River Flood Control for Agriculture*, Engineering Services, Atlantic Regional Office, Department of Regional Economic Expansion, Amherst, N.S., November, 1969, (unpublished).

the earlier estimates. Revised estimates for the other four dams not constructed indicate that only dam No. 7 might cost less than twice the original estimate and that the others would cost from three to more than four times the original estimate. The added water control provided would be small relative to the cost involved.

Comprehensive resource development

During the late sixties attitudes to and ideas about comprehensive rural development were changing. In the Musquodoboit valley, the comprehensive approach had developed and the sense of community became ever stronger. This process had been assisted by a further study of the people, which focused on their educational levels and needs and the role of education in rural development (Connor and Magill, 1965). This study, financed through an ARDA grant, and the other special surveys of local problems conducted by members of the MRDB, created a receptive attitude in the valley toward development proposals involving social and economic change.

The enactment of the revised ARDA legislation and the passage of the Fund for Rural Economic Development Act (1966) permitted the federal government to undertake comprehensive rural development programs and to focus more closely on the problems of human-resource development. In addition, the programs of the Canada Land Inventory (CLI) enacted under the 1961 ARDA legislation began to provide information on the capabilities of land within the settled parts of Canada to support sustained use for forestry, outdoor recreation and wildlife as well as for agriculture. By providing data on the other important land-based resource activities, in addition to agriculture, the Canada Land Inventory increased the awareness of the need to consider single sector resource development projects within broader contexts.

Another step in the promotion of comprehensive resource development was taken in November 1967. At that time, the Canada Land Inventory introduced a program which provided federal funds to the provinces for pilot scale land-use planning studies based on CLI data. Under this program, land-use plans covering all land-based resource development could be prepared.

With these developments the MRDB renewed its efforts to obtain a comprehensive view of land-development possibilities in the Musquodoboit valley, to ensure that all potential benefits accruing from the construction of the flood-control works were realized and not just those benefits pertaining to agriculture. Similar interest was shown by the provincial ARDA administration, as a reappraisal of the project had been requested by the federal ARDA administration. It had become important to identify the non-agricultural benefits of the project because, under the revised ARDA legislation, these could be included in a new cost-benefit analysis.

To provide the information required for the revised cost-benefit analysis and to obtain a comprehensive land-use plan for the valley, the province utilized the CLI pilot scale land-use planning program. The study proposal approved by CLI called for the preparation of a land-use plan for the Musquodoboit watershed based on a consideration of physical, social and economic factors. The study was scheduled for the 1969–70 fiscal year and coordination of the study components was assigned to the Nova Scotia Program Development Agency.[7]

Study design

The study was divided into five main tasks, most of which ran concurrently:

(i) The analysis of the Canada Land Inventory data on the physical capabilities of the watershed for agricultural, forestry, recreational and wildlife uses.

(ii) The preparation of large-scale maps of property ownership.

(iii) The execution of an interview program designed to obtain social and economic information concerning each of the persons owning five acres of land or more in the watershed.

(iv) The preparation of specific research studies on development possibilities for land-based activities in the watershed.

(v) The preparation of an indicative land-use plan for the watershed.

The Nova Scotia Program Development Agency enlisted the help of both federal and provincial agencies to undertake this work. Federal agencies involved included: the Conservation Planning Section of the Engineering Services, Department of Regional Economic Expansion; the Maritime field office of the Canadian Wildlife Service, Department of Indian Affairs and Northern Development; the Department of Agriculture, and the Resources and Land Use Unit, Department of Energy, Mines and Resources.[8] Three departments of the Nova Scotia government, Agriculture and Marketing, Mines, and Lands and Forests provided the provincial input.

Work on the property mapping and the landowner-interview programs was started in early 1969. The other studies were begun prior to or shortly after, the mapping and interviewing activities. As the work progressed, meetings were held between the study participants to

[7] Since the time of the study this agency has ceased to exist; many of its functions are now the responsibility of the Nova Scotia Department of Development.

[8] A reorganization of federal government departments since the time of the survey has resulted in several institutional changes; the Engineering Services, Department of Regional Economic Expansion has been transferred to the Council of Maritime Premiers and is now the Maritime Resource Management Service. The Canadian Wildlife Service is now in the Department of the Environment, and the Resources and Land Use Unit has been incorporated in the Lands Directorate of the Department of the Environment.

review progress, to identify possible sources of incompatibility between development proposals in different resource sectors, and to assist in the integration of the study results in the preparation of the indicative land-use plan, the principal object of the study. The results of the study were presented at a meeting of the MRDB in the fall of 1969.

The following sections describe the survey methodology and present the study findings.

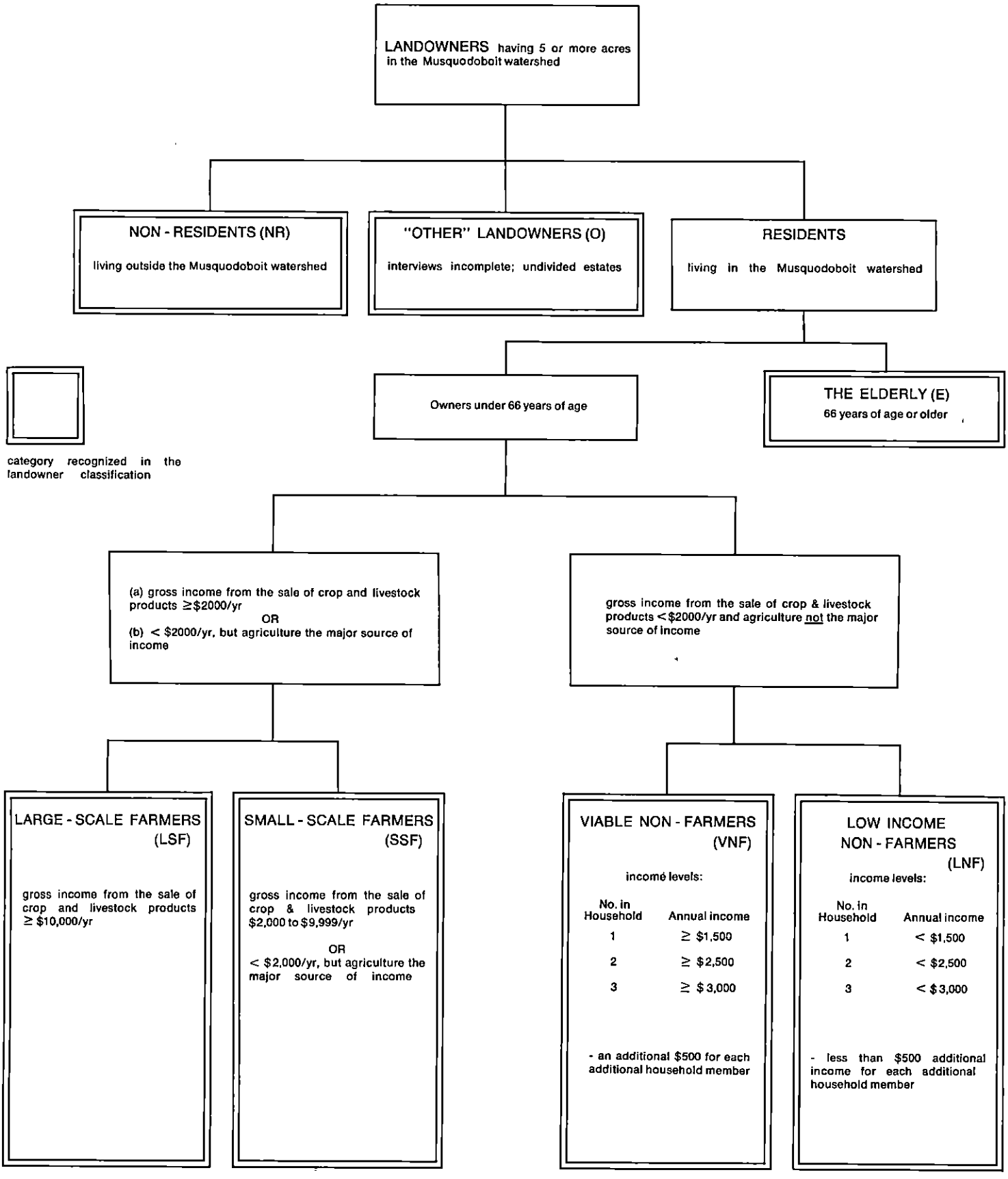

FIGURE 3. Landowner classification used in analysis of interview data

Landowner characteristics

Landowner-interview program

To assess the present use of land resources and development possibilities in the watershed, it was necessary to determine the ownership of these resources and to evaluate the capability and desire of their owners to respond to land-development programs.

The cadastral maps covering the watershed were updated by compiling on aerial photographs, with the aid of local residents, the property boundaries of all parcels of land five acres and larger. These boundaries were transferred to maps at a scale of 1:15,840 (4 inches to 1 mile). Attempts were then made to interview the 350 owners of the identified properties, but complete coverage was impossible because of the number of non-resident landowners. However, 300 interviews were obtained which covered most of the population associated with the large private landholdings. Data from the interviews were subsequently transferred to punch cards for computer analysis.

The landowners contacted in the interview program hold virtually all of the improved agricultural land in the watershed and account for almost all the gross farm income earned in the valley. A total of 74,426 acres, 14,003 of which were reported to be improved, were accounted for in the interviews. The total gross farm and forestry income of the landowners amounted to $838,979. These figures are close to those reported in the 1966 Census of Canada for the enumeration areas covering the Musquodoboit watershed,[9] which reported an improved agricultural acreage of 14,864 acres and a total gross farm and forestry income of $872,931.

The total population of the census enumeration areas covering the watershed was 4,352 in 1966. Of this number, 862 were defined as rural farmers and 3,490 as rural non-farmers. Most of the rural non-farmers reside in the valley's hamlets and villages, which, in 1966, contained 3,001 persons—nearly 70 per cent of the watershed's population. Most of these persons hold less than five acres of land. The households of the resident landowners, for which information on the number of persons in the household was obtained (226 of 238 households), contained a total of 913 persons.

Classification of landowners

A classification, based on the data from the interviews, was prepared in order to develop an overview of the importance of the valley's land resources to their owners. Seven landowner groups were established, using four criteria: place of residence, age, source and size of income, and are defined as follows: large-scale farmers (LSF); small-scale farmers (SSF); viable non-farmers (VNF); low-income non-farmers (LNF); the elderly (E); non-residents (NR); and other landowners (O). The derivation of these groups is explained in Figure 3.

This classification was used only as a tool in the analysis and has no legal significance. Although individuals and properties may have been incorrectly classified in a few cases, such an analysis does indicate the relative importance of the various land-based resource activities as income generators, and the implications which this has for the preparation of a land-use plan.

Landholding structure

The socio-economic status of the landowners and of the landholding structure in the Musquodoboit watershed is summarized in Figure 4, from data obtained in the interview program.

It is clear from the figure that less than 20 per cent of all owners are in the two farmer categories and of these, the large-scale farmers account for only 7 per cent of the landowners. Thirty-nine per cent of the owners are in the two non-farmer groups (VNF and LNF) and, although major landholders, derive most of their income from non-farm and non-forestry activity. Those non-resident owners from whom data were obtained made up 21 per cent of the owners and the elderly accounted for 16 per cent of the landowners.

The distribution of land amongst the owner groups is also shown in Figure 4. The two farmer groups, which account for only 20 per cent of all owners, control 39

[9] Enumeration areas nos.: 10, 11, 17, 53, 54, 55, 59, 63, and 64 of the Federal Electoral District of Halifax (1966 Census of Canada). The area covered by these enumeration areas does not coincide precisely with the Musquodoboit watershed, but it includes all the settled parts of the watershed.

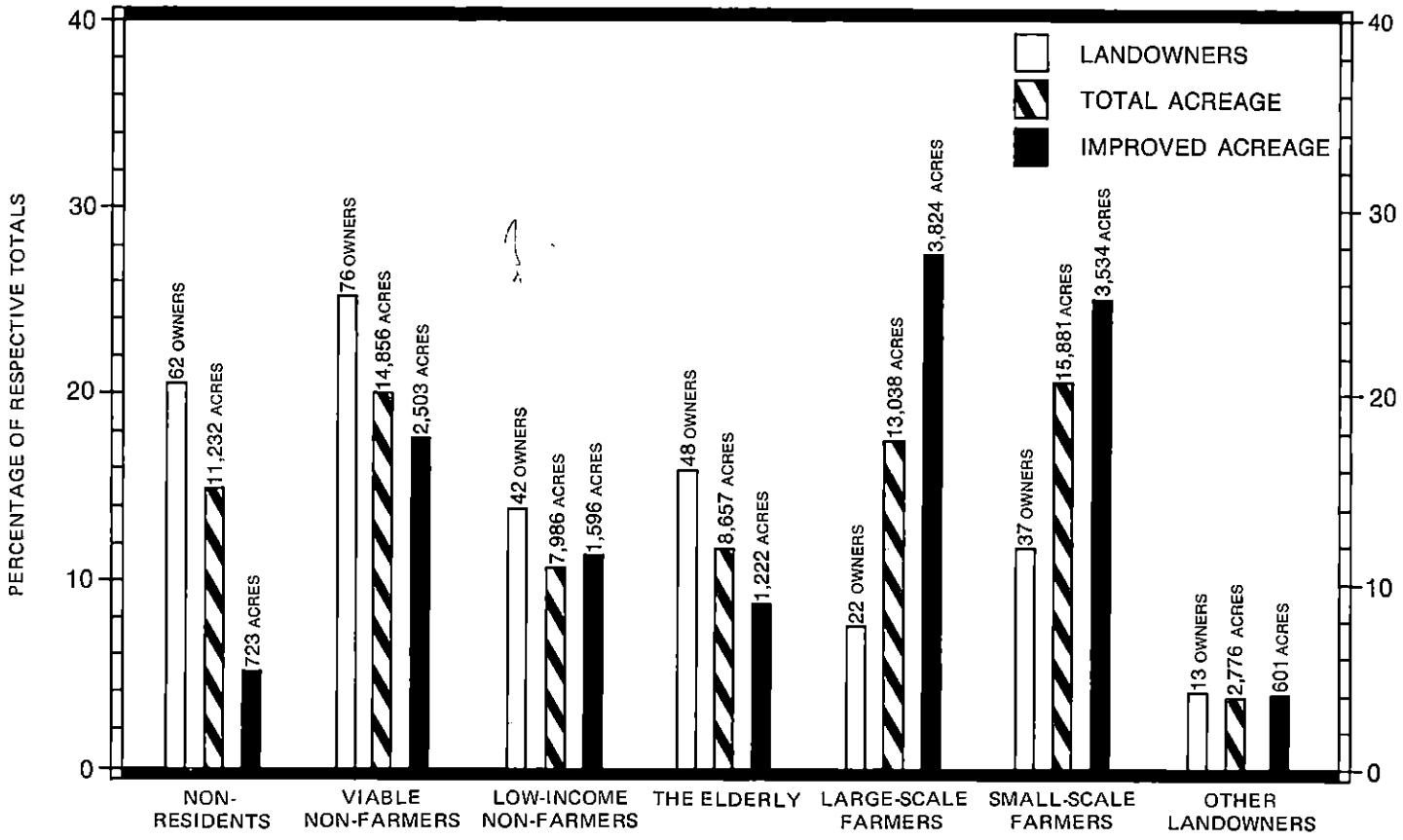

FIGURE 4. Land and landowners in the Musquodoboit valley, 1969.

per cent of the total acreage and 52 per cent of the improved acreage. The farmers clearly compose the most important group with respect to ownership of improved land. However, the corollary is also significant: almost one-half the watershed's improved land is held by either non-farmer, non-resident, or elderly owners. Land use by each landowner group is given in detail in Appendix 1.

The two groups of resident non-farmers (VNF and LNF) possess approximately 30 per cent of both the total and the improved acreage (31 and 29 per cent respectively). The non-residents also control a significant share of the total acreage (15 per cent) and have 5 per cent of the improved land. Twelve per cent of the total acreage and 9 per cent of the improved land is held by the elderly owners. Together, the owners in these four groups and those in the other landowners group hold 61 per cent of the total acreage and 48 per cent of the improved land reported in the interview program.

Significant differences exist between the two farmer groups in average farm size,[10] and particularly in the

[10] Figures on farm size are based on the average in properties owned outright as well as land leased from the Nova Scotia Farm Loan Board (FLB). They do not include the acreage in properties rented from other landowners. Only 884 acres in 38 properties were "rented-in" by the interviewed owners.

