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79547—1½

LAND USE AND POPULATION CHARACTERISTICS OF CENTRAL WINNIPEG

Thomas R. Weir[1]

The purpose of this paper is to analyze the day-time and night-time population patterns in relation to zones of land use within central Winnipeg.

The demography of most North American cities has been presented largely through the medium of census materials. This has led to a characterization of urban population in terms of domicile. Studies in distribution and density have usually been expressed in relation to the *concentric zone theory*.[2] As a result the central business district of most cities is referred to as having a "relatively low density".[3] Such statements as the following are typical of most urban population studies: "The same general distribution features, however, are evident in both cities (Berlin and Chicago), namely, the lowest densities in the core, the highest densities in the inner congested districts . . . and the decrease of densities outwards from the centre."[4] While it is perfectly clear that these statements refer to *residential* densities, they lead to negative thinking about the functional relationship of population and the "heart of the urban organism, throbbing with activity in the day-time." If the core and nerve centre of the large metropolitan city is to be described realistically in the sense of its function as the economic centre and focus of transportation routes, surely it must be thought of in terms of its *day-time* population.[5]

Most studies of day-time population prior to 1940 originated in Europe. The interest centred largely on the movement of peoples from city to city or from place of residence to work. Since 1940 the increasing problem of congestion in the central business districts of large North American cities has prompted many planning boards to initiate population studies in the downtown areas. Most studies are concerned with the practical problem of traffic movements. Few American geographers, however, have given attention to the day-time aspects of population.

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[2] Burgess, E. W.: "The Growth of the City", Chapter 2, in *The City* by R. E. Park, E. W. Burgess, and R. D. McKenzie: Chicago, 1925.

[3] Dickinson, Robert E.: "City Region and Regionalism", Routledge and Kegan Paul Ltd., London, 1952, p. 127 and p. 134.

[4] *Ibid.*, p. 134.

[5] See, for example, Breese, G. W.: "The Daytime Population of the Central Business District of Chicago," University of Chicago Press, 1949.

Practical Applications

A knowledge of day-time movements, densities, and distribution in the central zone of any metropolitan city may have a variety of applications. The retail trade, sensitive to the movements of people to the downtown areas, is much concerned with advantageous location within the central business districts. The tendency of shoppers to prefer less congested centres is necessitating a variety of expedients to attract the public downtown. The traffic engineer anxious to alleviate congestion, especially during peak traffic periods, is concerned with the volume of vehicles converging from all directions on the hub. The land evaluator must be guided in his estimates by the concentration of peoples in various parts of the downtown area. The planner, faced with the necessity of finding new land for development at the centre, or for off-street parking, must know where the people are at different times of the day. Civil defence officials, planning for the evacuation of our large cities, must know the work-place location of people, especially in the heart of the city.

Winnipeg's City Centre

The boundaries of the city centre are in part natural and in part man-made. Along the east the meandering Red River separates central Winnipeg from St. Boniface. The southern edge is delimited by the Assiniboine River. The northern margin is best defined by the tracks of the Canadian Pacific Railway. The western boundary may be conveniently placed along Colony and Balmoral streets. Since the rivers remain fixed and the C.P.R. tracks are likely to be a permanent feature, any future extension of the central zones will be westward for the most part.

Generalized Land Use Divisions

Burgess' concentric zone theory, accepted in broad outline as applicable to most metropolitan cities, applies in general to the central district of Winnipeg.[1] In the heart of the downtown area is the central business district, precisely defined by Murphy as the zone of retail business, large office buildings, and financial buildings.[2] Next comes a zone of mixed uses—wholesale, light industry, third-rate commercial, cheap hotels, and rooming houses—earning the designation "zone of deterioration". Fragments of a third zone are also discernible within the boundaries of the city centre: isolated segments of continuous rooming houses and apartment

[1] Burgess: *op cit.* chapter 2.

[2] Murphy, R. E. and Vance, J. E.: "Delimiting the C.B.D.", *Econ. Geog.*, vol. 40, No. 3, July, 1954. Pp. 189–192, 203.

dwellings. The first two zones lend themselves to further subdivision on the basis of regional specialization as indicated in Figure 1. (For a more detailed study of land use see Figure 2).

The First Zone

At the heart of the city, along the Y formed by the intersection of Winnipeg's two principal streets—Portage Avenue and Main Street—is the central business district. It contains a core area facing on the two principal streets. Here many of the tallest buildings are situated, showing a tendency to cluster near the intersection of the two main streets (Figure 6): the tallest building is 13 storeys. The core area shows differentiation into a financial district in the vicinity of the junction of the principal streets, where the grain exchange, wheat-pool, headquarters of two insurance companies, and branches of nationally known banks and investment concerns are located. (1^A in Figure 1). Along Portage Avenue between Smith Street and the edge of the city centre are found the leading department stores, including a seven-storey building (1^B in Figure 1).

The core area is fringed by a narrow zone of less typical C.B.D. (Central Business District) uses, as defined by Murphy:[1] newspaper publishing, automotive sales and showrooms, civic buildings, railroad depots, post-office (in process of building), medical clinics, hotels, and clubs. In short this is a zone of less typical commercial uses (1^C in Figure 1); it will be the next to be invaded by the core as pressure becomes more acute at the centre. At the same time the fringe area is gradually encroaching on the zone beyond —a zone of mixed uses (2 in Figure 1) where obsolescent houses ripe for demolition gradually yield to the pressure of higher economic use. The southern margin of the C.B.D., in contrast to the northern, is showing the most rapid movement into the adjacent zone.

The Second Zone

This zone, located on the margins of the central business district, is divisible into two parts: wholesale (including storage and light industry); and one of mixed uses. The major wholesale districts lie parallel to north Main Street (2^{A-B} in Figure 1).[2] Here railway facilities are provided and, prior to the turn of the century, most of the retail trade was found along north Main Street, giving rise to the tributary wholesale districts. This is the old warehouse section of the city, showing all the indications of obsolescence and marked by frequent migrations to the urban fringe.

[1] *Op cit.* page 204.

[2] See also Figure 2. Adjacent to south Main Street, near the Assiniboine River, is a small area designated in Figure 1 as "wholesale". This area is used for storage and maintenance of cars and buses of the Winnipeg Electric Company.

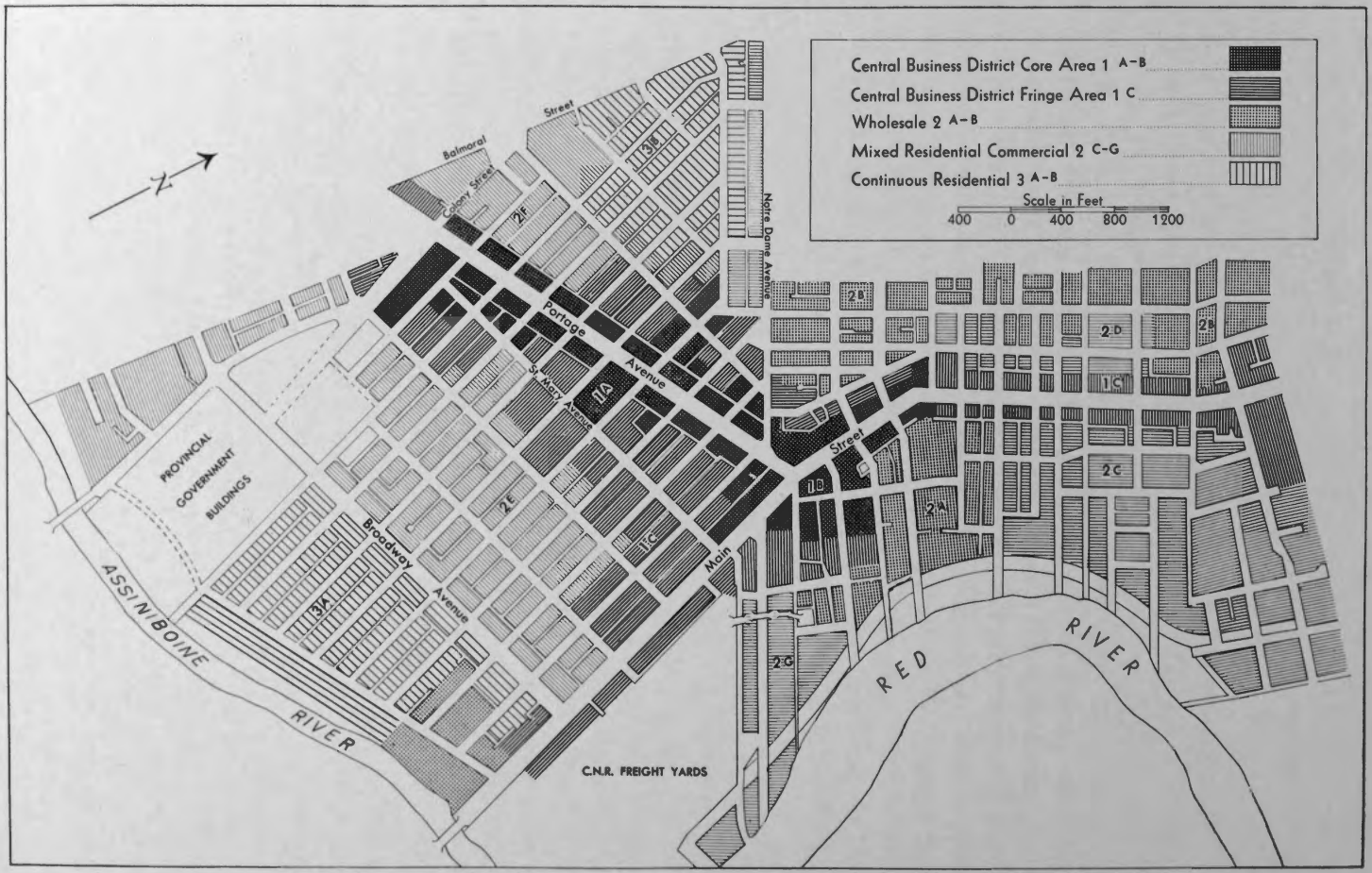

Figure 1. Central Winnipeg—generalized land use.

Buildings were erected in the 1890's, many of them from 4 to 7 storeys high (Figure 6), and strongly built of brick and stone; they are, however, unsuitable for many types of wholesale requirements of the present day. The increase in trucking has made the railroad of little importance to the district as a whole, and has brought with it the attendant evils of traffic congestion and costly delays. Light industry, particularly the needle trades, has found its way into the upper storeys of many of the larger buildings in this area, gradually replacing much of the function for which the buildings were designed. Light industry in this location can draw on a large, semi-skilled, low-income group in the rooming house sections nearby; it also benefits from proximity to the retail trade of the central business district as well as the warehouse facilities at hand and can avail itself of rail facilities if needed. The taking over of large parts of this zone by light industry has considerably facilitated the moving of wholesale firms requiring modern plants and large storage space.

An even larger area of zone two is taken up with obsolescent housing, some of which qualifies as "slum", intermixed with miscellaneous commercial and light industrial uses. Three distinct segments can be isolated close to the centre of the city. To the east of north Main Street is a very old section of the city, the point of landing of the Selkirk settlers in 1812 (2^{C} in Figure 1). Here, between the C.P.R. tracks and the wholesale district, is an area marked by blight and social disorganization. Strategically located on its edge is the police station. Its counterpart, the city's "skid row," lies west of north Main Street (2^{D} in Figure 1), and is scarcely distinguishable from the wholesale district. Close by is the City Hall, still housed in the original structure of 1884, of the highly ornate architectural design typical of that period.

The third segment of "mixed uses" is found to the south of the C.B.D. between St. Mary's Street and Broadway (2^{E} in Figure 1). It is an area of cheap rooming houses, well on the down-grade, and yet one of high land values caused by the encroachment of the C.B.D. It has a counterpart north of Portage Avenue showing the same physical and social characteristics (2^{F} in Figure 1). Many of these dwellings serve a group of poverty-stricken old people.

The Third Zone

Two segments of a third zone, referred to as "continuous residential" are to be found within the boundaries of central Winnipeg (3^{A-B} in Figure 1). One such area lies to the south between Broadway and the Assiniboine River; the other, a triangular area between Notre Dame Avenue and

Balmoral Street, lies to the northwest. Both are in a sense outliers of a zone of better-class rooming-houses completely surrounding the city centre. The former (3^A in Figure 1) is quite detached from the main zone west of Colony Street by the site of the Provincial Government Buildings. Most of the houses in this segment have 10 to 15 rooms and date from 1890 to 1900, when it was the city's most desirable residential area. It has long since lost its single-use function. Many first- and second-class apartment dwellings catering to the wants of those who prefer to live near the centre of of the city are sprinkled through the district. Otherwise, it is now given over entirely to rooming houses. It is only a matter of time until it is invaded by the adjoining zone of mixed uses. However, the land will probably remain highly desirable for apartment house use for many years.

The other segment of "continuous residential" use occupies an antipodal location in the northwest part of the downtown area (3^B in Figure 1). This salient is being more rapidly invaded by the adjoining zone of "mixed uses", although at present only the margins are affected. The average income in this segment is somewhat lower than in the preceding one. The physical condition of the buildings is poorer on the whole, especially in the case of the apartment buildings. Unlike its counterpart, it is not detached from the major rooming-house belt that hems in the city centre along the western margin.

Two large blocks of land within the map-area do not fall into the use classification described above. In the southeast corner are the freight yards of the Canadian National Railways. Adjoining Colony Street in the southwest is a large block of land used as the site of the Provincial Government Buildings. On its northern edge is the modern Civic Auditorium. This land as early as 1872 had been reserved for government purposes and later was the site of Fort Osborne Barracks until they were moved to the outskirts of the city.[1] The present Provincial Government Buildings were completed in 1920. The law courts building, the former university building, and a provincial jail are also located on this site.

Day-time Population

The population of an urban area during the working hours of a typical day may be divided into three groups: (1) residential and school, (2) employed, (3) transient. To determine *exactly* the number of people in each of the three groups at any given hour of a given day is virtually impossible. An army of census takers would be required to collect such

[1] "Plan of the Town of Selkirk, Manitoba", surveyed by A. H. Vaughan, 1872. In the Provincial Archives, Legislative Building, Winnipeg.

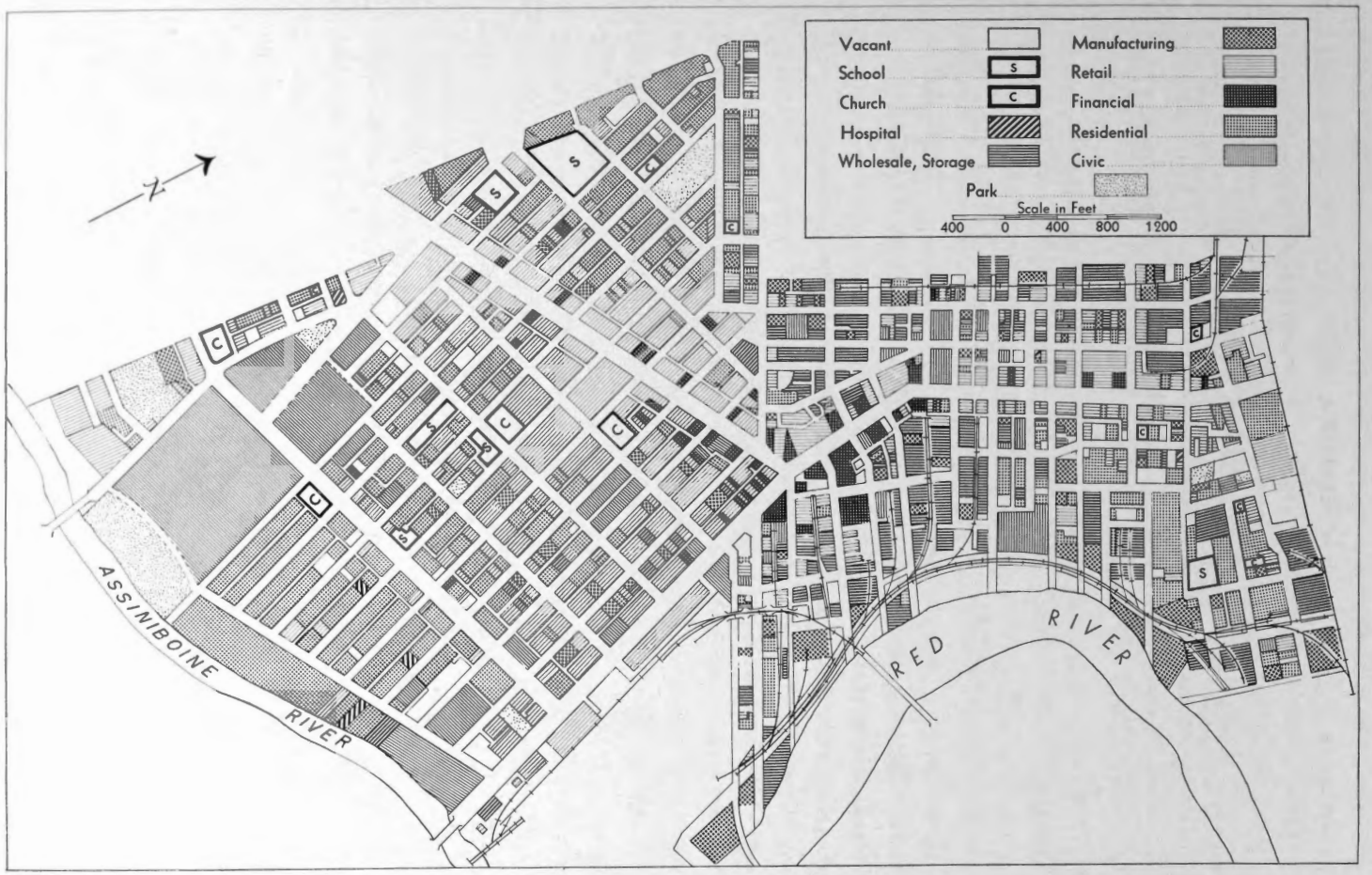

Figure 2. Central Winnipeg—land use.

data. This would be particularly difficult in the case of transients, namely, pedestrians; shoppers; people in theatres, offices, etc.; and those riding in vehicles. Such exactness is never likely to be required, however interesting such distributions might be from a purely academic standpoint. Of some practical value, however, is a reasonable *approximation* of the numbers and distribution of people within various parts of the city during a mid-morning or mid-afternoon period of a typical working day. Such information may be of great use to city planners and other agencies.