[11] Table based on information obtained in the landowner-interview program.

TABLE 1. Nova Scotia Farm Loan Board properties in the Musquodoboit valley, 1969[11]

Landowner groups	No. of owners reporting FLB properties	No. of properties	Total acreage	Improved acreage	Average improved acreage per owner
Non-residents (NR)	0	0	0	0	0
Viable non-farmers (VNF)	1	3	212	97	97.0
Low-income non-farmers (LNF)	0	0	0	0	0
The elderly (E)	0	0	0	0	0
Large-scale farmers (LSF)	16	26	6,536	2,125	132.8
Small-scale farmers (SSF)	10	18	3,278	837	83.7
Other landowners (O)	0	0	0	0	0
Totals	27	47	10,026	3,059	113.3

amount of improved land per holding. The large-scale farmers have, on average, 593 acres per holding, while the small-scale farmers have 429 acres per holding. Although the average total acreage per holding of large-scale farmers is only 38 per cent larger than that of the smaller farmers, the bigger producers have an average improved acreage per holding that is 80 per cent greater than that of the smaller operators (174 acres versus 96 acres). This appears to be primarily a result of a greater utilization of the Nova Scotia Farm Loan Board (FLB) farm enlargement program by the large-scale farmers (Table 1), for only those farmers who have been successful in expanding their improved land base have been able to maintain enterprises that have reasonable prospects for long-term viability.

It seems that little land is available for farm expansion in the Musquodoboit valley. Of 231 owners who replied to the question regarding the sale of all or part of their property, only 18 indicated their willingness to sell all and 20 stated that they would like to sell all except the house and a few acres of land. The opportunities for the large-scale farmers to *purchase* additional properties in the watershed would appear to be limited, in so far as dependence on the free market is concerned.

Farm fragmentation

Although the expansion of the land base has been successfully achieved by many of the farm operators, it has also led to increased farm fragmentation. When searching for lands which he could acquire either through direct purchase or FLB lease, the farmer has found that much good-quality improved land near his property is not available for one reason or another. The farmer has then acquired property a considerable distance from his homestead and existing improved land. The result is a farmholding composed of two or more parcels of land scattered up to several miles apart. This necessitates long trips with farm machinery on public roads, which reduces the farmer's efficiency, and results in higher production costs.

Evidence of farm fragmentation in the Musquodoboit valley is given in Table 2. As might be expected, the large-scale farmers who have pursued farm enlargement most aggressively, also have the largest average number of properties per owner. Some of these farmers have up to eight parcels; only five in this group have all their land consolidated in one property. The small-scale farmers have also experienced farm fragmentation, although not as severe as that experienced by the larger farmers. Ten of the 37 owners interviewed in this group have only one property each. Land fragmentation in the other landowner groups is less. Many of the non-farming landowners have acquired more than one property through inheritance or marriage rather than by purchase.

Farm expansion and use of intervale land

A key question, which must be resolved before the future of the flood-control program is decided, is whether the construction of these works would create benefits commensurate with the costs of the program?

The ownership of land threatened by flooding is of particular interest because it is this acreage which is of concern in the flood-control program. Only 3,888 acres of the 74,426 acres (the majority of which is forested) held by the interviewed landowners were reported to be subject to flooding (Table 3). This acreage represents 46 per cent of the floodplain of the Musquodoboit River. The large and small-scale farmers hold 1,920 acres of land subject to flooding, of which 1,168 acres are improved land. Of those farmers grossing more than $4,000 per annum from the sale of crop and livestock products, 16 (53 per cent) indicated that they required additional improved land, 21 (70 per cent) drainage improvements, 11 (37 per cent) land clearing and 2 (7 per cent) other requirements.[13]

TABLE 2. Land fragmentation in the Musquodoboit valley, 1969[12]

Landowner groups	Number of owners	Percentage of all owners	Number of properties	Average number of properties per owner
Non-residents (NR)	62	20.8	76	1.2
Viable non-farmers (VNF)	76	25.3	128	1.7
Low-income non-farmers (LNF)	42	14.0	59	1.4
The elderly (E)	48	16.0	71	1.5
Large-scale farmers (LSF)	22	7.3	61	2.8
Small-scale farmers (SSF)	37	12.3	90	2.4
Other landowners (O)	13	4.3	18	1.4
Totals	300	100.0	503	1.7

[12]Data refer to acreages reported by landowners in properties owned outright, as well as those leased (if any) from the Nova Scotia Farm Loan Board within the Musquodoboit River watershed, and excludes Crown and forestry holdings and properties of less than five acres.

[13]These results are only for those owners responding to the question on farm expansion in the interview survey. Some owners require more than one type of improvement, i.e., both land clearing and drainage improvements. Therefore, the percentages total more than 100.

TABLE 3. Land use in the Musquodoboit valley, 1969 [12]

	Land-use classes				
	Arable (improved)	Rough pasture	Forested	Wasteland	Total
Acreage subject to flooding					
Acres	2,060	1,377	255	196	3,888
% of acreage subject to flooding	53.0	35.4	6.6	5.0	100
Number of parcels involved	78	33	9	15	107
Average acreage per parcel	26	42	28	13	36
Acreage not subject to flooding					
Acres	11,943	2,553	55,075	967	70,538
% of acreage not subject to flooding	16.9	3.6	78.1	1.4	100
Number of parcels involved	233	84	351	20	398
Average acreage per parcel	51	30	157	48	177

The improved land subject to flooding, which is superior in fertility to all other land in the watershed, constitutes only 14 per cent of the total improved acreage in the watershed (Table 3). In terms of average improved acreage per landowner, the improved land subject to flooding covers only 38 acres (22 per cent) of the 174 improved acres per holding for the large-scale farmers, and 9 acres (9 per cent) of the 96 improved acres per holding for the small-scale farmers (Appendix 1). For each of the non-farmer landowner groups, only 14 per cent of the average improved acreage per holding is subject to flooding. The figure is slightly higher for the elderly landowners; 18 per cent of their average improved acreage per holding is subject to flooding.

A large proportion (35 per cent) of the rough pasture-land is located on the floodplain, however, this represents a total of 1,377 acres of which the farmers hold only 404 acres. Even if all of this acreage was made suitable for cropping, it would not significantly expand the total improved acreage in the watershed.

The two farmer groups (LSF and SSF) control 26,999 acres (38.3 per cent) of the acreage not subject to flooding, as reported during the interview survey. The remainder of the 70,538 acres not subject to flooding is distributed among the other landowner groups as indicated in Appendix 2.

In summary, slightly over one-half (53 per cent) of the total acreage reported to be subject to flooding is improved land and only 1,168 acres (30 per cent) is improved land held at present by the two farmer categories (LSF and SSF). Some of the improved land held by the other landowner groups might become available through sale or lease to the long-term viable farmers or candidates for expansion. It is also possible that some of the rough pasture acreage could be improved.

The 1968 revised estimate of the amount of funds needed to complete the flood-control program by building the remaining six dams was about $600,000. If considered solely in relation to the 1,168 acres of improved land in the floodplain held by the active farmers (LSF and SSF), this represents an input in the order of $500 per acre, to which must be added the costs of the other parts of the scheme which have already been constructed. The market price of improved intervale land in 1969 was approximately $100 per acre.

The cost-benefit relationship is not simple. Although the floodplain land is superior in quality to other land in the watershed, the original decision to construct the dams appears to have been very expensive when viewed in relation to the real potential benefits and to alternative means of improving agriculture in the economy.

Landowner income

The income of landowners in the Musquodoboit valley is derived from primary resource activities and from off-farm sources (Table 4). The primary resource income is derived from the sale of crop and livestock products and from woodlot operations.

The two farmer groups (LSF and SSF) earn the vast majority (94.7 per cent) of the total primary resource income. Almost 70 per cent of all primary resource income was reported among the 22 large-scale farmers, with an average, per farmer, of over $26,500 in 1968. In comparison, the small-scale farmers accounted for approximately 25 per cent, but the average per farmer was only slightly over $5,700. Only eight of 48 respondents in the elderly category reported income from primary resource activities with average gross receipts of $669 in 1968. In the two non-farm groups (VNF and LNF), the incomes from farming and forestry operations reflect relatively low returns from land-based activities of the two groups. Twenty-six of 76 households in the VNF group reported receiving income from primary resource activities for an average of $1,110 per household reporting. Only 12 of 42 in the LNF group reported any income from these activities and, for those reporting, the average was $878 per household.

The income from forestry operations accounts for only slightly over 7 per cent of the gross primary re-

TABLE 4. Landowners' gross income from primary resource activities, Musquodoboit valley, 1968

Landowner groups		Gross farm income					Gross woodlot income					Total gross income from primary resource activities				
			Aggregate income					Aggregate income					Aggregate income			
Group	No. of households	No. of households reporting	Total income reported $	% of group's gross primary resource income	% of total gross farm income	$ per household reporting	No. of households reporting	Total income reported $	% of group's gross primary resource income	% of total gross woodlot income	$ per household reporting	No. of households reporting	Total income reported $	% or group's gross primary resource income	% of total gross primary resource income	$ per household reporting
NR	62	Income data not collected			—	—	—	—	—	—	—	—	—	—	—	—
VNF	76	15	8,890	30.8	1.1	593	17	19,976	69.2	32.3	1,175	26	28,866	100	3.4	1,110
LNF	42	7	4,805	45.6	0.6	686	11	5,732	54.4	9.3	521	12	10,537	100	1.3	878
E	48	4	1,710	31.9	0.2	428	7	3,643	68.1	5.9	520	8	5,353	100	0.6	669
LSF	22	22	574,870	98.6	74.0	26,130	7	8,204	1.4	13.3	1,172	22	583,074	100	69.6	26,503
SSF	37	37	186,977	88.6	24.1	5,053	22	24,172	11.4	39.2	1,099	37	211,149	100	25.1	5,707
O	13	Income data not collected			—	—	—	—	—	—	—	—	—	—	—	—
Totals	300	85	777,252	92.6	100.0	9,088	64	61,727	7.4	100.0	964	105	838,979	100	100.0	7,990

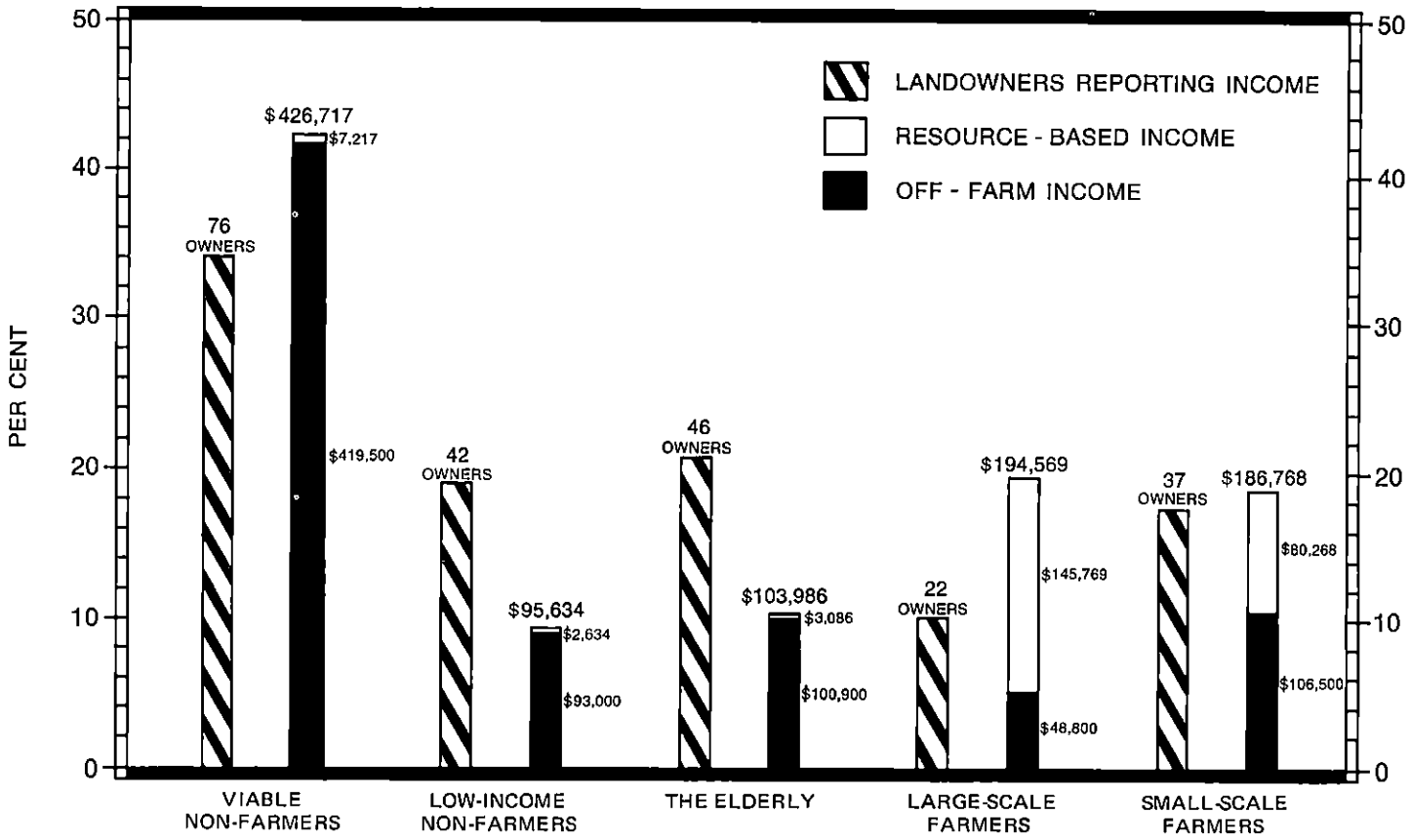

FIGURE 5. Estimates of landowners' total net cash income, Musquodoboit valley, 1968.

source income ($61,727). Approximately one-half (51.2 per cent) of this forestry income was derived from the sale of saw logs, with 41.1 per cent being received from pulpwood sales and the remaining portion (7.7 per cent) from the sale of Christmas trees. The relative importance of woodlot income to the various landowner groups can be seen in Table 4. The small-scale farmers received 39.2 per cent of all forestry income reported, and the viable non-farmer group received 32 per cent of the gross forestry income reported.

Fluid milk sales are the major source of farm income in the watershed. Thirty-two per cent of all farmers reported an income from the sale of fluid milk and 48 per cent of all gross farm income was derived from such sales. Income from the sale of cattle was the next most important source of farm income (18 per cent), followed by the sale of hogs (12 per cent). It should be pointed out, however, that 85 per cent of all households reporting farm income indicated that they received income from the sale of cattle and only seven of 85 (8 per cent) reported income from the sale of hogs.

The income received by householders from primary resource activities and from off-farm sources is summarized in Appendix 2. Estimates of net primary resource income of the various landowner groups are compared with income from off-farm sources in Figure 5. Since only gross incomes from primary resource activities were recorded during the interview survey, the calculation of net incomes was based on percentages described in Appendix 3 for the landowner groups. Such a method of estimating net income has its limitations. The size of the operation and the management ability of the operator are ignored as is the fact that not all off-farm income may be considered net. These figures are *not* intended to provide a basis for major planning and land-management decisions.

In 1968, 76.3 per cent of the estimated net income was derived from activities other than farming or woodlot operations. Even those classified as farmers (LSF and SSF) depended for a significant portion of their estimated net income on sources other than farming. The large-scale farmers derived 25.1 per cent of their total estimated net income from such sources and the small-scale farmers 57 per cent. Even allowing for the margin of error likely in such estimates of net income, the large difference existing between income derived from resource and non-resource-based activities is marked. Income from farm and woodlot operations accounted for less than one-quarter (23.7 per cent) of the estimated net income for all landowner groups. This illustrates that primary resource activity plays a secondary role as a source of income for the majority of the landowners in the watershed. Income-in-kind, although not included in the analysis, is most certainly important for some landowners.

Off-farm sources of income, and government transfer payments (pensions, welfare payments, family allowance, etc.) make up the bulk of non-resource-based income. Sixty-one per cent of the total non-farm income and 46.5 per cent of the estimated total net cash income is accounted for by the head of the household's non-farm employment. This type of income is the most important source of income for the non-farm categories (VNF and LNF). It also provides 21.8 per cent of the elderly group's estimated total net cash income, and even for the small-scale farmers, 24.9 per cent of the estimated total net cash income is derived from non-farm sources. The only group for which the head of household's off-farm employment income was of minor importance (10.6 per cent) was, not unexpectedly, the large-scale farmers.