The writer knows of no special procedure that will expedite the gathering of data on day-time population. In the present survey, the following methods were used. Statistics for employed population were collected by direct telephone contact or by personal visits. The records of the Unemployment Insurance Office were helpful but not complete. In the matter of transient population, estimates were obtained from leading department stores, or by actual counts in the case of smaller stores. Numbers in hotels, theatres, and office buildings were obtained from the management or by sampling. Traffic and pedestrian counts were made along main streets, and statistics provided by the City Traffic Department were also used. Numbers travelling in buses and street cars were obtained from periodic counts made by the street railway company.

Numbers in the residential sections were obtained by making a canvass of typical blocks within a fairly uniform district to determine the numbers at home in the day-time. A percentage of the night-time population (census) was then obtained. This percentage was then applied to the census figures for the entire district, giving an estimate of the day-time population of that district. It was found that sample blocks in a uniform district had representative day-time percentages. In this way the residential population of a large city can be arrived at with a degree of error not exceeding 10 per cent. Numbers in school can be obtained directly from the School Board.

By using these various methods, the total day-time population count for Winnipeg varied from independently gathered census data by only 3 per cent.

Day-time Population of Central Winnipeg

Applying the methods outlined above to all areas lying within the boundaries of *central* Winnipeg, the total day-time population was found to be approximately 102,080, as of August, 1953. This was 27 per cent of the total estimated population of Greater Winnipeg in 1954. Of this

number 63,140 were employed in the down-town area; 5,850 were resident; the remainder were "transients" and in school.

Distribution and Density

The day-time population was then plotted as in Figure 3, one dot representing twenty people. Dots were distributed within parts of blocks to show variations in densities. The scale chosen, while satisfactory to indicate numbers within blocks, is too small to show effectively the variations in density of street population.

In order to read densities quantitatively day-time population was plotted in relation to the *areas* of blocks as in Figure 1. Isograms permit more exact comparisons but fail to show details of distribution within blocks as in Figure 3.

With the aid of these maps it is possible to draw some general conclusions about the patterns of distribution and density. It may be assumed that in general the density of population within city blocks will vary according to the use of the land, as indicated by the type of structure (house, store, factory, etc.) and the size of the structure. A multi-storeyed building, assuming a similar use, will accommodate many times more people than a single-storeyed building of the same ground area. On this assumption a map of building heights was also constructed as an aid in accounting for density patterns. (Figure 6).

Distribution and Density Patterns

Assuming a mid-morning or mid-afternoon period of a typical week day, the population patterns of central Winnipeg are shown in Figures 3 and 4. Two observations may be made: (1) Populations are most dense along a central axis or core and show a tendency to decrease outward from it; and, (2) in general, there is correspondence between the three major zones of land-use (Figure 1) and population densities. There is insufficient conformity in detail, however, to use population densities alone to define any of the principal functional areas as shown in Zone One (1^{A-C} in Figure 1). As indicated by the clustering of dots (Figure 3) 45 per cent of the day-time population is within a narrow zone tributary to Portage Avenue and Main Street, the core of the C.B.D. (Zone 1^{A-B} in Figure 1). Within this belt densities range from 400 to 4,000 per acre. The centre of gravity is the intersection of the two main streets, which since 1870, when Winnipeg was a hamlet with only 215 souls, has remained the hub of commercial activity and the centre of high land values. Within this zone are 8 of the 12 blocks

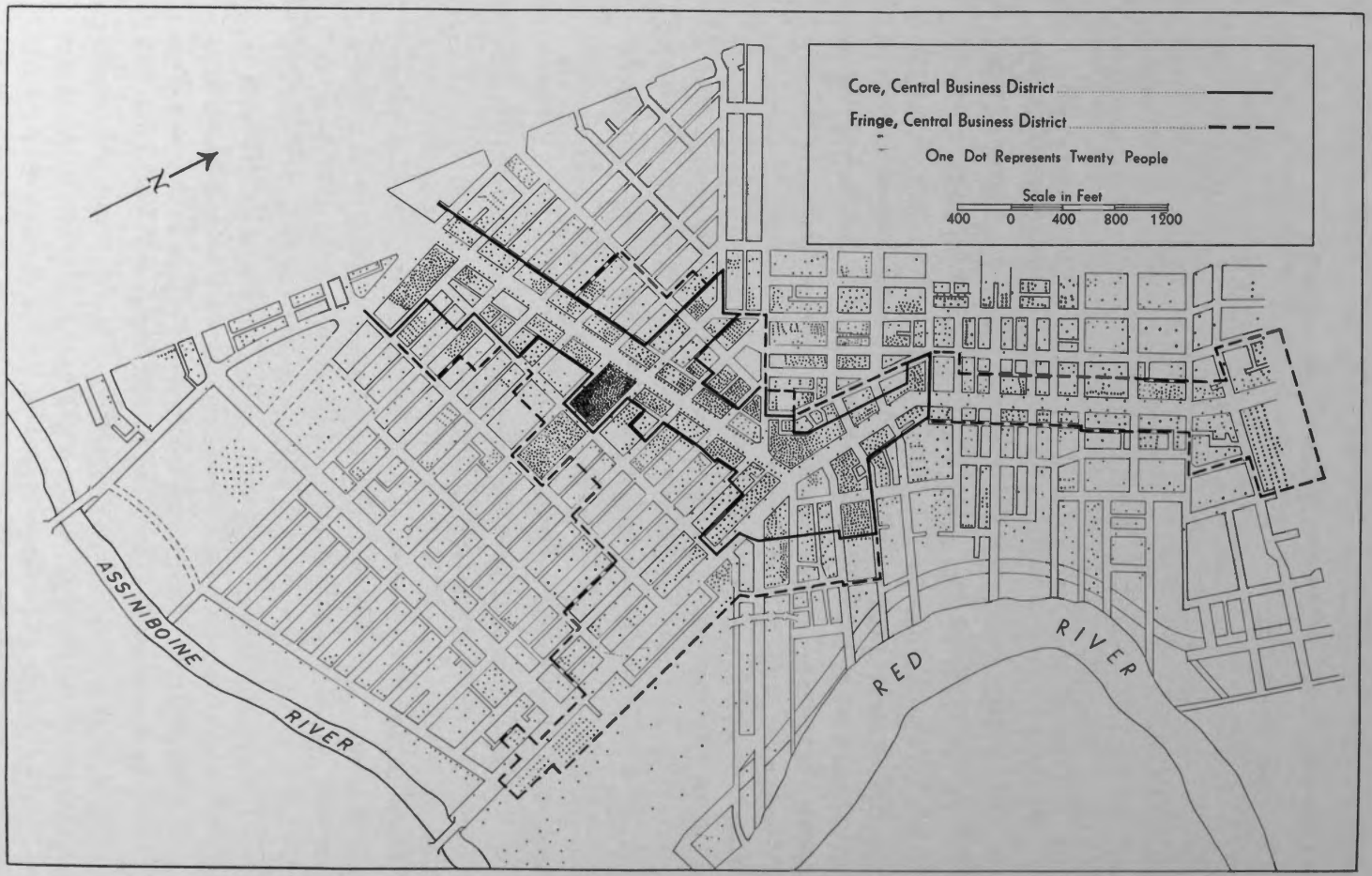

Figure 3. Daytime population of the central business district of Winnipeg.

in the city with densities exceeding 1,000 per acre.[1] The department store block with 3,975 persons per acre is the most densely populated block in the city. Six of the eight blocks consist mainly of office buildings; the other two are retail stores. The remaining four blocks are outside the core but within the C.B.D. boundary.

The outer fringes of the C.B.D. (1^E in Figure 1) show a lessening in densities, although four of the twelve blocks with more than 1,000 per acre are found within its boundaries. Their high densities are attributable to the C.N.R. depot and offices on south Main Street, a mail order building, a hotel, and a theatre. For the most part densities on the fringe of the C.B.D. range typically from 125 to 500. It is not possible to use population criteria alone to define the fringe boundary.

Correlation between heavy densities and height of buildings is also apparent in the core area of the C.B.D. (Figure 6). Ten of the twelve blocks referred to as having densities greater than 1,000 per acre have buildings from seven to thirteen stories in height. Of the forty-one buildings with heights greater than six storeys, twenty-nine lie within the C.B.D. Of this number twenty-two lie within the core, mostly within a short distance from the intersection of Portage and Main Street.