Government transfer payments account for 15.5 per cent of the estimated total net income. These payments were the most important for the elderly group (57.7 per cent of the estimated total net cash income), and for the low income group (LNF), 36.5 per cent.

The wives' off-farm income accounted for approximately 10 per cent of the estimated total net cash income. Income derived from other non-farm sources (from boarders, rent, etc.) is relatively unimportant in the over-all net cash income, comprising only 4.4 per cent of the total.

TABLE 5. Distribution of landowner households by estimated total net cash income, Musquodoboit valley, 1968

Income classes	Landowner householders							
	The elderly (E)		The farmers (LSF & SSF)		Non-farmers (VNF & LNF)		All in groups E, LSF, SSF, VNF & LNF	
	No.	%	No.	%	No.	%	No.	%
Less than $1,000	7	15.2	—	—	5	4.2	12	5.4
$ 1,000—1,999	19	41.3	5	8.5	14	11.9	38	17.0
$ 2,000—2,999	13	28.2	7	11.8	16	13.6	36	16.1
$ 3,000—3,999	3	6.5	7	11.8	24	20.3	34	15.3
$ 4,000—4,999	1	2.2	5	8.5	18	15.3	24	10.7
$ 5,000—5,999	1	2.2	6	10.2	13	11.0	20	9.0
$ 6,000—6,999	—	—	10	17.0	12	10.2	22	9.9
$ 7,000—7,999	1	2.2	6	10.2	7	5.9	14	6.3
$ 8,000—8,999	—	—	4	6.8	3	2.5	7	3.1
$ 9,000—9,999	1	2.2	2	3.4	1	0.9	4	1.8
$10,000 & over	—	—	7	11.8	5	4.2	12	5.4
All households reporting	46	100	59	100	118	100	223	100
Total households	48		59		118		225	

Distribution of landowners' net cash income

Three groups of landowners are compared; the farmers (LSF and SSF), the non-farmers (VNF and LNF) and the elderly (E). The distribution of their estimated net cash income by class is shown in Table 5.

This distribution is in contrast to the situation in the Tantramar area of New Brunswick where only 9 per cent of the respondents' incomes were $6,000 or more, and 74 per cent had incomes of less than $4,000 per year (Jackson and Maxwell, 1971). The latter group, however, includes over 90 per cent of the elderly group who rely primarily on old-age security payments for their income.

The distribution of the farmers among the various income classes within the watershed (LSF and SSF) is relatively even. Many of these operators, however, obtained a portion of their income from non-farm sources. This same group also appears to have had the highest median incomes; 49.2 per cent of this group had estimated net incomes of $6,000 or more in 1968 as opposed to the non-farm activity group who had only 23.7 per cent of their estimated net incomes rising above $6,000 or more. This also is in contrast to the Tantramar area of New Brunswick where the non-farmers had the highest median incomes and only 10.6 per cent of the respondents considered to be the farmers had estimated net cash income of $6,000 or more per annum (Jackson and Maxwell, 1971). The higher estimated net incomes of the farmers in the Musquodoboit valley are due largely to the type of farm enterprise; most are involved in fluid-milk production which tends to have a higher ratio of net to gross profit than beef, dairy and hay production which characterizes the Tantramar area.

Other social factors affecting development

Age

Of the 230 landowners who responded in the interview program, 68 per cent were over 45 years of age, and of these, 21 per cent were over the age of 65. Only ten of

the 22 large-scale farmers were over the age of 45. Seventeen of the 37 small-scale farmers were over 45. Based solely on the age of these farmers, the prospects for the continuation and expansion of farming in the valley seem good.

Attitudes regarding expansion and change in type of operation

The interviewed farmers were asked about their desire to expand their farms; 18 of the 22 large-scale farmers expressed a desire to expand. Among the 24 small-scale farmers who gross over $4,000 per annum from the sale of crop and livestock products, a sharp contrast was noted: only eight farmers expressed a desire to expand their operations, 11 had no desire to expand, and five were undecided. Therefore, of the 46 farmers grossing over $4,000 per year from the sale of crop and livestock products, 56.5 per cent indicated a desire to expand, 28.3 per cent expressed no desire to expand and 15.2 per cent were undecided.

The farmers were also asked about making changes in their farm operations. Of the 21 large-scale farmers who replied, 14 were considering a change. Of the 19 small-scale farmers grossing over $4,000 from the sale of crop and livestock produce who responded, only five were considering a change. This indicates a desire on the part of the large-scale farmers to change and alter their operations, while most of the small-scale farmers are content to retain their operations at their present scale.

Education

Most of the landowners in the valley reported the completion of an average of eight to nine years of formal schooling. Three of the 22 large-scale farmers had attended university. The only other group in which a significant proportion of the householders had had a university education is the elderly group.

Established landholding and settlement pattern

The pattern of landholding and settlement of the resident population (excluding "non-resident" and "other" landowner groups) within the Musquodoboit valley is well established. Of the 201 respondents, 44.9 per cent had resided in the valley for 50 years or more and only 10 per cent had lived in the valley for less than 20 years. In the farmer groups (LSF and SSF), 69.8 per cent of the householders had resided in the valley for 30 years or more. Their strong attachment to the land is revealed by the fact that 74.2 per cent of the respondents did not want to sell their property, and, of 158 who replied, 96.2 per cent were satisfied with their present occupation.

Housing

During the interview program, the age of the house occupied by the respondent was determined and a subjective appraisal of its quality was recorded by the interviewer. Of 225 respondents (excluding the "non-resident" and "other" landowner groups), 61.8 per cent lived in homes over 50 years old and 29.8 per cent lived in homes over 100 years old. The quality of the housing was judged to be low. Since only rural householders owning more than five acres of land were interviewed, a more detailed study of housing including that in the existing unincorporated settlements, would be needed to reveal the type and amount of additional housing needed to meet the long-term requirements of the valley residents.

Bases for future development

A feasible plan for land use must be based on a realistic appraisal of the development opportunities and constraints in various sectors of the local economy which have implications for land use.

In the Musquodoboit valley the major sectors involved are agriculture, wildlife, recreation, forestry and urban-based employment which leads to commuter settlements in the valley. The general prospects for each of these, as well as the role of the extractive industries, are discussed so as to provide background to the indicative land-use plan proposed for the Musquodoboit valley.

Agriculture[14]

The number of census farms in Halifax County has decreased steadily from 2,702 in 1931 to 1,656 by 1941, to 753 by 1951. Of the 346 remaining in 1966, only 138 grossed more than $2,500 per year. In 1969, based on results of the landowner-interview program, the Musquodoboit valley had 85 census farms, now defined as having gross returns of $50 or more from the sale of agricultural products. Only 21 of these were considered to be viable in the long term or could become viable with a moderate amount of assistance. Each of these farms had gross incomes from agriculture over $5,000 and all but three grossed over $15,000.

As the number of farms decreased, their average size and the average farm income increased, due, in part, to the desire of the active farmers to increase their profitability by extending the farm size. The smallest enterprises have tended to disappear, for, as competition becomes more intense, the holding is merged with a larger farm or rented to another farmer.

These changes are not unique to the Musquodoboit valley, or even to Halifax County, but are part of a trend which is affecting agricultural enterprises throughout the Maritime Provinces. This trend has been recently surveyed in its broad outlines and it is believed that not only the number but also the acreage in farms will continue to decline.

> "The area of land in farms will continue to decline, particularly in New Brunswick and Nova Scotia. Conversely, farming may be expected to continue to shift toward larger-scale enterprises. This shift was well advanced by 1967 and the large enterprises, though few, were already producing more than 75 per cent of the farm products marketed." (Carr, 1969).

That passage could have been written specifically about the situation in the Musquodoboit valley. Carr also made an important distinction between the *economic* role of the small-scale Maritime farmer and his *social* role in the community, which is highly relevant to the situation in the Musquodoboit valley:

> ". . . a few of these small-scale farmers enjoy living on small farms of their own, perhaps less because they want high incomes than because they enjoy the independence, closeness of nature, and convenience of rural recreational opportunities . . . This probality, that a considerable number of small farms will remain after the major modifications of the current adjustment have been completed, is not necessarily an undesirable outcome. These rural people can contribute much to the social progress and stability of the region provided they are not expected or encouraged to live in extremes of isolation, or to provide farm products of marketable qualities, or to expect more costly social amenities without contributing a substantial share of their additional costs." (Carr, 1969).

What form are competitive agricultural units in the watershed likely to take? The physical capability for agriculture has been determined by the Canada Land Inventory (1969*a*) and is outlined in Table 6.

Given the problems facing agriculture in the Maritimes, it seems unlikely that significant new clearance of land for agriculture will be undertaken in the Musquodoboit valley in the near future. In considering the acreage already cleared (Table 6), approximately 18 per cent is rated under the CLI Classification as Class 2 land. Soils in this class are considered to have only moderate limitations to high productivity and are clearly of significance for

[14] This section is based largely on the following unpublished reports: J. L. Nowland, *Musquodoboit Soils*, Canada Department of Agriculture, Truro, N.S., 1969; J. L. Nowland, J. I. MacDougall and R. L. Thompson, *Soil Survey of the Musquodoboit River Floodplain, Nova Scotia*, Canada Department of Agriculture and N.S. Department of Agriculture and Marketing, Truro, N.S., 1969; and Lloyd Palmer, *Musquodoboit Valley Land Use Study: Agriculture*, Extension and Economics Branch, Nova Scotia Department of Agriculture and Marketing, Truro, N.S., 1969.

TABLE 6. Soil capability for agriculture in the Musquodoboit valley

CLI Class[15]	Limitation	Total acreage		Cleared acreage (including improved pasture, cropland, rough pasture)	
2	Inundation by streams or lakes (I)		3,772		2,660
3	Undesirable soil structure and/or low permeability (D)	58,061		7,038	
	Inundation by streams or lakes (I)	324		78	
	Moisture limitation (M)	756		414	
	Stoniness (P)	1,080		78	
	Topography (T)	9,098		650	
	Excess water (W)	402		204	
			69,721		8,462
4	Inundation by streams or lakes (I)	18		18	
	Moisture limitation (M)	198		18	
	Stoniness (P)	108		0	
	Consolidated bedrock (R)	5,364		1,200	
	Consolidated bedrock and/or stoniness (RP)	11,577		102	
	Excess water (W)	1,402		78	
			18,667		1,416
5	Excess water (W)		3,402		1,164
7	Stoniness (P)	67,469		564	
	Consolidated bedrock (R)	2,616		0	
			70,085		564
0	Organic soils		6,031		384
	Water Area		4,194		
	Total watershed acreage		175,872		14,650

future agriculture in the valley. However, much of the Class 2 land is subject to flooding, with 1,741 acres[16] of it in the intervale lands. Most of this land will benefit from the flood-control structures already completed; however, as previously indicated, only partial protection from flooding is provided by the existing control structures. In addition, even with flood control during the growing season, the use of large areas of land will continue to be limited by excess water accumulation in the soil. Much of the poorly-drained soils and some of the imperfectly-drained soils are saturated for long periods due to semi-permeable layers in the subsoils, surface run-off, seepage from surrounding uplands, and a high water table. The cost of complete flood protection for intervale lands would be excessive in relation to their potential productivity.

Those Class 2 lands located in the floodplain share the climate and fertility limitations of all the floodplain soils. The frost-free period of the year is shortened by the accumulation of cold air on the valley floor. For the successful growth of most crops all soils in the valley require fertilization and liming for optimum productivity.[16]

On the land outside the floodplain the only upland soils considered to be of major significance for agriculture are the Queens and Wolfville series. The Queens soils are rated as Class 3D under the CLI classification,[17] for their undesireable soil structure and low permeability. For agriculture, the Queens soils are inferior to similar soils in Ontario and Western Canada. In addition to low fertility, the poor structure and low permeability of the subsoil causes drainage problems which are difficult to remedy. The Wolfville soils in the area have similar characteristics and neither series is particularly suited to intensive agriculture.

In his study of agriculture and soil capability in Nova Scotia, Hilchey (1970) includes the Musquodoboit valley in a "limited-use" agriculture block rather than a

[15] The Canada Land Inventory Soil Capability Classification for Agriculture (1969) uses a 7-class system; Class 1 soils having no significant limitations in use for crops, and Class 7 soils having no capability in use for crops or permanent pasture.

[16] J. L. Nowland, J. I. MacDougall, and R. L. Thompson, *Soil Survey of the Musquodoboit River Floodplain, Nova Scotia*, Canada Department of Agriculture and Nova Scotia Department of Agriculture and Marketing, Truro, N.S., 1969, (unpublished).

[17] The rating of Queens soils as Class 3 for agriculture in the original CLI survey is thought to be optimistic; these soils are now regarded as Class 4 for agriculture.

"multi-crop" agricultural block. The limited-use soils, Hilchey suggests, are ". . .useful for commercial production of a narrow range of crops (chiefly forage and forestry) with limited use for small grains, small fruits, vegetables and tree fruits."

During the interview program respondents were asked to state the dominant use of their land. They reported that 50,538 of the total 74,426 acres were used for "farming and forestry". Of this, 18,021 acres were used exclusively for forestry and 3,436 acres were reported to be idle land.

Two trends are apparent; first, a reduction in the total area of intensively-used cleared land, and secondly, changes in use and cropping patterns. The reduction in area reflects the diminishing size of the agricultural industry in the valley. Changes in the cropping pattern are due notably to the introduction of new species and varieties of crops, and associated changes in farm management and cropping systems.

In the past, the cleared land in the watershed was used primarily for pasture, hay, grain and blueberries. It seems likely that the same uses will continue to predominate with a possible expansion of the acreage in forage crops and a decrease in the use of land for hay and pasture.

It is impossible to state accurately what crops can be grown on the floodplain until the flood-control program is completed and secondary drainage works are undertaken. However, the establishment of an experimental plot or project farm on floodplain land, combined with the additional experience of local farmers, will aid in determining the most suitable crops for this land.

Fifteen of the 21 long-term viable farmers or those considered to be candidates for expansion produce fluid-milk. Since it seems likely that expansion of the metropolitan area of Halifax-Dartmouth will account for most of the future population average in the province, the Musquodoboit fluid-milk producers should continue to benefit from their proximity to this area.

The future dairy farm, however, is likely to differ considerably from that of the present. Studies by the Nova Scotia Department of Agriculture and Marketing suggest that an efficient fluid-milk enterprise might be run by two men. The farm unit would consist of a free-stall installation with milking parlour, a high proportion of roughage fed in the form of corn silage and haylage, little or no hay feeding to milk cows, and a year-round stored-feed program; i.e., the cows would not be pastured during the summer months. Two men could handle about 100 cows on this basis, with one man primarily concerned with managing the cow herd and the other mainly concerned with raising the replacement stock and producing the feed. Some part-time help would be needed during seeding and harvesting.

The land requirements for a herd of this size would be about 350 acres; 60 acres for production of corn silage, 120 acres of hay-land to produce both haylage and hay, 120 acres in grains, and 50 acres of pasture. This assumes the production of 20 tons of corn silage per acre, with 30 to 35 per cent dry matter; four tons of haylage per acre for one cut at 50 per cent dry matter; two tons of hay per acre; and one and one-half tons of grain per acre. Given these yields, the farm should be able to support, in addition to 100 cows, 25 two-year olds, an equivalent number of yearlings and 35 calves.

A detailed budget for such a commercial fluid-milk operation has been prepared recently by Sonntag (1969). A critical factor in the total budget appears to be the milk price. At $4.40 per cwt, which was the approximate 1967 price for manufactured milk, both a small-scale (25-cow) and large-scale (75-cow) operation showed deficits in labour income of $—429 and $—1,380 respectively.

For higher milk prices, however, the labour income in both enterprises becomes positive and the larger operation reaps increasing economies of scale. Thus, at a price of $5.00 per cwt, the 25-cow operation has a labour income of $846 and the 75-cow operation $4,020; at $5.50 per cwt, the returns are $1,908 and $8,520 respectively and at $6.00 per cwt it is suggested that the labour income to the larger operation would be $13,020. The actual prices paid for fluid milk at the time of the study ranged from ". . . $5.13 per cwt in Prince Edward Island to $6.20 per cwt in some areas in Nova Scotia. . . " (Sonntag, 1969).