Zone Two

In zone two there is a considerable range of densities, owing in large part to the great diversity of uses. In those sections where the residential function predominates, day-time population is relatively low compared with the wholesale-light-industrial sections. On the whole, however, the mixture of uses raises the day-time densities above the average of the continuous residential.

In the wholesale-light-industrial section west of Main Street (2^B in Figure 1), the densities reach as high as 1,500 in one block and commonly run from 400 to 800 persons per acre in many sections of this area. With the *relative* decline of Winnipeg as a wholesale centre since the thirties, and the migration outward of much of the remaining wholesale function, cheap space became available in the upper floors of many of the large wholesale buildings. The garment industry, which employs 5,200, found this type of accommodation cheap and satisfactory, with the result that it has become entrenched in the old wholesale section. Many of the buildings are from five to eight storeys in height (Figure 6). This, together with the high

[1] Since blocks vary greatly in area and population distribution, such comparisons are not absolute. A more exact method would be the plotting of densities within small units of equal size.

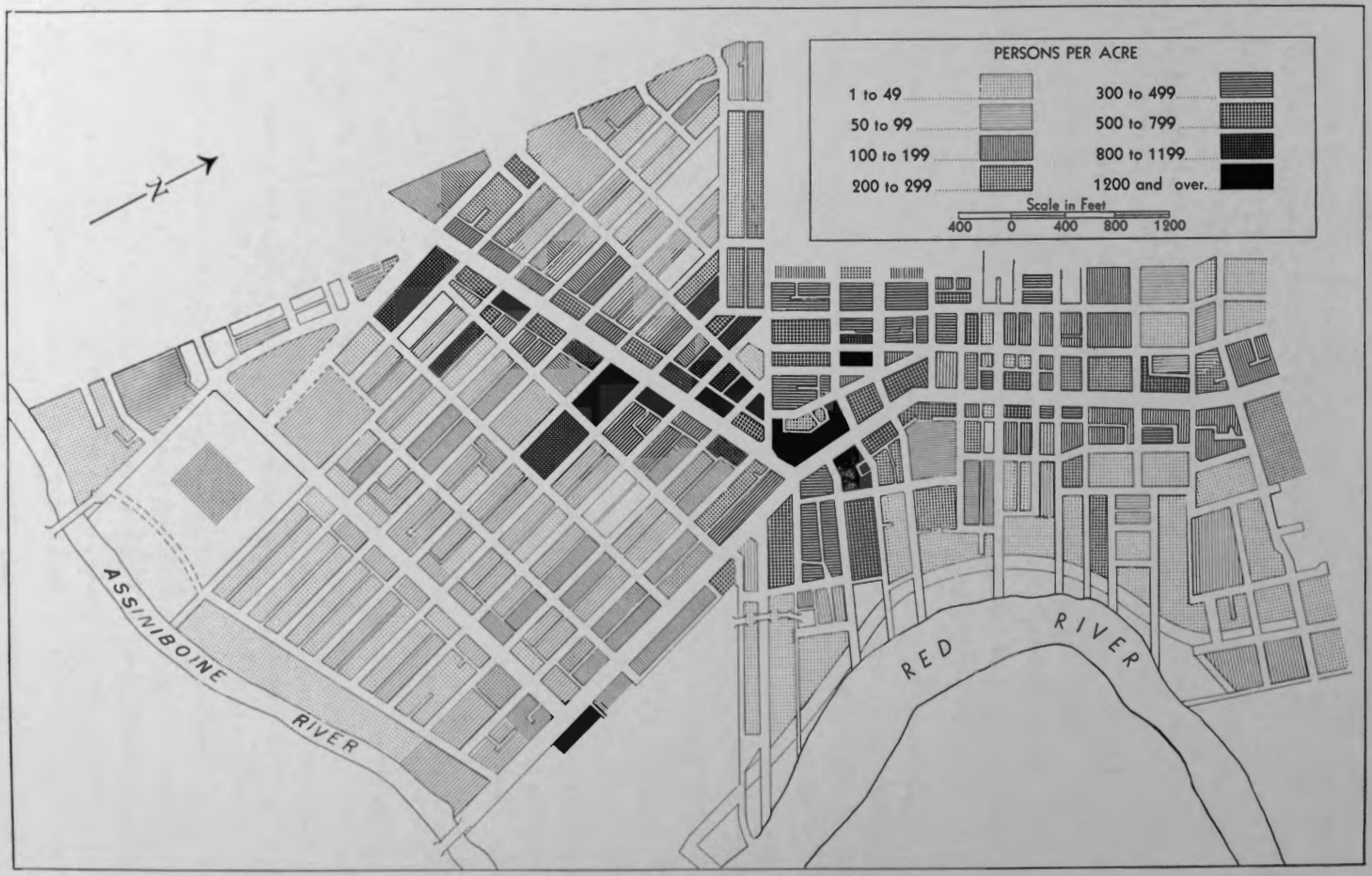

Figure 4. Central Winnipeg—Daytime population density.

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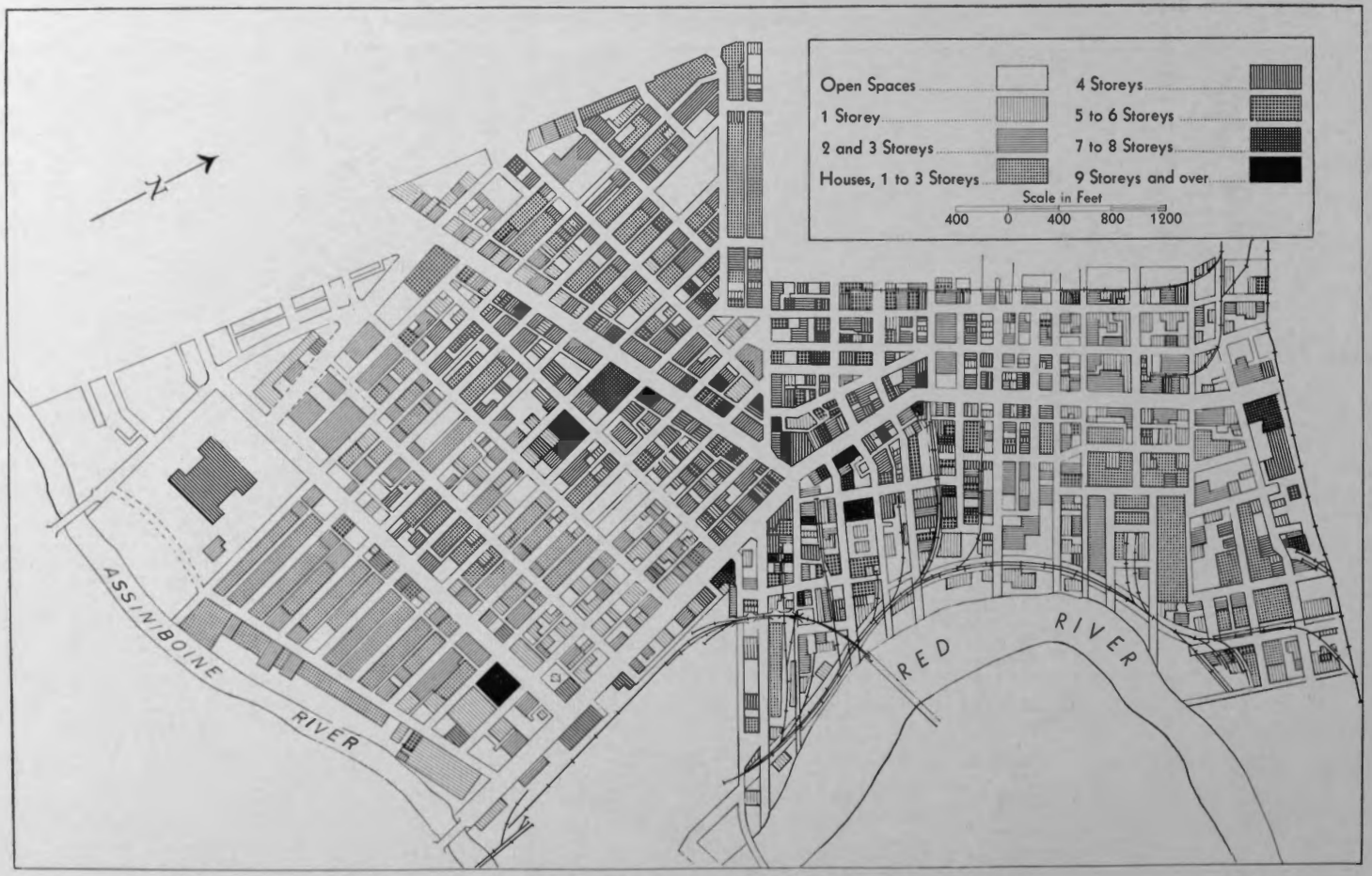

Figure 6. Average building heights in the central business district of Winnipeg.

concentration of workers per floor, has made for the highest densities in the central area apart from the C.B.D. core.