Other models dependent on the land base include the dairy replacement operations suggested by Hilchey (1970), requiring approximately 150 acres of cleared land per unit, and hog-beef combinations. In this latter case, the hog operation relies on purchased feeds. Forage crops or corn silage are grown and fed to beef cattle (feeder steers or cow-calf operations). Dairy replacement stock or sheep might be substituted for the beef cattle. The land requirements would again be of the order of 150 acres; the analyses by Carr (1969) and Sonntag (1969) illustrate the character of such farm models, their opportunities, problems and anticipated returns.

In summary, the opportunities for commercial agriculture in the Musquodoboit valley are limited but real, and are closely related to the expanding market in the Halifax-Dartmouth metropolitan area. The amount of land required to be set aside for agriculture in the land-use plan is, however, relatively small. If each of the 21 long-term viable farmers and candidates for expansion required 350 acres for a large fluid-milk enterprise, the land requirement would be approximately 7,500 acres, or slightly more than half the arable land in the valley according to the information obtained in the interview program. This acreage is roughly equivalent to the total amount of arable land (7,358 acres) held at present by large-scale farmers and small-scale farmers. No doubt, as Carr (1969) suggested, many of the small-scale farmers will continue to be unwilling to sell or lease

their land to the large-scale farmers. However, 6,645 acres of arable land are also held by the non-farm groups, so it seems that the land needs of commercial agriculture in the valley could ultimately be met.

Wildlife[18]

The importance of the waterfowl habitats in the Musquodoboit valley can be assessed, within the context of the availability of similar habitats elsewhere in Nova Scotia, using the CLI classification as a convenient means for such comparison. Class 1 lands, with very high capability for waterfowl production, are relatively scarce in the province. Where they do occur they tend to be widely scattered and small in size. In total they amount to 1,014 acres, and of these, 150 acres, or about 15 per cent, are found in the Musquodoboit valley. Class 2 lands, with high capability for waterfowl production, are scarcely more common than Class 1 and are again scattered and small in character. Of the 2,445 acres of Class 2 waterfowl lands in the province, 164 acres, or 7 per cent, are located in the Musquodoboit watershed. Wetlands of Class 3 capability (moderately high productivity) are more widespread throughout the province.

The Musquodoboit valley is of particular importance because of its proximity to the expanding Halifax metropolitan area. The valley contains the greatest concentration of waterfowl habitats in Classes 1 to 3 in the vicinity of Halifax. In addition, the area is accessible from other main population centres in Nova Scotia. A circle of 50-mile radius centred on the Musquodoboit valley includes the centres of Halifax, Dartmouth, Windsor, Truro and New Glasgow. Of the wildlife habitats enclosed within this circle, the Musquodoboit watershed possesses 70 per cent of the Class 1 waterfowl lands, 44 per cent of the Class 2 and 26 per cent of the Class 3 waterfowl lands.

Hunting surveys, conducted through the use of the Federal Migratory Bird Permit, have shown that most Nova Scotian waterfowl hunters operate within a 50-mile radius of their homes. The same surveys indicate that little waterfowl hunting takes place at present along the Musquodoboit River, but that Musquodoboit Harbour is heavily hunted. The development and management of the marshes along the intervale land of the Musquodoboit River, could, therefore, be of increasing importance, not only to increase the waterfowl resource, but to perpetuate a harvestable surplus for the increased hunting pressures expected within the area.

The most important factor affecting wetlands along the Musquodoboit River for waterfowl production is the fluctuation of water level. In the spring the flood waters overflow into the intervale lands creating, in favourable locations, excellent interspersions of shallow and deep waters, with numerous islands of dry land and very irregular edge development. These areas are attractive to waterfowl during spring high-water levels, but the areas dry up as the floods recede. In addition, because of the relatively short duration of the high-water levels, little aquatic vegetation becomes established. If the water levels could be maintained in certain areas at or near the spring levels, this would enable the establishment of aquatic vegetation, making the areas permanently attractive to waterfowl. Stabilized water levels during the nesting and rearing season are of primary importance if nesting is to be successful.

The lakes and rivers in the headwaters of the Musquodoboit River were all rated low in terms of supporting waterfowl production—Class 5 or 6 on the 7-class scale. Poor water fertility, steep banks, and a lack of aquatic vegetation create low productivity of the habitat in the headwaters, and the use, for waterfowl management, of the impoundments created under the flood-control program, would therefore be limited.

Recreation[19]

The future of recreational developments in the Musquodoboit valley appears closely tied to that of the Halifax metropolitan area. Since that area seems likely to increase substantially in size over the next few decades, the importance of recreation in the valley is likely to increase as well.

Although the valley is attractive and picturesque, it lacks outstanding features, even on a regional scale, which would make it of significance for tourists from outside the province. The absence of a major arterial road through the valley (and the presence of the main Halifax-Truro Highway just beyond its boundary) means that it does not attract tourists, even as passers-by. The area's real potential stems from its location within the shadow of one of the major Canadian urban complexes. The valley has ready access to the Halifax-Dartmouth metropolitan area and could become an important day-use recreational area.

In terms of its physical attributes and geographical location, the valley has the potential characteristics of an "intermediate recreation area" similar to those of a state park in the USA and described by Clawson (1963) as:

> "1. It lies within two hours drive (less than 100 miles) from urban areas, and therefore can readily be used for all-day outings.

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[18] Based on CLI data and field-survey information in a report by P. B. Dean, *Musquodoboit Land Use Plan: Waterfowl Report*, Sackville, New Brunswick, October, 1969, (unpublished).

[19] This section is based on information from unpublished reports on the recreational potential and use of land in the Musquodoboit watershed:
Tom Kovacs, *Musquodoboit Valley Recreational Land Use Analysis*, Department of Energy, Mines and Resources, Truro, N.S., April 1969, (unpublished).
Kees Verburg, *Recreation Potential of the Musquodoboit Watershed*, Parks Branch, N.S. Department of Lands and Forests, 1968, (unpublished).
Kees Verburg and P. A. Gillis, *Cottage Potential of the Musquodoboit Watershed*, Parks Division, Department of Lands and Forests, November 29, 1967.

2. Particular attention is paid to water-based activities; although beach and swimming areas may be relatively small.
3. Emphasis is placed on activities, rather than upon natural quality sizes, lending a locational flexibility to recreation areas.
4. An overriding portion of use is on a single-day basis."

Its present use as a recreation area is relatively small. The dominant uses are fishing, hunting and cottaging[20], each characteristically an extensive-use type of recreation. None provides much direct monetary benefit to the valley.

The quality of the present recreational activities cannot be maintained without co-ordinated planning, land-use controls and pollution abatement. For example, trout fishing has declined over the years and salmon angling has all but disappeared; the quality of sport fishing will further decline in the future unless pollution is reduced and the river rehabilitated (Connor, 1964). Similarly, there is a limit to the number of deer which can be harvested each year without severely depleting the stock. If the number of hunters increases, there will be a drop in the quality of hunting and the corresponding decline in user satisfaction. Finally, the growth of cottages will need regulation, although there is potential for a substantial increase in numbers.

The real need and the main opportunities for the future lie in the creation of both public and private recreation areas capable of handling high-density day-use participation, primarily from the Halifax metropolitan area. Such areas could include public and private picnic sites, camping and trailer parks, public beaches, put-and-take fish ponds, game preserves, trails for horseback riding, hiking and possibly over-snow vehicles, and planned cottage developments.

The quantitative results of such development are difficult to assess. Revenue may be obtained from the collection of user fees and the sale of goods and services, but additional economic gains may also be realized through higher land values, increased tax revenues, and the creation of new jobs and businesses. Clawson (1963) claims that in such intermediate recreation areas, 45 per cent of total expenditures for recreation are spent for goods and services provided within the locality. This 45 per cent of expenditures enters the economic cycle of the area until a total impact of 75 per cent of the original spending is obtained. On this basis, the total impact can be approximated as 0.75 (a x m), where "a" equals average party expenditures per trip and "m" equals number of party visits per season. Values of "a" for Nova Scotia have been suggested, based on 1966 figures, as $6.06 for day trips and $30.00 for overnight trips, assuming an average party size of 2.77 persons and 2.18 persons respectively (Baker, 1969). In 1966, residents of the Halifax-Dartmouth metropolitan area were estimated to have participated in 279,400 day-trips and 96,600 over-night trips expending an estimated $1,693,000 and $2,868,000 respectively, for each type of trip. By 1981 these expenditures are expected to increase by about 60 per cent to $2,708,800 and $4,590,000 respectively.

These figures are large and, at first sight, so are the implications for the Musquodoboit valley. For example, 10,000 parties of day-users in a season might contribute about $45,000 to the economy and even double this amount does not seem impossible if the 1966 figures are of the right order of magnitude. However, $45,000 does not represent a large amount when expressed in terms of job opportunities, and against it must be set the cost of providing recreational facilities before these can begin to produce these returns. As Clawson and Knetsch (1966) stated:

> "...it is important to recognize that there are problems connected with the recreational business itself and that the recreation business potential of an area is affected by specific characteristics of area, location, and economic structure as well as other conditions. Realistic appraisals must be made in each case."

There are limits to the value of theoretical discussions, especially when they deal with such a wide range of activities as is comprehended in the term "recreation". However, there appear to be prospects of reasonable economic opportunities in developing recreational facilities in the Musquodoboit valley. Even if the returns are marginal, this is probably a case where the internal economic benefit to the Musquodoboit valley is outweighted by the external benefits accruing to the metropolitan area through development of the valley's resources. The indicative land-use plan should make provision for recreational development on both social and economic grounds.

Recreation may benefit from the effects of the flood-control program by the reduction of summer flooding, the lessening of bank erosion, and the metering of water to improve the flow during periods of drought. The recreational potential of the reservoirs created behind the water-control structures varies. The reservoirs on the smaller lakes and streams have little potential for recreational use due to their limited size, shallow depth and fluctuating water levels. The deeper lake reservoirs, and those where control dams have been built on large existing lakes (Beaver Lake and Mill Lake), would appear to have high potential for recreational use. For example, dam number 14 on the South Musquodoboit River was designed to form a new 160-acre permanent lake. This reservoir, along with Lower and Upper Mill Lakes (sites of dams 11 and 12) forms a large water body which is used for canoeing and fishing. In addition, Lower Mill Lake already supports a summer-cottage colony.

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[20] Within the watershed in 1968 there were 103 summer cottages in addition to 15 hunting and fishing camps. More than 75% of the owners come from the Halifax-Dartmouth metropolitan area.

Forestry

No clear statement of policy exists on the future role to be played by small private woodlots in the provincial economy of Nova Scotia. This situation is not unique to that province; a recent survey of forestry in the Atlantic Provinces pointed out that:

> "...Governments have been timid in asserting their responsibility—even with respect to publicly owned forests, and they have exerted very little authority over the management of private forest lands. Among Canadian provinces only Ontario, Alberta and British Columbia have faced up to the need for regulatory measures and given them legal force. Most of these measures, although in the right direction are essentially limited to preventing further breakdown." (Atlantic Development Board, 1968)

In Nova Scotia there are special problems:

> "...the lack of accurate, detailed knowledge about growth rates related to species, soils and locations is a serious deterrent to improving forest management in Nova Scotia. As well, it makes difficult an orderly and equitable allocation of resources and the rationalization of forest-based industries." (Atlantic Development Board, 1968).

This problem will be eased considerably when a major provincial re-inventory has been completed. It was intended that the inventory should become a continuing operation, with an updated report on one of the seven forest sub-divisions becoming available each year. The first report on the Halifax sub-division, which includes the Musquodoboit valley, was based on information gathered in 1967, and was published by the Nova Scotia Department of Lands and Forests (1969). The Forestry Committee of the Musquodoboit Rural Development Board requested the Nova Scotia Department of Lands and Forests to carry out a forest inventory of the valley. This was completed as part of the scheduled provincial inventory of the Halifax sub-division and a report was prepared in 1969[21].

That report revealed that softwood species (comprised primarily of fir, red and black spruce) occupy about three-quarters of the gross volume of timber in the watershed. The hardwood volume is comprised mainly of red maple, yellow birch and white birch. More than 90 per cent of the gross volume of trees standing in the watershed are over 40 years of age. The densities in various age classes of trees are also related to volumes of timber per acre. The volume per acre yield in age classes over 60 years was less than expected, due primarily to cutting, and to a lesser degree, mortality due to age, low densities on poor sites, and lack of management in establishing new sites. The softwood trees remaining in the older age classes (over 60 years) are primarily suited for the chemical pulpwood market, with a limited potential for saw logs. The quality of the trees less than 60 years of age is estimated to be good, depending on the species being regenerated after the removal of the original stand and upon the degree of forest-land management.

At the same time as this special inventory was being carried out for the MRDB, the CLI forestry inventory was being completed, the results of which reveal that about 80 per cent of the estimated 175,872 acres[22] in the Musquodoboit watershed is forested. The land capability for forestry, with the exception of the southwestern portion of the watershed, is fair to good depending on soil drainage, rooting depth and texture. Class 3 forest lands however, with moderate limitation to the growth of commercial forests, occupy only 2 per cent of the land area. Class 4 lands, which are considered to have moderately severe limitations, occupy approximately 49 per cent of the land area in the watershed, and a similar area is occupied by Classes 5, 6 and 7 land.

Inventory programs are essential to establish base information on the species composition and physical capability of the land in the valley to support commercial forest production. However, even when this information is available other problems remain, including those of ownership. In 1963 the Nova Scotia Voluntary Planning Board estimated that 39 per cent of the forest lands of the province were in private holdings of less than 200 acres; only one-quarter of the total 11,600,000 acres in Crown land. These small woodlots are decreasing in significance:

> "...The area in farm woodlots declined from more than 1.8 million acres in 1951 to less than 1.4 million acres in 1961...This probably reflects the practice of selling woodlots to sawmill operators for liquidation cutting. In recent years pulp and paper companies have been acquiring these small holdings, either before or after cutting for saw logs or pulpwood.
>
> Despite this decline, a substantial proportion of forest land is still made up of farm woodlots and other small holdings. A special survey in 1966 revealed that there were 49,500 separate ownerships of wild (forested) land in parcels from 50 to 1,000 acres in extent. Of the owners, 35,700 (72 per cent) were not engaged in agriculture. The average age of owners was 55 years; the average length of tenure, 19 years." (Atlantic Development Board, 1968)

This general picture is reflected in the local situation in the Musquodoboit valley:

> "The bulk of the forest land is owned by small woodlot owners who account for approximately 70,000 acres or over 60% of the productive forest land. The Crown owns approximately 20,000 acres (15%) while the remaining 20% plus is held by commercial operations...
>
> The majority of the small woodlot holdings are of relatively low average (size) indicated by the valley median of 140 acres." (Connor, 1964).

Additional information of the state of forest utilization in the watershed was obtained in the interview program. Of 207 woodlot owners who replied, 117 either never

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[21] Nova Scotia Department of Lands and Forests, Forest Inventory Section, *Forest Inventory Summary Report: Musquodoboit Valley Watershed, Field Work 1967*, Truro, N.S., March 25, 1969. (unpublished).

[22] This includes a land area of 171,678 acres and a water area of 4,194 acres.

sold any woodlot products or did so at a frequency of less than once every five years. From 204 responses on the subject of the chief value of the woodlot to the owner, only 79 regarded it as a source of regular or occasional income. Sixteen considered that it had little or no value, while 99 saw its main value as an investment.

If a comprehensive policy of forest management is agreed to by the province, provincial authorities may be able to persuade a large number of woodlot owners to give up their holdings for woodlot consolidation purposes, provided of course, the price is right. In this respect, a fairly small sample of 42 estimates of the local market value of good woodland, showed a median value of $20 per acre. There was, however, a strong mode at the bottom end of the scale; $2 per acre being suggested by sixteen respondents. At any rate, present ownership of land appears to be less of a problem in the assembly of viable woodlot operations than it does in regards to similar assembly of agricultural land in the Musquoboit valley.

Extractive activities

The largest quarrying operation in the valley is located at Upper Musquodoboit where limestone has been quarried since 1940 (Connor, 1964). The product is used primarily for agricultural lime with about 87 per cent of the output being distributed within a 65-mile radius of the quarry; the bulk of the remaining portion is shipped to Prince Edward Island.[4]

Outcrops of kaolinite clay in the Musquodoboit valley have been described in geological reports as early as 1900[23]. Prior to World War II, local clay deposits near Murphy Brook, Middle Musquodoboit were worked to provide raw material or "fireclay" for a New Brunswick pottery works.