In that part of zone two designated "mixed uses", densities show marked contrasts. Variations between adjacent blocks of the order of 20 to 200 persons per acre are not infrequent. This is to be expected, since residential use is strongly mingled with wholesale, industrial, and some forms of commercial use. For the most part building heights do not exceed three storeys (Figure 6). Densities, therefore, are more closely allied to the *type* of use. In section 2^C (Figure 1) the higher densities are found to correlate with light industry, while the residences in the area cause densities to be from 30 to 60 in many blocks. In section 2^D (Figure 1), the city's "skid-row" district, an assortment of "flop-houses," cheap retail, and some wholesale establishments give rise to densities of 100 to 200. The purely residential use is confined to upper floors of commercial buildings. Near the tracks densities are lower owing to open storage uses (compare Figure 2).

In section 2^G densities are very low owing to a considerable area in railroad tracks and warehouses; a steam plant covering a large block accentuates this. Part of the area along the river, once used for docking, is now abandoned entirely.

In section 2^C (Figure 1), the largest district in mixed uses, rooming-house use predominates over much of the area. In the blocks adjacent to Main Street, on the other hand, densities range from 60 to 170, reflecting light industry and commercial uses associated in large part with the automotive industry. This section is also a congested rooming-house district, with the result that, on the average, densities are greater throughout than in the adjacent zone of continuous residences to the south. The section 2^F is fast giving way to small retail stores, some of which are backed by obsolete residences.

Zone Three

In the segments of "continuous residential" occupying marginal positions, densities are both uniform and light. From 30 to 90 persons per acre is fairly typical throughout. Variations within this zone are chiefly the result of apartment buildings (Figure 2). This is particularly the case in section 3^B, where averages range from 40 to 60. Fewer apartments in section 3^A, (except along Broadway, which is nearly solid) have resulted in densities of 31 to 41. This is a better-class rooming house district where congestion is not so great.

79547—2½

Night-time Population Density

The location of people in the centre of the city during the hours from midnight to 6 a.m. can best be obtained from the census. Additional information from hotels and rooming houses is necessary to complete the pattern. The night-time density map is a composite of the two. (Figure 5).

It has been customary to represent the population of a city centre in terms of census data.[1] As pointed out previously, such a representation ignores all the functional zones of the city except the residential. However, for purposes of contrast with the day-time densities, the night-time population has been included in this study.

The pattern of night-time densities is in many respects complementary to that of day-time densities. The C.B.D. is now nearly deserted. *Isolated* blocks within it have densities from 200 to 862 persons per acre; but in each case a hotel or large apartment building occupies the block or a large part of it. Only four blocks exceed densities of 300 per acre. These are the sites of the four largest hotels in the city.

Like the C.B.D. the warehouse, wholesale, and light industrial sections are, with few exceptions, without night-time population. The occasional rescue mission or low-class hotel scattered through this zone stands out with a high density.

The C.B.D. is ringed about with a narrow band of high night-time densities, the highest in the city. These range from 100 to 200 per acre and are found mainly within the zone of "mixed uses" (Figure 1). These blocks belong to the lower-class rooming-house sections where lots are small and where three-storey houses have been cramped together. In many blocks long rows of attached houses and third-rate apartment dwellings account for the high night-time densities. In general, such high densities indicate the areas of blight, over-crowding, and poor social conditions. Moderate densities in the zone of continuous residences (3A in Figure 1) denote a better class of rooming-house, with larger lot sizes and less congestion. This is typical of the large tributary zone extending beyond the city centre.

RÉSUMÉ

Les études démographiques des grandes villes de l'Amérique du Nord sont ordinairement faites en fonction du lieu domiciliaire de la population, de telle sorte que les quartiers des affaires ne semblent avoir qu'une faible densité de population. Cela a pour effet de minimiser beaucoup l'impor-

[1] Map of Population Distribution of Greater Winnipeg, 1951, Metropolitan Planning Bureau, Winnipeg, Manitoba.

tance de la population de jour du centre de la ville, qui est pourtant un aspect de tout premier ordre aux spécialistes en circulation, aux urbanistes et aux dirigeants de la défense civile.

Le but de l'étude présentée ici est l'examen de la population durant le jour et durant la nuit dans le centre de Winnipeg en rapport avec les zones d'utilisation du sol. Adoptant la théorie de Burgess sur les zones urbaines concentriques, on partage le centre de la ville en trois zones et examine le plan de répartition de la population en fonction de ces zones. La distribution et la densité de la population durant le jour sont évaluées d'après les statistiques d'embauchage et un relevé fait dans les magasins et en quelques endroits clefs sur les principales rues. La répartition de la population durant la nuit s'obtient du recensement. Les données ainsi obtenues sont portées sur des cartes qui illustrent bien la distribution de la population à différents moments de la journée.

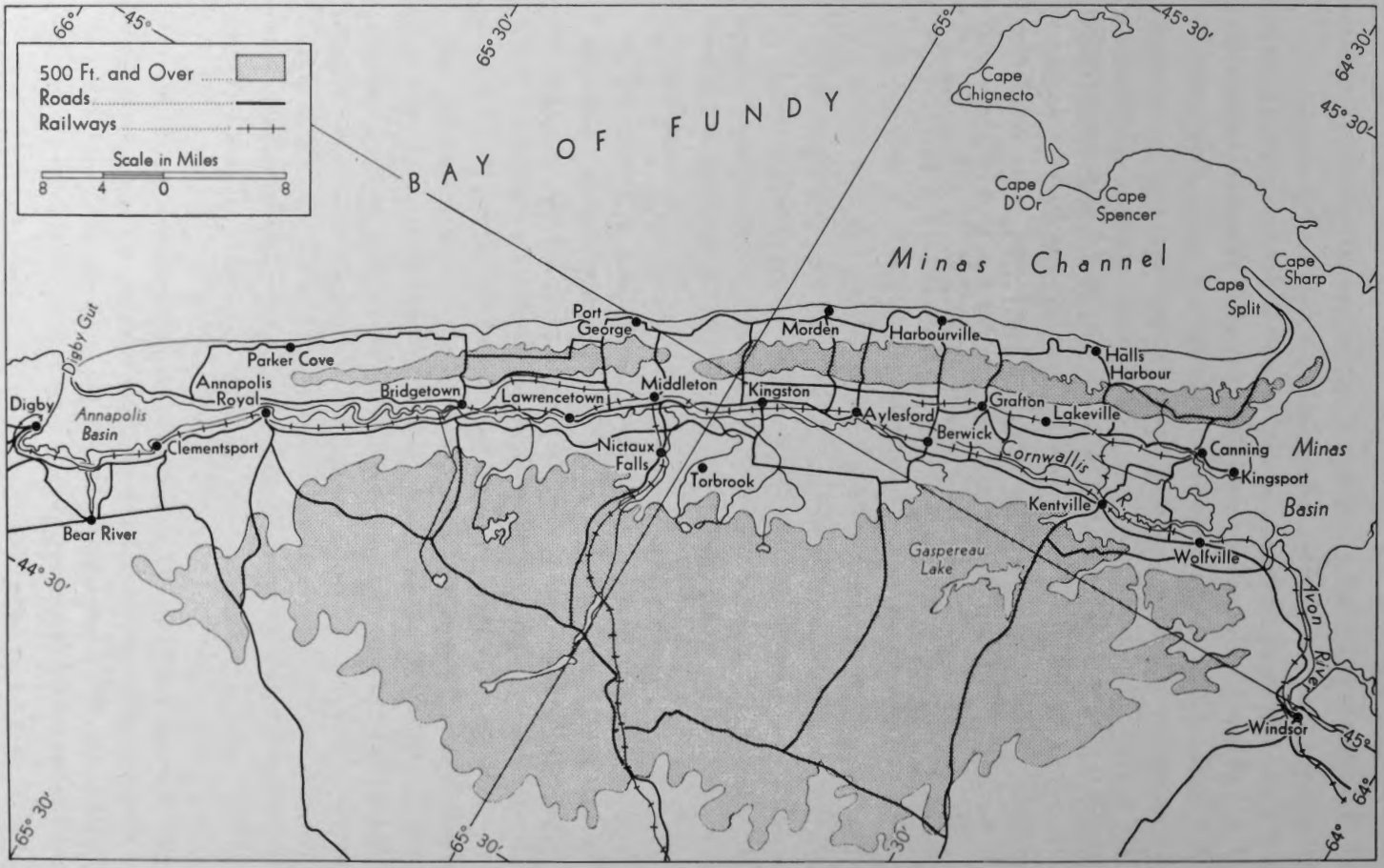

Figure 1. Annapolis–Cornwallis area, Nova Scotia.

A LAND USE RECONNAISSANCE OF THE ANNAPOLIS-CORNWALLIS VALLEY, NOVA SCOTIA

Brooke Cornwall

Field investigations of the Annapolis-Cornwallis Valley were made by the writer during the summer of 1953 in order to establish the land use pattern and to examine the relationships that exist between each urban centre and its trade territory. The main objective of the study was to carry out a systematic examination of each type of land use and the physical and human environmental factors that reflect the land use pattern, for, despite the common misconception that the valley is entirely devoted to apple-growing, there is variety in the agricultural use of the land.

The part of Nova Scotia discussed here extends for 65 miles between Wolfville, at the northeastern end of the Annapolis-Cornwallis Valley and Annapolis Royal, at the southwestern end. The southern boundary follows the lower slopes of South Mountain and the area extends northward to the Bay of Fundy. These boundaries enclose an area of about 700 square miles.

FACTORS AFFECTING LAND USE

Physiography

The Annapolis-Cornwallis Valley is one of several lowland areas of Nova Scotia formed by erosion. It is a long, tapering valley eroded in Triassic sandstone and bounded to the north by North Mountain, a highland of resistant Triassic lavas, and to the south by South Mountain, composed of Devonian granite, quartzite slate, and limestone.

North Mountain, formed of basaltic lavas and rising to 780 feet, has three distinct physiographic sections. First, there is a steep escarpment resulting from the erosion of the lavas. Below the escarpment, at the junction of the lavas and the underlying sandstone, generally at an elevation of 200 feet, is a slope that drops gradually to the valley floor. The third section is the gently sloping northern side of the highland which, because of the northwest dip of the lava beds, ends at the Bay of Fundy either as low cliffs or a gently shoaling coastline. The south-facing escarpment forms a continuous feature broken only by shallow, glaciated saddles and faulted localities such as Digby Gut, Petit Passage, and Grand Passage, where erosion has opened passes to the sea.

South Mountain has approximately the same elevation as North Mountain and forms a distinct boundary to the Annapolis Valley though it lacks the sharply-defined characteristics of North Mountain. The northward-facing side of the highland is a gentle slope with an undulating surface caused by stream erosion and glacial deposition. From St. Mary Bay to Kentville the edge of the upland is clearly defined, but from this point eastwards the more easily eroded rocks of the lowlands invade the upland and cause a blending of the two types of terrain.[1]

The one exception to the indistinct character of South Mountain is "The Ridge". This spur, with an average elevation of 300-400 feet, branches from the main highland south of Kentville and disappears under the Avon River; only in the Gaspereau Valley between White Rock Mills and the village of Gaspereau are there slopes too great for agricultural use. To the east, however, on the wide upper level, on the sides sloping down to the Gaspereau and Cownwallis River, and over the drumlins of the low eastern end of the ridge there are more gentle slopes that permit agriculture.

In the Kentville-Wolfville area of the Annapolis Valley, where it is 8 miles wide, there are three almost parallel ridges of Triassic sandstone separating the Pereau, Habitant, Canard, and Cornwallis Rivers. All

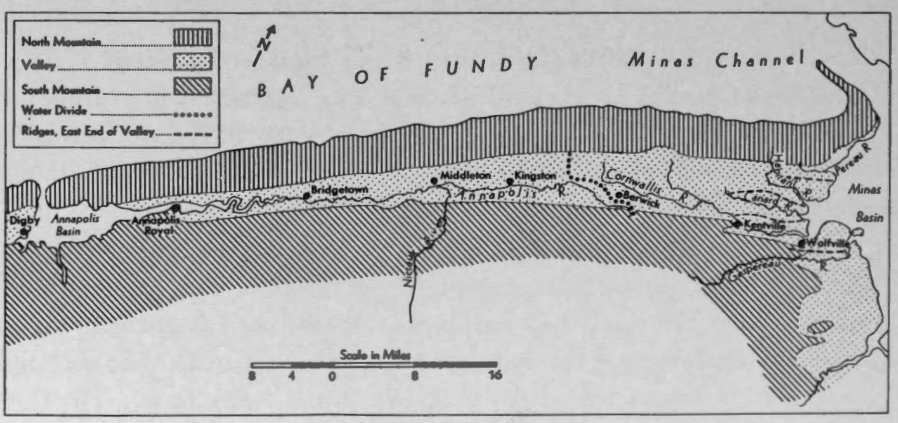

Figure 2. Physiography of the Cornwallis–Annapolis area.

three are broad with undulating surfaces resulting from erosion of glacial debris and the underlying sandstone. Elevations of the two northernmost ridges vary from 100 to 150 feet above sea-level, but they are so broad that, with a few minor exceptions, slope is nowhere great enough to prevent use

[1] Goldthwait, J. W.: "Physiography of Nova Scotia"; Canada. *Dept. Mines, Ottawa*, 1924.

of the land. The ridge between the Cornwallis and Canard Rivers has elevations of 175 to 200 feet and is of a slightly more complex structure.

Along the watercourses there are areas of mud flats. On the Minas Basin coastline and at the outer reaches of the estuaries, these mud flats are subjected to flooding by the sea. Where damming has proved feasible, the alternating flow of streams and tide has been controlled to prevent flooding by salt water and there are now expanses of fertile, alluvial soil, protected by dykes.

From Minas Basin westward, there is a gradual increase in elevation to 175 feet in the vicinity of Berwick. The divide between the rivers flowing to east and west is marked by Caribou Lake, a peat-bog two miles long and one mile wide, that lies almost at the centre of an extensive sand plain. Still farther westward, extending from Auburn to Lawrencetown, is a second area of low-lying, level land also composed largely of sandy soils.

In the narrowest, western part of the valley, the surface is undulating with dyked marshland on the Annapolis River, the whole restricted between the highlands to north and south.

On each side of the valley the floor slopes gradually upward to the highland border. On the north, for the entire length of the valley, the lower slopes are used for agriculture. At the upper level of land use there is a distinct boundary marked by the contact of sandstone and basalt. On the south side, where slopes are more gradual, only local differences, such as steep slope or rock outcrop, interrupt agricultural use. Through individual preference much of the hillside is left forested and there is no clean break between lowland agriculture and the upland areas of forest.

Drainage

The rivers of the Annapolis-Cornwallis Valley drain into the Bay of Fundy from three distinct areas. First, the entire north-facing slope of North Mountain drains directly to the bay. Second, the area east of Berwick drains to Minas Basin, from Caribou Lake eastward the main river being the Cornwallis with tributaries from both North and South Mountains; the Gaspereau River, rising on the rocky upland to the south, completes the drainage of the eastern part of the area. The third area lies west of Berwick and is drained by the Annapolis River and its tributaries, the major one being the Nictaux River, which, like the Gaspereau, has its source many miles inland to the south.

As a result of long, continuous settlement, many uses of rivers and streams have developed. Many smaller streams have been dammed to

form pools for watering stock or filling spray tank carts, and in a very few instances streams have been used for irrigation, generally of commercial vegetable gardens. Some towns, such as Wolfville, Kentville, and Annapolis Royal, have set aside small drainage basins as sources of town water supply, but this is not usual for the rural areas, as wells and flowing springs are common and adequate. The Gaspereau and Nictaux Rivers, with their courses extending far into the southern highland, are used for hydro-electric power. Some of the power is for rural and urban domestic use, but much of that produced on the Gaspereau goes to a pulp and paper mill at Hantsport on the Avon River.

Soils

The soils of the Annapolis-Cornwallis valley are leached podsols that have formed readily in an area of mixed vegetation with an excess of precipitation during the winter months, a factor that produces considerable leaching. As a result of Pleistocene glaciation, the whole area was covered by a layer of drift deposited over the bedrock and obscuring it almost everywhere except on the steepest slopes. The deposit consists largely of unstratified boulders, gravel, sand, and clay. Many of the most fertile soils of the lowland have, however, been formed from parent materials deposited by glaciation.

There are four main divisions of the soils; those originating on glacial till; those on sedimentary rock; organic soils; and a small group of miscellaneous soils.

Soils developed on glacial till cover the highlands and slightly more than half of the lowland area.[1] They can be divided into two groups on a basis of texture, those developed on clay and those on sandy till. The former, characterized by fine texture, are subject to erosion in some locations, whereas the other type readily absorbs moisture. Both are excellent orchard soils.

Soils on sedimentary rocks are of a light texture and are found most commonly along the Annapolis and Cornwallis Rivers. Generally, they are loose and porous and are, therefore, among the least fertile soils in the area. As a result, they are unsuited to mixed farming, and are mainly used for special crops such as vegetables.

Organic soils in the area are peat and muck. Peat, which is semi-decomposed vegetable matter, is found at Caribou Lake west of Berwick and in an area south of Aylesford. Muck, consisting of more completely

[1] Harlow, L. C. and Whiteside, G. B.: "Soil Survey of the Annapolis Valley Fruit Growing Area;" Canada, *Dept. Agriculture, Ottawa*, 1943.

decomposed vegetable matter, is found in numerous small deposits throughout the lowland and in a large area west of Caribou Lake. Uses of organic soils are limited. Some areas of muck are used for cranberry production and both muck and peat have been used to enrich sandy upland soils. At Caribou Lake a small plant processes peat for commercial use.