In 1966 the Geological Division of the Nova Scotia Department of Mines began a project to evaluate clay occurrences in the province. During the period 1967-69, this group carried out detailed field and laboratory investigations of the kaolinite clay deposits in the Musquodoboit valley, between Upper Musquodoboit and Middle Musquodoboit. The clay is only exposed where the Musquodoboit River and its tributaries cut through overlying glacial drift. Three major clay deposits exist in the valley: (1) in the village of Middle Musquodoboit adjacent to Murphy Brook and extending southward across Highway 224 towards the Musquodoboit River; (2) at Elmsvale; and (3) at Paint Brook in Centre Musquodoboit. The deposit in Middle Musquodoboit was not investigated because it lies within the village limits. The deposits at Paint Brook graded from a low-duty to a medium-duty refractory clay.[24] The Elmsvale deposit is slightly larger with the deposit grading from low-to slightly high-duty refractoriness.

In their raw state, these deposits of low- to medium-duty refractory clay have potential use in the manufacture of face brick, floor tile and chimney tile. The use of laboratory techniques (physical and chemical separation and removal of impurities such as oxidized iron and fine grain-free quartz) could upgrade these deposits to medium- and high-duty refractory clays.

Associated with the clays, and located elsewhere throughout the valley, are deposits of silica sand. Tests were also conducted to see what grade of silica sand could be produced from these deposits. The average percentage of all samples was approximately 97 per cent silica. Additional tests would be required to determine the feasibility of using this sand for commerical purposes.

In conclusion, the clay deposits and associated silica sand at Paint Brook and Elmsvale have potential as sources of raw materials for commercial uses, if upgrading procedures prove economical and markets exist for the products.

Urban developments

The proximity of the Halifax-Dartmouth metropolitan area has already been suggested as a major factor in the future development of the Musquodoboit valley.

The demand for cottage and home sites is likely to grow, but the total amount of land required in the foreseeable future is likely to be small when compared to other extensive-type land uses.

A survey of commuting from the valley conducted in 1964 (Connor and Magill, 1965) revealed that of 685 households in the valley providing response, only 59 indicated that their present job was located in Halifax-Dartmouth. It is likely that the percentage has increased since that time. There are already signs of new building occurring on small holdings by persons whose main job is in the city. This trend seems likely to continue and to increase in relation to the anticipated growth in Halifax-Dartmouth. Major public investment for infrastructure development within this growth area will continue to be one of the prime reasons for ensuring its continued growth. However, the Halifax-Dartmouth hinterland does not lend itself easily to urban use. Expansion is limited by difficulties of terrain, which has led to ribbon development along existing roads, especially along the coasts, and also to long-distance commuting. Solutions of this type are undesirable both in individual cases and for effective planned growth.

The main disadvantage of the valley for future residential development is the circuitous route necessary to reach it along the coast. Against this is the fact that the

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[23] The following section is based on an unpublished report by J. Fowler, *Kaolinite Clay Deposits in the Musquodoboit*, Nova Scotia Department of Mines, Stellarton, N.S. 1969, and a more detailed unpublished report by J. D. Wright, *Kaolinite Clay Deposits in the Musquodoboit Valley, Halifax County, Nova Scotia*, Nova Scotia Department of Mines, April, 1969.

[24] This type of clay is suitable for use in products which are required to withstand high temperatures; eg., linings of kilns.

greater soil depths to bedrock in the valley present some of the few obvious sites for relatively easy building. If residential development is to take place, adequate provision should be made for it in the plan to avoid possible land-use conflicts in the future and to ensure adequate control of such development.

The future: a development plan outlined

Land-capability analysis

Under the Canada Land Inventory (CLI) program, which covers all of the Atlantic Provinces and the settled portions of Quebec, Ontario and the Western Provinces, land is assessed and rated in terms of its physical capability to sustain uses for agriculture, forestry, outdoor recreation and wildlife. In addition, the present use of land is mapped. Mapping is done at two scales: 1:50,000 scale maps are prepared using a seven-class rating system for each resource sector (Appendix 4); the data are then generalized and published on maps at a scale of 1:250,000 (Canada Land Inventory 1969*a* and *b*, 1970*a*, *b* and *c*). Class 1 lands have the highest physical potential for the given resource use, and Class 7 lands have no potential use.

To summarize the physical potential of the individual sectors in the watershed, the only sector which has any land rated as Class 1 is waterfowl (150 acres), and in the entire watershed, only 2,664 acres (1.5 per cent) of the area are rated as Class 3 or better for the production of waterfowl.

The acreage breakdown by capability classes for the agriculture sector (Table 6) indicated that 14,650 acres of land within the watershed were cleared at the time of the CLI survey. This compares to a total of 14,864 acres of improved land reported in the Census of Canada (1966), and 14,003 acres of improved land reported in the interview program. The difference between the figures is no doubt partially due to the problem of defining cleared acreage and improved acreage. In addition, the landowner surveys are more recent than either the CLI land-use maps or the census data and may then reflect changes in cleared acreage.

The highest capability rating for agricultural land in the Maritime Provinces is Class 2. Although over 40 per cent of the soils in the watershed have moderate to moderately severe limitations on the range of crops (Class 2 agricultural land, 2.1 per cent and Class 3, 39.7 per cent), with proper land management these soils could produce a wide range of field crops adapted to the region.[25]

Class 3 lands are the highest capability ratings within the watershed for both the forestry and outdoor recreation sectors. Approximately 2 per cent of the land in the watershed is rated as Class 3 for the growth of commercial forests and almost 50 per cent is rated as Class 4, i.e. as lands having moderately severe limitations to the growth of commercial forests; less than 1 per cent of the land within the watershed is rated Class 3 for outdoor recreation.

The lack of high capability ratings within the watershed does not necessarily mean however, that its development potential is limited. For example, when it is realized that there are no Class 1 agricultural lands within the Maritime Provinces and only limited areas of Class 2 agricultural land throughout New Brunswick and Nova Scotia, the land in the watershed compares favourably with that of the region.

The Canada Land Inventory Integrated Capability Map (Figure 6, end pocket) represents an attempt to identify the areas with the highest capability for each resource sector. This was achieved by plotting the following information in the sequence indicated.

1. Cleared land with agricultural capability ratings of Classes 2, 3 or 4.
2. Land with wildlife (waterfowl) capability ratings of Classes 1, 2 or 3.
3. Land with an outdoor recreation capability rating of Class 3.
4. Forested land with a capability rating of Class 3 or 4 for forestry.
5. Forested land with agricultural capability ratings of Classes 2 and 3.

In some places the areas of comparatively high capability for the different resource sectors overlap and thus the map can be used to point out not only the potential uses of the area but also the potential conflicts of use which may arise.

[25] The fact that the Queens soils, which were rated in the original CLI Survey as Class 3 for agriculture, are now considered to be Class 4 would reduce the percentage of Class 3 agricultural land from 39.7 per cent to 6.6 per cent.

The cleared land with an agricultural capability rating of Classes 2 and 3 extends along the valley and onto the upland from Middle Musquodoboit to Newcomb Corner. In addition, isolated areas of cleared Class 2 and 3 land are found on the upland soils. There is a limited acreage of cleared Class 4 agricultural land centred primarily on upland soils extending from Upper Musquodoboit to the northeast boundary of the watershed.

The areas with high capability for waterfowl production are located along the intervale lands and associated ponds. Some of these areas have been cleared and also have high capability for agriculture; for example, in the Meaghers Grant and Elderbank—Middle Musquodoboit reaches of the valley. The reversion of some of this land to pasture provides a habitat suitable for the production of wildlife as well as grazing.

Except for the lower portion of the watershed, the capability of the land for the growth of commercial forests is fair to good (Figure 6). Large portions of the watershed are presently forested and also have capability for agricultural use. However, due to the amount of cleared land in the valley at present and the cost of clearing land, it is doubtful if any significant portions of the watershed will be cleared in the near future for agricultural use.

The areas of highest capability for outdoor recreational use are around the shores of Dollar Lake, Shaw Big Lake, Sherlock Lake and Mill Lake. Portions of the Class 3 recreation areas have high capability for other uses as well, for example forestry, and this may result in conflicts of use.

An indicative land-use plan

Conflicts of use may arise not only between resource sectors but also as the result of pressures from outside the watershed, in particular from the Halifax-Dartmouth area (the demand for cottage sites, building sites, etc.). The Indicative Land-use Plan (Figure 7, end pocket) represents a combination of the integrated land-capability data (Figure 6) and the social and economic information collected by interviews. Within the watershed, the main purpose of the plan is to outline general areas for certain types of uses with particular reference to outlining areas where major investments to agriculture should be concentrated.

In analyzing the plan, the basic division of the valley into cleared and uncleared land is comparable to "farmscape" and "wildscape" suggested by Coleman (1969). The basic economy of the Musquodoboit valley has historically been divided between forestry and farming. Other forms of land use, including urban uses, are beginning to increase in relative importance and are likely to increase still more in the future, however, they do so at the expense of either forestry or agriculture. This raises potential conflicts between agriculture and other land uses. However, given the present state and future prospects of agriculture in the Musquodoboit valley, it seems likely that even after the land requirements of the viable agriculture sector have been met and other uses have been accommodated, a surplus of cleared land will still remain which could be converted to other uses in the future.

The plan should be considered only as a guide to the future use of land in the watershed. It indicates those areas which appear suitable for specific types of land use in the future, but does not preclude them from other forms of land use. The absence of a specific type of indicated land use suggests however, that any proposed development in these areas should be given careful scrutiny before being approved.

Agriculture

The area proposed for agriculture (Figure 7) comprises land adjacent to the river, including some intervale land, from Upper Musquodoboit to Elderbank, with two extensions onto the upland soils. The larger extension is located on upland (primarily Queens) soils in the Middle Musquodoboit to Newcomb Corner area, and the smaller area extends from Upper Musquodoboit to the northeast boundary of the watershed.

TABLE 7. "Viability Scale" for full-time farmers in the Musquodoboit valley, 1968

Viability scale	Number of farmers	Total acreage	Total arable acreage	Total arable acreage subject to flooding	Total arable acreage not subject to flooding	Total gross crop & livestock income ($)	Average arable acreage	Average gross crop & livestock income ($)
Long-term viable farms	15	9,870	3,016	650	2,366	475,720	201	31,715
Short-term viable farms	7	3,283	888	275	613	87,320	127	12,474
Questionable viability	13	4,927	1,292	188	1,104	84,639	99	6,511
Doubtful viability	11	7,301	1,188	30	1,158	69,908	108	6,355
Non-viable	11	3,310	907	65	842	26,430	82	2,403
All farms[26]	57	28,691	7,291	1,208	6,083	744,017	128	13,053
Percentage of total for area		39	52	59	51	96		
Total for area		74,426	14,003	2,060	11,943	777,252[27]		

The agricultural area coincides largely with the cleared agricultural land located on Class 3 soils (85 per cent of which are now considered as Class 4). It is closely related to the lands held by the viable farmers identified in the interview survey. Fifty of the fifty-nine large and small-scale farmers are located within the area where it is suggested that agriculture should be concentrated.

Agriculture is, at present, being carried on outside the area outlined for agriculture on the indicative land-use plan. For example, a comparison of Figures 6 and 7 reveals that there are areas outside the designated agriculture area, near Meaghers Grant, immediately south of Elderbank, and at Hutchinson Settlement, as well as scattered areas located on upland soils, where land has been cleared and agricultural activity is taking place. This does not mean that agriculture should not continue in these areas, but any major public investments proposed for enterprises located outside the main designated area should be examined thoroughly before implementation.

Of the total 57 farmers[26] (large and small-scale) reported in the landowner classification, the actual number of truly-viable farm operations is less than 25 (Table 7). The viability scale was defined as follows:

Long-term viable farms	Over $10,000 gross crop and livestock income in 1968; operator is young or has a son who is a prospective farmer; considers farming his main occupation; indicated a desire to expand.
Short-term viable farms	Over $10,000 gross crop and livestock income in 1968; but income dropped below that figure the following year; operator is over 60 years of age; does not consider farming his main occupation; undecided about expansion or does not want to expand.
Questionable viability	Gross crop and livestock income between $4,000 and $10,000 in 1968; operator wants to expand or is undecided about expansion.
Doubtful viability	Gross crop and livestock income between $4,000 and $10,000 in 1968; operator does not want to expand.
Non-viable	Gross crop and livestock income less than $4,000 in 1968.

Only those landowners who depend on the sale of crop and livestock products for their major source of income, i.e. the large and small-scale farmers are included in Table 7. These 57 full-time farmers received $744,017 from the sale of crop and livestock products (96 per cent of the total gross farm income reported), and thus only $33,235 was to be shared among the remaining 28 part-time farmers[27].

There is a wide range in incomes among full-time farmers, and only the first two groups (which comprise the large-scale farmers) are truly viable at present. All of the long-term viable farmers are young or have a son who is a prospective farmer and indicated a desire to expand their farm operations. The seven short-term viable farmers also have gross incomes of more than $10,000 from the sale of crop and livestock products, but their average income is only $12,474. Because of various factors such as age, a change in farm operations, off-farm employment or indecision about expansion, the future of these farmers is in doubt over the long term, but they are considered to be viable over the short term.

The farmers of questionable viability were either undecided about expanding their operations or expressed a desire to expand, but in this case major inputs would be required to bring the operations up to a viable scale. The farmers of doubtful viability indicated that they did not wish to expand their operations. Eleven were classed as "non-viable" full-time farmers, who had gross crop and livestock incomes of less than $4,000 annually, but this group includes one operator who will eventually take over the long-term viable operation of a relative.

Using the census definition of a farm "...an agricultural holding of one acre or more with sale of agricultural products, during the 12-month period prior to the census, of $50 or more", (Census of Canada, 1966), 85 farms could be recognized from the interview data. Many of these, however, were small-scale or part-time operations. The landowner classification revealed that there were a total of 59 large and small-scale farmers in the valley. The "viability scale" (Table 7) further refines this number and only 22 farmers could be considered the real commercial core of agriculture in the watershed.

An attempt was made to determine within the farm group not only those presently viable operators, but also to consider legitimate candidates for expansion where there was a reasonably good prospect for achieving the viable level. A committee consisting of the local Agricultural Representative, the local Resource Development Officer and the Chairman of the Agricultural Committee of the Musquodoboit Rural Development Board considered the operations identified as the commercial core of agriculture in the valley. The personal knowledge of these individuals, regarding the Musquodoboit valley and the individual farm operators, added a new dimension which was not possible to obtain from the interview information, particularly in relation to the management ability and future plans of the individual farmers. A total of 21 farm operators were considered to be either viable in the long term or candidates for expansion. With respect to their "viability scale" the breakdown is as follows: 15 farmers were considered to be viable in the long term, two viable in the short term, three of questionable viability and one classed as non-viable, although this latter operation would be combined with the long-term viable operation of a relative.

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[26] Two small-scale farmers were excluded because the major source of their income was derived from non-farm sources, and includes one viable farmer whose operation will be taken over by a non-viable relative.

[27] A total of 85 respondents reported that they received income from farming operations, but data were not collected from the non-resident and other landowner groups.

The total agricultural area in Figure 7 is approximately 20,000 acres, of which approximately 6,850 acres are presently held by long-term viable farmers and candidates for expansion. Bearing in mind that a desirable minimum size of farm for economic agriculture in the area is in the order of 350 acres, it is apparent that sufficient land is available for those who are most likely to become and remain the long-term viable farmers.

Wildlife[28]

The water-control dams constructed under the ARDA program were built to stabilize water levels on the Musquodoboit River by holding back floodwaters in the headlands. However, little use can be made of the resulting impoundments for waterfowl production due to the low productivity of the habitat in the headlands. The wetlands considered to be of prime importance for waterfowl production (CLI Classes 1 to 3) are located mainly in the intervale lands between Middle Musquodoboit and Bayer Lake. The greatest benefit of stabilized water levels for waterfowl production and management would be in these prime waterfowl-producing intervale lands.

The indicative land-use plan (Figure 7) indicates four wildlife management areas where it is suggested that land be acquired at key locations and converted to the production and management of wildlife, primarily waterfowl. In all cases, the sites are rated Class 3 or better, according to the CLI capability for waterfowl; and have relatively low capabilities for development by the other land-use sectors. The total area involved in these wildlife-management units is 1,177 acres.

Area 1

This is an area of approximately 700 acres of primarily intervale land located downstream from Middle Musquodoboit (Figure 7). This site consists of 275 acres of wetland, 239 acres of pasture and 186 acres of upland, and, assuming reasonable costs of acquisition ($5 to $10 per acre for wetland, $30 to $40 per acre for pasture and $15 per acre for upland) its total cost of acquisition would be in the range of $11,000 to $15,000 (1969 values).

In the westerly portion of the site (330 acres), the soils are imperfectly drained and rated as only Class 5 for agriculture, but as Class 3 for waterfowl. It is therefore suggested that this portion be used exclusively for the purpose of production and management of wildlife, primarily waterfowl. In the easterly portion of the site (370 acres), the intervale lands are presently used for pasturing cattle and there are long-term viable farm operations located within the site. The possibility of integrated waterfowl-agriculture use in this portion of the site should be seriously considered. It might be necessary to fence off the wildlife habitats from the agricultural area (except for stock watering areas) to protect nesting sites and prevent destruction of vegetation. This would allow the area's potential for wildlife to be utilized without affecting the greater part of idle, but improved Classes 2, 3 and 4 agricultural land which could still be utilized for cattle pasture.

In managing this area for wildlife production it would be essential to maintain the water levels at or about the present spring heights. The topography of the area is very irregular and if flooded would offer an excellent variety of habitats for Black Ducks and Wilson's Snipes, and it is highly probable that the islands created by flooding would be attractive to geese as nesting sites. A permanent water body in this area would also create a habitat suitable for muskrats.

The maintenance of the water levels would involve the construction of about seven water-control structures, the approximate cost of which was estimated (in 1969) to be $7,300. The total cost of the project would be reduced by leasing grazing rights on lands that are not of importance to the primary purpose of waterfowl production.

A reduction in the cost of acquiring the land might be achieved by investigating means other than outright acquisition of land, for example, the leasing of grazing rights to the original owner for those lands not of importance for management purposes, and the possibility of easements. The fact that the area suggested for integrated use by waterfowl and agriculture would probably not involve any expenditure of funds for land acquisition, but merely a management program, would mean that the cost of developing and maintaining such an area would be minimal.

Area 2

Located on a small tributary of the Musquodoboit River near Meaghers Grant (Figure 7), this tract of land comprises approximately 240 acres. Acquisition costs of the land, which consists of about 57 acres of wetland, 148 acres of pasture and 35 acres of woodland (assuming the price of woodland is $15 per acre), would be in the order of $5,250 to $7,000 (1969 value). Four control structures to maintain high-water levels would cost approximately $4,500 and dyking might be necessary. The creation of permanent ponds would increase the area's attractiveness for muskrat as well as maintaining a suitable habitat for nesting waterfowl. Wildlife production at the site would be compatible with a limited amount of day-use for recreation such as picnicking.

Area 3

This area is located just downstream from site 2 (Figure 7). Two small streams flow into this marsh, one of which drains Christopher Lake. The proposed site includes approximately 76 acres, primarily wetland, and at $5 to $10 per acre, the acquisition cost would be $380–$760 (1969 values). The erection of a water-control structure, at an estimated cost of $2,500, across the

[28] Based on CLI data, and field-survey information in a report by P. B. Dean, *Musquodoboit Land Use Plan: Waterfowl Report*, Sackville, N.B., October, 1969, (unpublished).

outlet of the stream at its confluence with the Musquodoboit River, would stabilize the water level and create a pond of approximately 20 acres in size. A low dyke might be necessary around the end of the inlet, where the waters would come close to overflowing into the main rivers; this could only be determined by a more detailed land survey.

Area 4

Area 4 consists of a natural basin of 161 acres beside the Musquodoboit River, immediately west of Elderbank. A small stream flows through and could be controlled by a single structure where the stream leaves the basin. Acquisition costs of the present 14 acres of pasture and 147 acres of wetland should be about $1,555 to $2,030. The estimated construction costs, which include the cost of fill to be used for dyking and excavation work, would total $3,500 (1969 values).

Other possibilities for enhancement of wildlife production in the valley include a deer-management yard, a pheasant-hunting preserve, and a put-and-take fishery for some of the reservoirs. However, all of these suggestions would require additional research to indicate their feasibility.

Recreation

None of the lands in the Musquodoboit valley are rated higher in the CLI land capability for recreation than Class 3, but these are considered to have moderately high capability for recreational use (Figure 6). In terms of relative importance, the recreational activities for which the area appears to be suited are: camping, cottaging, canoeing, hunting, fishing, boating, wildlife viewing and various trail-associated activities.

Rather than offering a detailed plan for implementation within the recreation sector, emphasis is placed on providing directions for recreation developments and establishing land-use guidelines for areas, with only general suggestions as to possible development programs.

The CLI recreation-capability classification was used as a base to outline areas of high potential for outdoor recreation. The areas have been delineated either to protect a particular site or to ensure that it is put to its best use. Of the nine recreation areas shown on the indicative land-use plan (Figure 7), the only exception to this is the area between Elmsvale and Middle Musquodoboit which is the site of a provincial picnic park. Seven of the areas are associated with lakes and/or reservoirs formed by dams on these lakes. The remaining area is located in the lower stretch of the River; it was designated for recreational use because of its aesthetic qualities. The lower section of the valley is also being considered for inclusion in the new Ship Harbour National Park.

Mill Lake, Upper Mill Lake and the reservoir associated with dam 14, Shaw Big Lake, Beaver Lake, and Dollar Lake are considered suitable for cottage development. From the point of view of resource allocation, the growth of cottages needs to be regulated. In 1968 there were already 20 cottages on Mill Lake and 23 on Cook Lake. Although cottages have been built elsewhere throughout the Musquodoboit valley, it is suggested that further cottage developments be channelled into these four locations where planned development could bring about an efficient management of the resource base and allow efficient servicing of cottage sites. The designation of these areas for cottage development should not preclude other forms of recreational use. For example, there is a fine sand beach located at the north end of Dollar Lake and it is suggested that this beach and the area immediately adjacent to it be considered for acquisition by the province or municipality for development as a public beach and camping park. Areas around the other three lakes are also suited for other forms of recreation. For instance, there appears to be a possibility of developing an upland recreation complex centered on the Mill Lake, Upper Mill Lake, reservoir water system. However, such proposed development would require further detailed study to assess the possibilities of a large development of this type.

Recreation areas have also been indicated around Brown Lake, Cook Lake and Lay Lake (Figure 7). Although these lakes are relatively small and do not rate high in the CLI recreation-capability classification, it is suggested that they be retained for general recreation purposes and for the protection of resources. Some recreational development has already taken place around these lakes.

With respect to all of these areas designated for recreation, two types of policies and programs are suggested: the protection of the physical resources and the planned development of these areas on the basis of their physical capability and use potential. Protective policies and programs should be aimed at pollution control: garbage-dump siting, location of sawdust heaps and sewage-disposal facilities including septic tanks. Implementation of the Forest Improvement Act (Province of Nova Scotia, 1968) to eliminate clear cutting of woodland immediately adjacent to lakeshores would aid in retaining the natural quality of the landscape.

In conjunction with the recreation areas, three conservation areas are outlined on the indicative land-use plan (Figure 7). These areas are designated primarily to control ribbon development with some opportunities for management for recreation. For example, in the Meaghers Grant area, the portion encompassing wildlife areas 2 and 3, extending above Meaghers Grant is outlined as a conservation area to prevent unrestricted development from occurring. The portion of the area which includes the Musquodoboit River below Meaghers Grant and centred on Crawford Bridge is designated for conservation in order to preserve the scenic and aesthetic qualities of the river gorge. The areas near Reynolds and

Middle Musquodoboit are designated for conservation purposes in order to control ribbon development along the roads in these two areas.

These conservation areas would serve as "buffer zones" against haphazard urban development, while at the same time protecting the quality of the landscape from undesirable encroachment and providing possibilities for recreational use. These areas should be seen in this light and be recognized as an important component of the over-all land-use plan for the valley.

Forestry

An assessment of the role to be played by forestry in the development of a land-use plan is complex. It is quite simple to the extent that it will rarely require a specific change of use since there is little incentive at present to convert cleared land to forest. Conversely, agriculture and other land uses are unlikely to require significant clearing of land presently under forest. It is difficult in that there has been no clearly enunciated policy with respect to the role of small, private woodlots in the provincial economy. In addition, the lack of basic information regarding growth rates of species and an inventory of physical capability of the area to support commercial forest production has hampered the development of a sound forest-management program. Both the provincial forest inventory and the CLI forest-capability classification program should provide much needed information in this regard.

Forestry is both the main user of land in terms of area of the watershed, and also the residual user. Substantial proportions of the forested area are either Crown lands or managed by forestry firms (Figure 7). In several cases these blocks are relatively small, but there appears to be opportunity in the future for the development of a rational management policy for all lands under forest. However, such a policy is not a matter for this study.

With regards to the withdrawal of land from forestry, the areas concerned are mainly those with potential for recreation or wildlife development. In both cases the areas concerned are mainly shorelands (Figures 6 and 7).

Urban development

One of the major problems which must be faced in land-use planning in rural areas, especially in the urban shadow of an expanding metropolitan area, is the control of ribbon development along existing roads. This problem is present in the Musquodoboit valley.

Areas where additional residential development should be concentrated, in an attempt to limit such uneconomic and wasteful use of land, are indicated in the indicative land-use plan (Figure 7). There are five major areas designated for such use: Musquodoboit Harbour, Lower Meaghers Grant—Meaghers Grant, Elderbank, Middle Musquodoboit and Upper Musquodoboit. These outlined areas are all centred on existing settlements and it is suggested that any further residential development should be associated with these existing communities. In 1966, the unincorporated centres on which the outlined areas are centred contained approximately 2,300 people, a 4 per cent increase over 1961.

Approximately 2,800 acres have been designated for use as urban development on the indicative land-use plan. On the basis of past and anticipated future growth, the amount of land should be more than adequate to accommodate the residential needs in the valley over the medium to long-term.

Ribbon development should be controlled along all major roads within the watershed. Specific areas along major roads in the valley are outlined as conservation areas on the indicative land-use plan for protection from ribbon development. Although some houses already exist within these areas, a special effort should be made to ensure the protection of the landscape from further uncontrolled development.

Study results

The development of a land-use plan for the Musquodoboit watershed does not necessarily solve all the problems of the area. The study was not all-inclusive in that those rural residents owning less than five acres of land were excluded as well as those living in the unincorporated settlements scattered throughout the watershed. On the basis of the land-use plan, fewer people would earn their income from farming operations than is the case at present. A comprehensive plan for the area—its resources and people—could only be developed after additional assessment of the possibilities of retraining marginal farmers or those who wish to leave farming.

Principal findings

1. Of 300 rural property owners in the Musquodoboit River watershed owning five acres or more of land, only 59 could be considered farmers. Only 22 farmers had gross incomes from the sale of crop and livestock products in 1968 of $10,000 or more. These 22 farmers accounted for 74 per cent of the area's gross farm income. Fifteen of these 22 large-scale farmers were considered to be viable in the long-term, an additional six operators were considered to be candidates for expansion. Therefore, it is expected that a total of 21 farm operators will form the basic component of future commercial agriculture in the valley.

2. Four groups of landowners—the non-residents, viable non-farmers, low-income non-farmers and the elderly—whose major source of income is from non-farm sources, accounted for 76.1 per cent of all landowners interviewed. According to this survey, they controlled 57.4 per cent of the total acreage, 43.2 per cent of the total arable acreage, and 41.9 per cent of the total arable acreage subject to flooding.

3. Resource-based income is derived from farming and forestry operations; however, forestry accounts for only about 7 per cent of the total gross income from resource-based activities as reported by the landowners interviewed.

4. Approximately 76 per cent of the estimated net cash income earned by landowners from all sources was from non-resource-based activities. The husband's off-farm income alone accounted for 46.5 per cent of the estimated total net cash income; this is nearly double the estimated net cash income from farming and forestry operations.

5. Only 5 per cent of the interviewed landowners had estimated net income of $10,000 or more in 1968 and approximately 54 per cent received less than $4,000 per annum. The farmer groups are scattered throughout the income range of $1,000 to $10,000 and over. They also have the highest median incomes as approximately 49 per cent had estimated net incomes of $6,000 or more in 1968. In contrast, the non-farm group (less than 66 years of age) had only 24 per cent with estimated net cash incomes of $6,000 or more.

6. The Canada Land Inventory indicated that there were 14,650 acres of cleared land (improved pasture, cropland and rough pasture) located in the watershed. The landowner interviews, which accounted for virtually all of the improved farmland, indicated that 14,003 acres were arable. A detailed field survey of land use carried out in 1969 revealed that there were 21,619 acres of cleared, non-forested land in the watershed; 13,788 acres were regularly used for agriculture (cultivated land and improved pasture).

7. Approximately 2,060 acres (53 per cent) of the acreage subject to flooding is arable and only 1,168 acres (30 per cent) is held by the two farmer categories—large and small-scale farmers. The long-term viable farmers and candidates for expansion hold only approximately 745 acres (31 per cent) of the improved (arable) land subject to flooding. Although the floodplain land is superior in quality to other land in the watershed and the benefits of protected floodplain land will only be

realized over a period of time, the flood-control program appears to have been very expensive in relation to the potential benefits and alternative means of improving agriculture in the valley.

8. The valley faces a problem which it shares with most other agricultural areas of the Maritimes—fragmentation of land holdings. Although a program of farm enlargement has been pursued through the Nova Scotia Farm Loan Board, the result, due to the availability of property, has tended to be increased farm fragmentation. A program of land consolidation is required to make optimal use of the land resources for agriculture in the valley. In total there are only 21 farmers who are likely to form the core of commercial agriculture in the valley over the next few years, and 15 of these operators produce fluid milk.

9. Although the valley does not possess outstanding features which would attract tourists, its location in relation to the expanding Halifax-Dartmouth metropolitan area make it potentially important as a recreational area for day-use. The valley is also likely to become increasingly important as a residential area for those who choose to live in the valley and work in Halifax-Dartmouth. If such use is to be made of the valley, it is important to preserve the natural features and environmental quality of the watershed by controlling ribbon development and setting aside certain key sites for wildlife management now.

Conclusion

The indicative land-use plan for the Musquodoboit valley (Figure 7, end pocket) provides a spatial framework, for the medium to long term, in which present social and economic trends can be accommodated with minimum conflict. These trends include the decline of subsistence-type farming and its replacement by a smaller number of agricultural units which have a reasonable prospect of economic security and prosperity in the future; the development of a major metropolitan centre in the Halifax-Dartmouth area and the consequent increasing demands on the recreational and residential opportunities in the Musquodoboit valley; a growing concern for the maintenance of environmental quality and for the conservation of wildlife as an essential part of that environment. To a large extent, these factors are complementary to each other.

Agriculture in the Musquodoboit valley faces problems common to other agricultural regions of the Maritime Provinces. It suffers from a limited market resulting from a weak competitive position in current agricultural markets, and also the limitations imposed by the fragmented property pattern and landownership structure. Consequently, many of the farms in the valley are little above the subsistence level while those that are viable in the long term tend to produce products for the local consumer markets, such as fluid milk for the Halifax-Dartmouth metropolitan area.

On the basis of information concerning cleared land, soil capability for agriculture and other information obtained in the interview program, it is possible to outline areas where it is suggested that future investments in agriculture be concentrated (Figure 7, end pocket). The area proposed for agriculture in the indicative land-use plan comprises an area along the river, including some intervale land, from Upper Musquodoboit to Elderbank with two extensions on the upland soils. The larger area on upland soils is located in the Middle Musquodoboit to Newcomb Corner section and the smaller extension from Upper Musquodoboit to the northeast boundary of the watershed. These areas contain all of the long-term viable farmers and candidates for expansion.

The problem of immediate concern to landowners in the Musquodoboit valley is that of flooding. The original flood-control program was designed to prevent flooding of agricultural land, but only nine of the 15 proposed dams were completed. The question remains as to whether the remaining six dams should be built and the associated dredging work completed. On consideration of the costs already incurred both in control of floodwaters in the headlands and in secondary drainage works, land clearing and land consolidation, it would appear unwise to proceed with the construction of the remaining 6 dams until there is an indication that the land benefiting from the construction works already undertaken will be put to optimum use. There have been benefits to resource sectors other than agriculture, in particular to recreation. However, it would seem more logical to use additional public monies for projects such as land consolidation or development programs concerned with uses other than agriculture.