Miscellaneous soils include dykeland soils, salt marshes, and bottom-land. In the estuaries of the streams and rivers, soils composed of clay and silt have been deposited. With the elimination of sea-water by dyking, these have been converted into some of the most fertile soils of the region. They are used principally for general crops such as grain, clover, and potatoes, but not for orchards. Outside the dykes, where the land is periodically covered by the sea, there are infertile salt marshes producing only small quantities of marsh hay.

Of minor importance are the scattered areas of bottom-land in stream and river valleys and the two extensive areas of unproductive sandy soil east of Kentville and between Auburn and Lawrencetown. These bottom-land soils are not fully developed because of continual change due to deposition, which, however, usually produces quite fertile soils. Neither of these soils is suitable for large-scale farming.

Climate

In general, the climate of Nova Scotia is temperate. From the interior of the continent, west and northwest winds introduce some characteristics of the continental type climate. These, in turn, are countered by marine characteristics introduced by south and southwest winds blowing over the Gulf Stream and Atlantic Ocean. The result is that the Maritime Provinces lie in a broad area of transitional climate.

Of all parts of the Maritimes the Annapolis Valley, perhaps, suffers least from this transitional type of climate, largely owing to the protection from wind afforded by North and South Mountains and the proximity of the Bay of Fundy, Minas Basin, and St. Mary Bay, with their ameliorating influence on temperature. The result is that the valley, climatically, is the finest agricultural area in the Maritime Provinces.

In only a few instances do climatic factors hinder the production of crops common to all of Canada. In the entire range of tree fruits, peaches are about the only variety that cannot be generally grown, although excellent orchards exist in certain warmer locations. In the case of raspberries, the fluctuations in winter temperature often break the dormancy of the plants, resulting in winter-killing. The prevalence of summer mists and fog

in the past often prevented ripening of sweet corn and tomatoes or encouraged diseases in potatoes. New varieties with shorter maturing periods and the development of disease-resisting strains of potatoes are rapidly changing production. In the case of other crops, such as peas and beans for canning, cucumbers, fresh vegetables, hay and other forage crops, the climate (which can be described generally as cool and moist) is ideal. It is also an excellent climate for live stock. Only in the case of grains is the environment poor and here the weakness is primarily one of soil.

Generally, mild temperatures prevail throughout the year. For most climatic data there is information from three stations, Annapolis Royal, Kentville, and Wolfville. For these stations the highest monthly average of daily maximum temperature is 77° F. in July, the lowest is 13° F. in February. Extremes of temperature have been recorded as follows:— Annapolis Royal, 91° F. in August; 13° F. in January and February: Kentville, 94° F. in July; 24° F. in February: Wolfville, 96° F. in August; 16° F. in February.

The sea is a major factor controlling temperature. One of its most noticeable effects is seen in the lateness of spring, resulting from the slow melting of sea-ice to the north and northeast. The coldness of the sea tends to produce a high-pressure area with easterly winds. Thus cool air is moved over the land, retarding the start of spring. This is counterbalanced by autumn conditions lasting late into the year as a result of slow cooling of the sea, over which is produced a low-pressure area with southwest winds which bring moist, warm air to the province. The ultimate effect is that October has temperatures 9° to 10° F. higher than April. The result, in terms of apple production, is that spring is retarded until danger of frost is past and mild temperatures are continued long enough into the autumn for ripening.

Although summers are short and there are occasional hindrances to the maturing of some crops owing to mist and fog, the frost-free period is adequate for agriculture. For virtually all the area, this period is between 160 and 180 days. A more accurate picture is given with the length of the growing season which, with a total of 190 days, is somewhat longer.[1]

The average annual precipitation is approximately 40 inches, of which slightly over 50 per cent falls during the winter as a result of cyclonic storms. Almost 20 per cent of the total falls as snow. Because of slightly higher winter temperatures resulting from proximity to the sea, only 17 per cent

[1] Putnam, D. F.: "The Climate of the Maritime Provinces," *Geog. J.*, vol. 21, pp. 134–147.

of the total precipitation falls as snow at Annapolis Royal; at the other stations the amount is 21 per cent.

Even though total precipitation for the summer is less than 50 per cent of the annual total, there is sufficient for agriculture, no month as a rule having less than 2 inches.

Wind velocities in the area are generally low, varying from 5 to 10 m.p.h. in summer and 10 to 15 m.p.h. in winter. The most frequent directions are from west and northwest, but North Mountain affords considerable shelter. In summer, a period critical for tree fruits, the strongest winds are south and southwest, the most common, west and southwest. As the valley is aligned nearly to the southwest, those winds with a southerly component can be dangerous. On rare occasions winds of hurricane force have reached the area with drastic results to ripening apples.

The average number of hours of sunshine for the three stations is, 1,797. The highest of these is Wolfville with 1,901 hours; the lowest is Annapolis Royal, where fog is more common, with 1,723. The greatest concentration comes during the bloom period of May, June, and July. This is also the time of maximum spraying, an operation that requires clear sunny days for the best results.

SETTLEMENT AND EARLY AGRICULTURE

The early 17th century French settlers found the environment an ideal one for agriculture but far from pleasant in other respects. In addition to isolation and primitive living conditions, there was a lack of security owing to intermittent wars between France and England and the conflict between farmers and those settlers primarily interested in fishing and the fur trade.

Originally, production was for local consumption, primarily to supply military garrisons. For this purpose little land was cleared and by 1671 only 364 acres, including dykeland, were under cultivation at Annapolis Royal.[1] Much of this was easily cleared land, with only scattered oaks and underbrush, on the peninsula now occupied by the town.

In 1632, forty families arrived from the Saintonge district of western France, where reclamation of marshland had long been practiced. On the Annapolis River these settlers found a familiar combination of tides and mud flats. By the use of dyked lands, a relationship between marsh and upland was introduced that was to continue until the use of commercial fertilizers was started early in the 20th century. Marshlands were primarily

[1] Calnek, W. A. and Savary, A. W.: "History of the Country of Annapolis," Briggs, Toronto, 1897, p. 31.

rich hay-production areas, the hay being used for live stock on upland areas. Live stock, in turn, served as a source of fertilizer for the soils which are still classified as low in natural fertility.

The first apple trees were planted in 1610[1] and further plantings were made in 1633. Although there were almost 1,600 trees by 1698, and apple production was to grow into a major industry, there were no exports until 1849. The slow growth can be attributed to the importance of the fur trade until the middle of the 17th century, and lumber exporting until the middle of the 18th century.

The French settlers remained within tidal limits in order to follow their dykeland agriculture. From their first settlement they expanded in the 1670's to the Minas Basin, leaving a long strip of unsettled lowland between the two settlements. The new dykelands proved to be highly suitable for hay and grain and thus provided a basis for the establishment of large herds of cattle. Unaffected by the military and political unrest of Annapolis Royal, the new settlement rapidly increased and, largely untouched by both the French and the British until 1755, became the homeland of the Acadians.

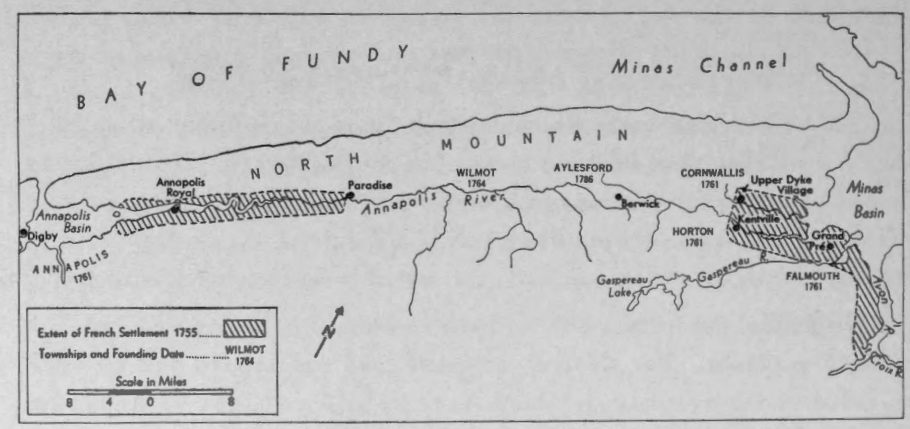

Figure 3. Historical development.

By 1755 the French settlement at the western end of the valley extended from Paradise along both banks of the river to Goat Island. In the east, settlement covered the area from the St. Croix River, a tributary of the Avon, to Kentville and Upper Dyke Village. This area included 2,100 acres of dykeland at Grand Pré and 2,000 at Canard.[2] The main crops throughout both these areas were wheat, rye, barley, hay, and peas; live

[1] Kelsall, Arthur: "Early Canadian Agriculture," *Agr. Rev.*, vol. 7, p. 66.
[2] Eaton, Arthur Wentworth Hamilton: "The History of Kings County;" Salem Press, Salem, 1910, p. 32.

stock consisted of dairy and beef cattle, horses, pigs, and sheep, all subsistence forms of agriculture.

In 1755, virtually all the Acadians were expelled from Nova Scotia. In 1758, the government started a resettlement program with people of English origin from Connecticut, Rhode Island, and Massachusetts. Owing to administrative delays and attacks by Indians and a few remaining Acadians, settlement was delayed until 1760.