The dredging program is virtually completed in the upper part of the river (Zone-2, Figure 2), whereas in the lower part of the river (Zone-1, Figure 2) much of the dredging work originally outlined has not been completed. The dredging is regarded, by those concerned with the design of the flood-control program, as an important part of that program. It is felt that in order to realize the benefits from the flood-control work already completed and from the entire program, the dredging must be completed.

The indicative land-use plan also recognizes the influence on the valley of the expanding Halifax-Dartmouth metropolitan area in the form of demands for recreational opportunities and as a place to reside for those commuting to work in the metropolitan area. Although the valley lacks outstanding tourist attractions, its location provides real potential as a day-use area offering opportunities for activities such as camping, picnicking and cottage living.

The areas outlined for urban use on the indicative land-use plan are all centred on existing settlements. Additional lands are indicated for the expansion of

those existing communities to accommodate their anticipated growth as Halifax-Dartmouth expands and the valley becomes the residence of a growing number of people working in the metropolitan area.

In the face of increasing demands on the physical resources of the watershed, it is essential to preserve the quality of the landscape by preserving natural areas and by regulating uncontrolled development such as residential ribbon development along major roads in the valley.

Associated with the maintenance of environmental quality in the valley is the need to conserve wildlife. Four areas are outlined for wildlife (primarily waterfowl) management. One of these areas is suggested as a joint wildlife-agriculture management area where the two uses could be integrated within the area. In addition, there is the possibility that a portion of at least one of the sites could be managed and used in conjunction with a day-use recreation area.

The indicative land-use plan should not be regarded as a rigid document. It is intended only to serve as a general plan for guiding development of land use in the Musquodoboit valley in the future. As conditions change, revisions of the plan may be warranted.

Recommendations

The following recommendations are provided to serve as guidelines for the future use of land in the Musquodoboit valley.

1. *General*

(*a*) It is recommended that an official land-use plan for the Musquodoboit watershed be adopted using the indicative land-use plan prepared in this study as a basis. Regulations related to the use of land for agriculture, recreation, wildlife, forestry, urban and industrial development should be specified in such a plan.

(*b*) Due to the limitations of the market in directing land to its best use, especially with regard to the development of agriculture, forestry and recreation, some mechanism should be required to facilitate the consolidation of land for specific uses and the transfer of land to other or better uses. Such a program might be possible through the Nova Scotia Resources Development Board if it were given the authority to purchase, sell, lease or hold land for development. In order to effectively carry out such a program, basic information on property boundaries and land ownership would be required. To provide this information, the ongoing coordinate survey, mapping and land-registration program in the province should be extended to include the Musquodoboit River watershed as soon as possible.

(*c*) A thorough evaluation of the entire flood-control program in the valley is required. Such a study should examine the costs and benefits of flood-control works completed to date as well as evaluate the cost of constructing the remaining six dams, the remaining dredging works and the resultant benefits likely to be derived from such construction.

2. *Agriculture*

(*a*) The area delineated for agriculture includes an area along the river and some of the adjacent intervale lands from Upper Musquodoboit to Elderbank. In addition, there are two extensions onto the upland soils; one in the Middle Musquodoboit-Newcomb Corner area and the other from Upper Musquodoboit to the northeastern boundary of the watershed. Investments in agriculture outside these areas should be seriously questioned.

(*b*) A program of land transfer and consolidation is suggested as an alternative to the construction of additional flood-control works as a means of expanding and improving farm operations. Such a program would require the cooperation of the Nova Scotia Department of Agriculture and Marketing as well as the provincial government's loaning agency. Land for consolidation purposes should be leased only to farmers who have shown a high degree of management ability and have developed a plan for their individual farms.

(*c*) Development priorities should be based on:

(i) satisfying the land requirements of the viable or potentially-viable farmers according to the model which best fits their needs in terms of economics and the land base.

(ii) residual land should be available for non-commercial farmers. However, these farmers should not expect to reap directly the benefits of programs geared to commercial farmers.

(*d*) Additional research is required on the types of crops that can best be grown on floodplain land which is protected by existing flood-control structures.

3. *Wildlife*

Due to the increasing concern expressed over the need to maintain environmental quality and for the conservation of wildlife, particularly waterfowl, as a necessary component of that environment, it is recommended that four waterfowl-management areas, be established. Of these it is suggested that one be a joint wildlife-agriculture management area. It is recommended (1) that the four areas should be secured by purchase or long-term lease as public lands; (2) that the suggested water-control structures be erected to stabilize water levels in the wildlife-management units; (3) that Areas 1 and 2

should have first priority, Area 4 second priority and Area 3 third priority; (4) that the areas be managed to their highest capability to produce ducks, geese and muskrat; and (5) where desirable, as the result of surrounding development, and where compatible with the primary purpose of the areas, recreational developments such as picnic sites, walking trails and lookout sites could be established in and around the wildlife-management units.

4. *Recreation*

Due to the location of the watershed relative to the Halifax-Dartmouth area, there is much potential for the use and development of the area's resources for day-use recreational activities. It is recommended that areas be designated immediately for recreational use, to ensure the protection of the physical resources within them and to ensure that development would be in the manner best suited to their resource base and use potential.

5. *Residential Development*

The potential importance of the watershed as a residential area for persons employed in the Halifax-Dartmouth area is very real. To ensure that such anticipated development is not detrimental to the area, it is recommended that future growth be encouraged in existing communities in the area and that ribbon development be controlled.

6. *Comprehensive Development Program*

On the basis of the earlier studies (Connor, 1964; Connor and Magill, 1965) and the present study, a great deal of information is available to form a comprehensive development plan for the watershed. The Musquodoboit Rural Development Board should work closely with the Regional Planning Commission for the municipality of the County of Halifax and the Planning Advisory Board to incorporate the recommendations of these reports into a comprehensive or regional development plan for the area.

Appendices

Appendix 1

Land use by landowner group, Musquodoboit valley, 1969[1]

Landowner groups	Land-use classes														
	Acreage subject to flooding					Acreage not subject to flooding					Total acreage				
	Arable (improved)	Rough pasture	Forested	Waste-land	Total	Arable (improved)	Rough pasture	Forested	Waste-land	Total	Arable (improved)	Rough pasture	Forested	Waste-land	Total
Non-residents															
Acres held	60	620	—	10	690	663	362	9,517	—	10,542	723	982	9,517	10	11,232
% of group's total	8.7	89.8	—	1.5	100	6.3	3.3	90.4	—	100	6.4	8.8	84.7	0.1	100
% of class total	2.9	45.0	—	5.1	17.7	5.6	14.2	17.3	—	14.9	5.2	25.0	17.2	0.8	15.1
Viable non-farmers															
Acres held	351	183	5	25	564	2,152	856	11,198	86	14,292	2,503	1,039	11,203	111	14,856
% of group's total	62.3	32.4	0.9	4.4	100	15.0	6.0	78.4	0.6	100	16.8	7.0	75.4	0.8	100
% of class total	17.0	13.3	2.0	12.8	14.5	18.0	33.5	20.3	8.9	20.3	17.9	26.4	20.2	9.5	20.0
Low-income non-farmers															
Acres held	234	93	—	45	372	1,362	291	5,948	13	7,614	1,596	384	5,948	58	7,986
% of group's total	62.9	25.0	—	12.1	100	17.9	3.8	78.1	0.2	100	20.0	4.8	74.4	0.8	100
% of class total	11.4	6.8	—	23.0	9.6	11.4	11.4	10.8	1.3	10.8	11.4	9.8	10.8	5.0	10.7
The elderly															
Acres held	219	39	10	8	276	1,003	266	6,922	190	8,381	1,222	305	6,932	198	8,657
% of group's total	79.4	14.1	3.6	2.9	100	12.0	3.2	82.5	2.3	100	14.1	3.4	80.3	2.2	100
% of class total	10.6	2.8	3.9	4.1	7.1	8.4	10.4	12.6	19.6	11.9	8.7	7.8	12.5	17.0	11.6
Large-scale farmers															
Acres held	845	192	210	75	1,322	2,979	185	8,467	85	11,716	3,824	377	8,677	160	13,038
% of group's total	63.9	14.5	15.9	5.7	100	25.4	1.6	72.3	0.7	100	29.3	2.9	66.6	1.2	100
% of class total	41.0	13.9	82.4	38.3	34.0	24.9	7.2	15.4	8.8	16.6	27.3	9.6	15.7	13.8	17.5
Small-scale farmers															
Acres held	323	212	30	33	598	3,211	488	11,013	571	15,283	3,534	700	11,043	604	15,881
% of group's total	54.0	35.5	5.0	5.5	100	21.0	3.2	72.1	3.7	100	22.3	4.4	69.5	3.8	100
% of class total	15.7	15.4	11.8	16.8	15.4	26.9	19.1	20.0	59.0	21.7	25.2	17.8	20.0	51.9	21.3
Other landowners															
Acres held	28	38	—	—	66	573	105	2,010	22	2,710	601	143	2,010	22	2,776
% of group's total	42.4	57.6	—	—	100	21.1	3.9	74.2	0.8	100	21.6	5.2	72.4	0.8	100
% of class total	1.4	2.8	—	—	1.7	4.8	4.1	3.6	2.3	3.8	4.3	3.6	3.6	1.9	3.7
All landowners															
Acres held	2,060	1,377	255	196	3,888	11,943	2,553	55,075	967	70,538	14,003	3,930	55,330	1,163	74,426
% of group's total	53.0	35.4	6.6	5.0	100	16.9	3.6	78.1	1.4	100	18.8	5.3	74.3	1.6	100
% of class total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

[1] These data refer to properties in the Musquodoboit River watershed that are owned outright, as well as those leased (if any) from the Nova Scotia Farm Loan Board by landowners contacted in the landowner-interview program.

Appendix 2

Income distribution of major landowners in the Musquodoboit valley, 1968[1]

Income classes	Viable non-farmers		Low-income non-farmers		The elderly		Large scale farmers		Small scale farmers		All landowners reporting income	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Gross forestry income												
$ 0– 499	7	41.2	4	36.4	5	71.4	—	—	8	36.4	24	37.5
500– 999	3	17.6	5	45.4	1	14.3	3	42.9	4	18.2	16	25.0
1,000– 2,999	6	35.3	2	18.2	1	14.3	4	57.1	8	36.3	21	32.8
3,000 & over	1	5.9	—	—	—	—	—	—	2	9.1	3	4.7
All households reporting	17	100	11	100	7	100	7	100	22	100	64	100
Gross farm income												
$ 0– 499	6	40.0	4	57.1	2	50.0	—	—	—	—	12	14.1
500– 999	7	46.7	1	14.3	1	25.0	—	—	1	2.7	10	11.8
1,000– 1,999	2	13.3	2	28.6	1	25.0	—	—	8	21.6	13	15.3
2,000– 2,499	—	—	—	—	—	—	—	—	11	29.8	11	12.9
2,500– 4,999	—	—	—	—	—	—	—	—	10	27.0	10	11.8
5,000– 7,499	—	—	—	—	—	—	—	—	2	5.4	2	2.3
7,500– 9,999	—	—	—	—	—	—	—	—	5	13.5	5	5.9
10,000–12,499	—	—	—	—	—	—	3	13.6	—	—	3	3.5
12,500–14,999	—	—	—	—	—	—	—	—	—	—	—	—
15,000 & over	—	—	—	—	—	—	19	86.4	—	—	19	22.4
All households reporting	15	100	7	100	4	100	22	100	37	100	85	100
Off-farm income												
$ 0– 999	—	—	5	11.9	7	15.2	8	38.1	4	12.9	24	11.1
1,000– 2,999	6	7.9	24	57.1	33	71.7	8	38.1	14	45.2	85	39.4
3,000– 4,999	30	39.5	13	31.0	3	6.5	2	9.5	5	16.1	53	24.5
5,000– 6,999	24	31.6	—	—	1	2.2	—	—	4	12.9	29	13.4
7,000– 7,999	8	10.6	—	—	1	2.2	2	9.5	2	6.5	13	6.0
8,000– 9,999	3	3.9	—	—	1	2.2	—	—	1	3.2	5	2.3
10,000–11,999	1	1.3	—	—	—	—	1	4.8	—	—	2	0.9
12,000–13,999	3	3.9	—	—	—	—	—	—	1	3.2	4	1.9
14,000 & over	1	1.3	—	—	—	—	—	—	—	—	1	0.5
All households reporting	76	100	42	100	46	100	21	100	31	100	216	100

[1] The data reported in this table were compiled from information obtained in the landowner-interview program. Income data were not collected from the "non-residents" and the "other landowners".

Appendix 3

Estimates of landowners' total net cash income, Musquodoboit valley, 1968.

Landowner groups		Husband's off-farm income				Wife's off-farm income				Government transfer payments				Other off-farm income				Estimated net primary resource income**				Estimated total net cash income			
			Aggregate Income				Aggregate Income				Aggregate Income				Aggregate Income				Aggregate Income				Aggregate Income		
Group*	No. of households	No. of households reporting	$	% of estimated total net cash income	$ per household reporting	No. of households reporting	$	% of estimated total net cash income	$ per household reporting	No. of households reporting	$	% of estimated total net cash income	$ per household reporting	No. of households reporting	$	% of estimated total net cash income	$ per household reporting	No. of households reporting	$	% of estimated total net cash income	$ per household reporting	No. of households reporting	$	% of estimated total net cash income	$ per household reporting
NR	62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
VNF	76	73	321,300	75.3	4,401	20	56,900	13.3	2,845	57	25,600	6.0	449	10	15,700	3.7	1,570	26	7,217	1.7	278	76	426,717	100	5,615
LNF	42	25	57,700	60.3	2,308	0	0	0	0	39	34,900	36.5	895	1	400	0.4	400	12	2,634	2.8	220	42	95,634	100	2,277
E	48	10	22,700	21.8	2,270	3	6,900	6.6	2,300	43	60,000	57.7	1,395	7	11,300	10.9	1,614	8	3,086	3.0	386	46	103,986	100	2,261
LSF	22	5	20,600	10.6	4,120	5	13,100	6.7	2,620	20	11,000	5.7	550	7	4,100	2.1	586	22	145,769	74.9	6,626	22	194,569	100	8,844
SSF	37	16	46,500	24.9	2,906	9	22,600	12.1	2,511	27	24,300	13.0	900	9	13,100	7.0	1,456	37	80,268	43.0	2,169	37	186,768	100	5,048
O	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ALL OWNERS	300	129	468,800	46.5	3,634	37	99,500	9.9	2,689	186	155,800	15.5	838	34	44,600	4.4	1,312	105	238,974	23.7	2,276	223	1,007,674	100	4,519

* NR: Non-residents
VNF: Viable non-farmers
LNF: Low-income non-farmers
E: The elderly
LSF: Large-scale farmer
SSF: Small-scale farmer
SSF: Small-scale farmer
O: Other landowners

**Only gross primary resource income was determined in the household survey; therefore, net primary resource income had to be estimated. It was calculated according to the following rules: selection of the percentage figures used was based on an examination of several farm business studies. The per cent of gross primary resource income used to estimate net income has been increased with decreasing gross income on the assumption that fewer inputs, proportionately, are purchased by small operators than by large ones. For example, fertilizer application is usually more intensive on large commercial operations than on small marginal farms.

A—For landowner groups LSF, SSF and E:

Gross primary resource income	Net primary resource income as per cent of gross
Over $10,000	25%
$5,000 – $ 9,999	30%
$2,000 – $ 4,999	50%
Less than $2,000	65%

B—For landowner group VNF:
Net primary resource income is estimated to be 25% of gross primary resource income. It was assumed that, because of non-farm employment, little time would remain for the part-time operators to produce many of their own inputs; therefore, purchased inputs would consume a major part of gross income.

C—For landowner groups NR, and O:
Income data were not collected.

Appendix 4

Canada Land Inventory Land Capability Classifications: Descriptions of Main Classes

Agricultural land capability classification:

In this classification the mineral soils are grouped into seven classes on the basis of soil survey information. Soils in classes 1, 2, 3 and 4 are considered capable of sustained use for cultivated field crops, those in classes 5 and 6 only for perennial forage crops and those in class 7 for neither.

Some of the important factors on which the classification is based are:

The soils will be well managed and cropped, under a largely mechanized system.

Land requiring improvements, including clearing, that can be made economically by the farmer himself, is classed according to its limitations or hazards in use after the improvements have been made. Land requiring improvements beyond the means of the farmer himself is classed according to its present condition.

The following are not considered: distances to market, kind of roads, location, size of farms, type of ownership, cultural patterns, skill or resources of individual operators, and hazard of crop damage by storms.

The classification does not include capability of soils for trees, tree fruits, small fruits, ornamental plants, recreation, or wildlife.

The classes are based on intensity, rather than kind, of their limitations for agriculture. Each class includes many kinds of soil, and many of the soils in any class require unlike management and treatment.

CLASS 1: Soils in this class have no significant limitations in use for crops

The soils are deep, well to imperfectly drained, hold moisture well, and in the virgin state were well supplied with plant nutrients. They can be managed and cropped without difficulty. Under good management they are moderately high to high in productivity for a wide range of field crops.

CLASS 2: Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices

The soils are deep and hold moisture well. The limitations are moderate and the soils can be managed and cropped with little difficulty. Under good management they are moderately high to high in productivity for a fairly wide range of crops.

CLASS 3: Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices

The limitations are more severe than for Class 2 soils. They affect one or more of the following practices: timing and ease of tillage; planting and harvesting; choice of crops; and methods of conservation. Under good management they are fair to moderately high in productivity for a fair range of crops.

CLASS 4: Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both

The limitations seriously affect one or more of the following practices: timing and ease of tillage; planting and harvesting; choice of crops; and methods of conservation. The soils are low to fair in productivity for a fair range of crops but may have high productivity for a specially adapted crop.

CLASS 5: Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible

The limitations are so severe that the soils are not capable of use for sustained production of annual field crops. The soils are capable of producing native or tame species of perennial forage plants, and may be improved by use of farm machinery. The improvement practices may include clearing of bush, cultivation, seeding, fertilizing, or water control.

CLASS 6: Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible

The soils provide some sustained grazing for farm animals, but the limitations are so severe that improvement by use of farm machinery is impractical. The terrain may be unsuitable for use of farm machinery, or the soils may not respond to improvement, or the grazing season may be very short.

CLASS 7: Soils in this class have no capability for arable culture or permanent pasture

This class also includes rockland, other non-soil areas, and bodies of water too samll to show on the maps.

O: Organic soils

(Not placed in capability classes.)

Forestry land capability classification:

In this classification all mineral and organic soils are grouped into one of seven classes based upon their inherent ability to grow commercial timber. The best lands of Canada for commercial tree growth will be found in Class 1 and those in Class 7 cannot be expected to yield timber in commercial quantities; these represent the extremes. Because of unsuitable climate no Class 1 land will be found in several regions of Canada and in certain regions the Class 2 areas will be too small to show at the chosen scales of mapping.

Some of the important factors on which the classification is based are:

All known or inferred information about the unit including subsoil, soil profile, depth, moisture, fertility, landform, climate and vegetation.

Associated with each capability class is a productivity range based on the mean annual increment of the best species or group of species adapted to the site at or near rotation age. Productivity classes are expressed in gross merchantable cubic foot volume to a minimum diameter of four inches. Thinnings, bark, and branch wood are not included. The productivity as expressed is that of "normal", i.e., fully-stocked stands. It may be assumed that only good management would have produced stands of this nature.

The following are not considered: location, access, distance to markets, size of units, ownership, present state or special crops such as Christmas trees.

The classes are based on the natural state of the land without improvements such as fertilization, drainage or amelioration practices. It is realized that with improved forest management the productivity may change; to the extent that the limitations shown in the symbol may be altered, class changes may also take place. However, significant changes will only be achieved through costly and continuing practices.

CLASS 1: Lands having no important limitations to the growth of commercial forests

Soils are deep, permeable, of medium texture, moderately well-drained to imperfectly drained, have good water-holding capacity and are naturally high in fertility. Their topographic position is such that they frequently receive seepage and nutrients from adjacent areas. They are not subject to extremes of temperature or evapotranspiration. Productivity will usually be greater than 111 cubic feet per acre per year.

When required this class may be subdivided on the basis of productivity into classes 1 (111 to 130), 1a (131 to 150), 1b (151 to 170), 1c (171 to 190), 1d (191 to 210), and by 20 cubic foot classes thereafter, as necessary.

CLASS 2: Lands having slight limitations to the growth of commercial forests

Soils are deep, well-drained to moderately well-drained, of medium to fine texture and have good water-holding capacity.

The most common limitations (all of a relatively slight nature) are: adverse climate, soil moisture deficiency, restricted rooting depth, somewhat low fertility and the cumulative effects of several minor adverse soil characteristics.

Productivity will usually be from 90 to 110 cubic feet per acre per year.

CLASS 3: Lands having moderate limitations to the growth of commercial forests

Soils may be deep to somewhat shallow, well to imperfectly drained, of medium to fine texture with moderate to good water-holding capacity. They may be slightly low in fertility or suffer from periodic moisture imbalances.

The most common limitations are: adverse climate, restricted rooting depth, moderate deficiency or excess of soil moisture, somewhat low fertility, impeded soil drainage, exposure (in maritime areas) and occasional inundation.

Productivity will usually be from 71 to 90 cubic feet per acre per year.

CLASS 4: Lands having moderately severe limitations to the growth of commercial forests

Soils may vary from deep to moderately shallow, from excessive through imperfect to poor drainage, from coarse through fine texture, from good to poor moisture-holding capacity, from good to poor structure and from good to low natural fertility.

The most common limitations are: moisture deficiency or excess, adverse climate, restricted rooting depth, poor structure, excessive carbonates, exposure, or low fertility.

Productivity will usually be from 51 to 70 cubic feet per acre per year.

CLASS 5: Lands having severe limitations to the growth of commercial forests

Soils are frequently shallow to bedrock, stony, excessively or poorly drained of coarse or fine texture, may have poor moisture holding capacity and be low in natural fertility.

The most common limitations (often in combination) are: moisture deficiency or excess, shallowness to bedrock, adverse regional or local climate, low natural

fertility, exposure particularly in maritime areas, excessive stoniness and high levels of carbonates.

Productivity will usually be from 31 to 50 cubic feet per acre per year.

CLASS 6: Lands having severe limitations to the growth of commercial forests

The mineral soils are frequently shallow, stony, excessively drained, of coarse texture and low in fertility. A large percentage of the land in this class is composed of poorly drained organic soils.

The most common limitations (frequently in combination) are: shallowness to bedrock, deficiency or excess of soil moisture, high levels of soluble salts, low natural fertility, exposure, inundation and stoniness.

Productivity will usually be from 11 to 30 cubic feet per acre per year.

CLASS 7: Lands having severe limitations which preclude the growth of commercial forests

Mineral soils are usually extremely shallow to bedrock, subject to regular flooding, or contain toxic levels of soluble salts. Actively eroding or extremely dry soils may also be placed in this class. A large percentage of the land is very poorly drained organic soils.

The most common limitations are: shallowness to bedrock, excessive soil moisture, frequent inundation, active erosion, toxic levels of soluble salts, and extremes of climate or exposure.

Productivity will usually be less than 10 cubic feet per acre per year.

Recreational land capability classification:

Seven classes of land are differentiated on the basis of the intensity of outdoor recreational use, or the quantity of outdoor recreation, which may be generated and sustained per unit area of land per annum, under perfect market conditions.

"Quantity" may be measured by visitor days, a visitor day being any reasonable portion of a 24-hour period during which an individual person uses a unit of land for recreation.

"Perfect market conditions" implies uniform demand and accessibility for all areas, which means that location relative to population centres and to present access does not affect the classification.

Intensive and dispersed activities are recognized. Intensive activities are those in which relatively large numbers of people may be accommodated per unit area, while dispersed activities are those which normally require a relatively larger area per person.

Some important factors concerning the classification are:

The purpose of the inventory is to provide a reliable assessment of the quality, quantity and distribution of the natural recreation resources within the settled parts of Canada.

The inventory is of an essentially reconnaissance nature, based on interpretation of aerial photographs, field checks, and available records, and the maps should be interpreted accordingly.

The inventory classification is designed in accordance with present popular preferences in non-urban outdoor recreation. Urban areas (generally over 1,000 population with permanent urban character), as well as some non-urban industrial areas, are not classified.

Land is ranked according to its natural capability under existing conditions, whether in natural or modified state; but no assumptions are made concerning its capability given further major artificial modifications.

Sound recreation land management and development practices are assumed for all areas in practical relation to the natural capability of each area.

Water bodies are not directly classified. Their recreational values accrue to the adjoining shoreland or land unit.

Opportunities for recreation afforded by the presence in an area of wildlife and sport fish are indicated in instances where reliable information was available, but the ranking does not reflect the biological productivity of the area. Wildlife capability is indicated in a companion series of maps.

CLASS 1: Lands in this class have very high capability for outdoor recreation

Class 1 lands have natural capability to engender and sustain very high total annual use based on one or more recreational activities of an intensive nature.

Class 1 land units should be able to generate and sustain a level of use comparable to that evident at an outstanding and large bathing beach or a nationally known ski slope.

CLASS 2: Lands in this class have a high capability for outdoor recreation

Class 2 lands have natural capability to engender and sustain high total annual use based on one or more recreational activities of an intensive nature.

CLASS 3: Lands in this class have a moderately high capability for outdoor recreation

Class 3 lands have natural capability to engender and sustain moderately high total annual use based usually on intensive or moderately intensive activities.

CLASS 4: Lands in this class have moderate capability for outdoor recreation

Class 4 lands have natural capability to engender and sustain moderate total annual use based usually on dispersed activities.

CLASS 5: Lands in this class have moderately low capability for outdoor recreation

Class 5 lands have natural capability to engender and sustain moderately low total annual use based on dispersed activities.

CLASS 6: Lands in this class have low capability for outdoor recreation

Class 6 lands lack the natural quality and significant features to rate higher, but have the natural capability to engender and sustain low total annual use based on dispersed activities.

CLASS 7: Lands in this class have very low capability for outdoor recreation

Class 7 lands have practically no capability for any popular types of recreation activity, but there may be some capability for very specialized activities with recreation aspects, or they may simply provide open space.

Waterfowl land capability classification:

In general, the needs of all waterfowl are much alike; each individual and species must be provided with a sufficient quality and quantity of food, protective cover, and space to meet its needs for survival, growth, and reproduction. The ability of the land to meet these needs is determined by the individual requirements of the species or group under consideration, the physical characteristics of the land, and those factors that influence the plant and animal communities.

The land is divided into units on the basis of physiographic characteristics important to waterfowl populations. The degree of limitation associated with each unit determines its capability class. The subclass denotes the primary factor that causes the limitation.

This classification system is based on two important considerations.

Capability ratings are established on the basis of the optimum vegetational stage (successional stage) that can be maintained when good wildlife management is practiced.

Capability ratings assigned do not reflect present land use (except in extreme cases such as heavily populated urban areas), ownership, lack of access, distance from cities, or amount of hunting pressure.

CLASS 1: Lands in this class have no significant limitations to the production of waterfowl

Capability on these lands is very high. They provide a wide variety and abundance of important habitat elements; rolling topography is well suited to the formation of wetlands. Predominant water areas on these lands are both shallow and deep permanent marshes, and deep, open water areas with well-developed marsh edges.

CLASS 1S: Water areas in this special class are class 1 areas that also serve as important migration stops

CLASS 2: Lands in this class have very slight limitations to the production of waterfowl

Capability on these lands is high but less than Class 1. Slight limitations are due to climate, fertility, or permeability of the soils. Topography tends to be more undulating than rolling; a higher proportion of the water areas than in Class 1 are small temporary ponds or deep, open water areas with poorly developed marsh edges.

CLASS 2S: Water areas in this special class are Class 2 areas that also serve as important migration stops

CLASS 3: Lands in this class have slight limitations to the production of waterfowl

Capability on these lands is moderately high, but productivity may be reduced in some years because of occasional droughts. Slight limitations are due to climate or to characteristics of the land that affect the quality and quantity of habitat. These lands have a high proportion of both temporary and semipermanent shallow marshes poorly interspersed with deep marshes and bodies of open water.

CLASS 3S: Water areas in this special class are class 3 areas that also serve as important migration stops

CLASS 3M: Lands in this special class may not be useful for waterfowl production, but are important as migration or wintering areas. This class has no subclasses

CLASS 4: Lands in this class have moderate limitations to the production of waterfowl

Capability on these lands is moderate. Limitations are similar to those in Class 3, but the degree is greater. Water areas are predominantly temporary ponds, or deep, open waters with poorly developed marsh edges, or both.

CLASS 5: Lands in this class have moderately severe limitations to the production of waterfowl

Capability on these lands is moderately low. Limitations are usually a combination of two or more of the following factors: climate, soil moisture, permeability, fertility, topography, salinity, flooding, and poor interspersion of water areas.

CLASS 6: Lands in this class have severe limitations to the production of waterfowl

Capability on these lands is very low. Limitations are easily identified. They may include aridity, salinity, very flat topography, steep-sided lakes, extremely porous soils, and soils containing few available minerals.

CLASS 7: Lands in this class have such severe limitations that almost no waterfowl are produced

Capability on these lands is negligible or nonexistent. Limitations are so severe that waterfowl production is precluded or nearly precluded.

References

Atlantic Development Board.

1968: *Forestry in the Atlantic Provinces.* Background Study No. 1. Ottawa: Queen's Printer for Canada, 211 p.

Baker, W. M.

1969: *Tourism and Recreation in Relation to Water Resources.* Appendix V, Stage 1, *Maritime Provinces Water Resources Study.* Atlantic Development Board, 79 p.

Canada Land Inventory.

1970: *Objectives, Scope and Organization.* Report No. 1, Second Edition. Ottawa: Queen's Printer for Canada, 61 p.

1969: *Soil Capability Classification for Agriculture.* Report No. 2, Second Edition. Ottawa: Queen's Printer for Canada, 16 p.

1970: *Land Capability Classification for Forestry.* Report No. 4, Second Edition. Ottawa: Queen's Printer for Canada, 72 p.

1969: *Land Capability Classification for Outdoor Recreation.* Report No. 6. Ottawa: Queen's Printer for Canada, 114 p.

1970: *Land Capability Classification for Wildlife.* Report No. 7 Ottawa: Queen's Printer for Canada, 30 p.

Carr, D. W.

1969: *The Competitive Position of Maritime Agriculture.* Background Study No. 2. Prepared for Atlantic Development Board. Ottawa: Queen's Printer for Canada, 176 p.

Census of Canada.

1931: *Agriculture.* Volume VIII.

1941: *Agriculture.* Volume VIII, Pt. 1.

1951: *Agriculture.* Volume VI, Pt. 1.

1961: *Agriculture, Canada and Atlantic Provinces.* Volume V, Pt. 1.

1966: *Agriculture, Canada and Atlantic Provinces.* Volume III.

Clawson, M.

1963: *Land and Water for Recreation.* Resources for the Future, Policy Background Series. Chicago: Rand McNally and Co., 144 p.

Clawson, M. and Knetsh, J. L.

1966: *Economics of Outdoor Recreation.* Baltimore: Johns Hopkins Press, 328 p.

Coleman, A.

1969: *The Planning Challenge of the Ottawa Area.* Geographical Paper No. 42. Geographical Branch, Department of Energy, Mines and Resources. Ottawa: Queen's Printer for Canada, 98 p.

Connor, D. M. and Magill, D. W.

1965: *The Role of Education in Rural Development.* ARDA Research Report No. RE–1. Ottawa: Queen's Printer for Canada, 131 p.

Connor, J.

1964: *Musquodoboit River Valley Study: Socio Economic Report.* No. 15. Wolfville, N.S.: Acadia University Institute, 62 p.

Hilchey, J. D.

1970: *Soil Capability Analysis for Agriculture in Nova Scotia.* Canada Land Inventory Report No. 8. Ottawa: Information Canada, 66 p.

Jackson, C. I. and Maxwell, J. W.

1971: *Landowners and Land Use in the Tantramar Area,* New Brunswick. Canada Land Inventory Report No. 9 and Geographical Paper No. 47. Ottawa: Queen's Printer for Canada, 37 p.

Nova Scotia Department of Lands and Forests.

1969: *Nova Scotia Forest Inventory: Halifax Subdivision, Counties Halifax, Hants 1967.* 72 p.

Province of Nova Scotia.

1967: *Forest Improvement Act.* R.S.N.S., ch. 114.

1968: *Forest Improvement Act.* R.S.N.S., ch. 28.

Sonntag, B. H.

1969: *Maritime Farm Enterprise Analysis.* Technical reference volume to *The Competitive Position of Maritime Agriculture.* Appendix, Background Study No. 2. Prepared for Atlantic Development Board. Ottawa: Queen's Printer for Canada, 281 p.