In 1760-61, six to seven thousand settlers moved from New England to the Annapolis Valley. Most of the 'planters', as they were called, took over the French lands while others started the first settlements in the unused central portion of the valley. These new settlements took the form of townships of 100,000 acres or more, which included marshland and both cleared and forested upland. Lots were drawn and each settler received land in each category. In addition, church and school land, and often parade grounds, were set aside. The first townships established were Falmouth, Horton, Cornwallis, and Annapolis in 1761, and Wilmot in 1764.

Farming by the 'planters' was almost entirely similar to that of the French, with two exceptions. First, the land of North Mountain in Cornwallis township was considered better for wheat than the lowland; second, with the founding of Wilmot township, full settlement of the valley was started.

From 1775 to 1783 the last major influx of settlers occurred. This was the movement of Loyalists from the United States, the greatest number arriving in 1783. In that year 2,500 settled in Annapolis township between Annapolis Royal and Digby, and a small number chose the central portion of the valley. One result of this new immigration was an eastward movement towards Wilmot and the new township of Aylesford in 1786. Those taking part in this expansion were, as a rule, the more adventurous of the 'planters', who mingled near Berwick with a small group of Loyalists expanding westward from Kentville.

In the new areas of Wilmot, Aylesford, and Berwick, the settlers first turned to logging, floating the logs down the river to Annapolis Royal. Even in the 1780's and 90's lumbering was considered more important than farming. In fact, farming throughout the entire province progressed slowly for the next 50 or 60 years. However, between 1818 and 1820 the "Letters of Agricola" appeared in a Halifax newspaper, causing sufficient interest in the agricultural possibilities of the province to form a Central Agriculture Society and twenty-five local societies. These encouraged better farming methods and use of improved stock, and arranged annual exhibits.

The final step in the transformation from subsistence farming to exporting came in 1849, when the first apples were shipped to England. In 1861 the first shipment was made directly from Annapolis Royal to London. In that year 65,485 bushels were shipped from Annapolis county alone; 118,608 in 1871; and 242,492 in 1891.

Accompanying this growth of the industry was an increase in cattle raising. Beef cattle were pastured during the summer on the uplands and fattened in the fall on the dykelands. Towards the end of the 19th century there began a change to dairying owing both to cheap beef production in Western Canada and an increased demand for dairy products with increased urbanization throughout Nova Scotia. Further impetus was received during World War I, partly owing to decreased shipping space for apples but mainly because of increased prices of dairy products. Dairying continued as one of the major activities in a mixed farming economy and gained its main support from the Halifax market and from creameries at Annapolis Royal, Middleton, Kingston, and Kentville.

As a further incentive and support to the growing agricultural industry of the Annapolis Valley, a School of Horticulture was organized at the Nova Scotia Agricultural College at Truro, which, with the Dominion Experimental Station at Kentville, established in 1910, and the Experimental Farm at Nappan, now constitute the main agricultural research centres of the province.

PRESENT LAND USE

To determine the agricultural use of land in the Annapolis-Cornwallis region, four sample areas, varying in size from 36 to 100 square miles were mapped by the writer during field investigations in 1953. Factors governing

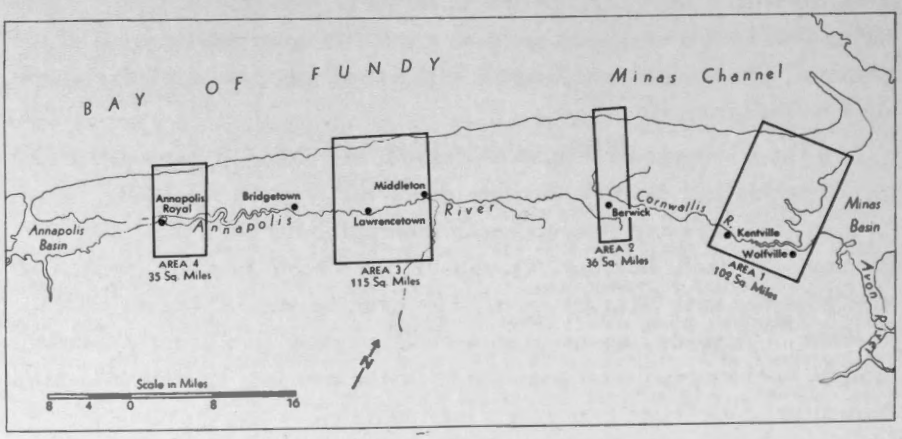

Figure 4. Location of sample areas

the location of the sample areas were geology, soils, terrain, settlement, and accessibility. Manuscript maps representative of the various parts of the area, and depicting, in a measurable form, changes and contrasts in agricultural use throughout the region, were prepared.

Table 1 showing the uses of land as a percentage of cleared land is based on measurements of the acreage of each item mapped within the sample areas. To define the types of agriculture in the valley, some of the main agricultural activities have been selected as shown in Table 2. The first group consists of hay, grain, permanent pasture, and potatoes, and is representative of a mixed farming program. The second group, called specialized, consists of orchards, market gardens, poultry, and small fruits.

TABLE 1. Uses of Land as Percentage of Cleared Land.

	Area 1	Area 2	Area 3	Area 4
Hay	23·6	28·9	37·9	36·8
Grain	11·9	16·2	8·9	4·1
Potatoes	3·9	1·8	·7	·4
Permanent Pasture	16·4	13·6	16·9	7·4
Rough "	3·3	6·4	9·1	5·6
Corn	·5	1·04	·2	·1
Market Gardening	·6	4·6	3·5	1·8
Orchards	18·9	14·6	5·9	4·7
Poultry	·7	·3	·13	·0
Small fruits[1]	·1	·06	·17	·2
Dykeland	9·4	—	—	2·8
Salt Marsh	4·1	—	—	9·6
Unused[2]	2·4	10·2	14·8	15·5
Built-up	4·2	2·3	1·8	11·0
Cleared	46·8	45·6	31·3	19·2
Wooded	53·2	54·4	68·7	80·8

[1] Strawberries, cranberries.
[2] Land once cleared, now not used for farming.

TABLE 2. Mixed and Specialized Farming as Percentage of Cleared Land*

	Area 1	Area 2	Area 3	Area 4
A. Mixed				
Hay	23·5	27·6	37·7	36·7
Grain	11·9	15·4	8·9	4·0
Potatoes	3·9	1·5	·7	·3
Permanent Pasture	16·4	13·0	16·8	7·3
Total	55·7	57·5	64·1	48·3
B. Specialized				
Orchards	18·9	13·9	5·8	4·6
Market Gardening	·6	4·3	3·4	1·8
Poultry	·6	·3	·1	·0
Small fruits	·1	·05	·1	·2
Total	20·2	18·55	9·4	6·6

*Statistics from Table 1.

Table 2 indicates that the greatest proportion of cleared land is used for mixed farming. It also shows that, in areas 2 and 3, a higher percentage of cleared land is used for grain than for orchards. This table also shows that the portion of the region containing areas 1 and 2 has a significant percentage of cleared land devoted to specialized farming.

Tables 1 and 2 refer more to agriculture in the lowland than to that of the highlands, so they, and in particular North Mountain, are discussed separately. Because of the proximity of the infertile granites of the Nova Scotia uplands to the southern slope of the valley, the highland here is little used for farming. Such farming as exists is an extension from the lowland, where slope or sufficient depth of soil is suitable. The result is that much of this highland remains wooded. At the eastern end of North Mountain the soil is a heavy clay that remains wet late into the spring. This has precluded extensive farming, cleared land on North Mountain being only 8 per cent of the total cleared within sample area 1. Farther west, in sample areas 2 and 3, the proportion increases to 21 per cent, an increase due primarily to soils which change from heavy clay to a lighter sandy clay loam. The early settlers considered these the finest soils of the region.

A second factor is climate. From the experience of seed-potato growers, it is known that slightly lower temperatures, continuing two weeks longer than in the valley, retard aphid growth and result in better quality seed potatoes. Also known is the serious effect on many crops of frost drainage from the highlands. What is little known, however, is the effect of the Bay of Fundy tides. With the rise of the tide, which may reach 40 feet, air lying over the bay is displaced and the assumption is that some of this air, warmed by the sea, moves over North Mountain or at least disturbs the atmosphere and prevents cold air from settling. In some parts of the highlands, particularly north of Middleton, low saddles facilitate such movement of air. It is of interest to note the greater use of these areas in comparison to other parts of the upland.

Land use in the lowland has two divisions, dykeland agriculture, and the use of the ridges and the undulating valley floor. At each end of the valley, dykelands are used for hay, grain, and pasture, but not for orchards, because of excessive moisture. There is a marked contrast between the two areas, particularly if the percentage of salt marsh is also considered, and it is noted that much of the salt marsh in area 4 results from broken dykes and flooded marshland. At the eastern end (sample area 1) dykes are maintained, and the reclaimed land is well managed and adequately

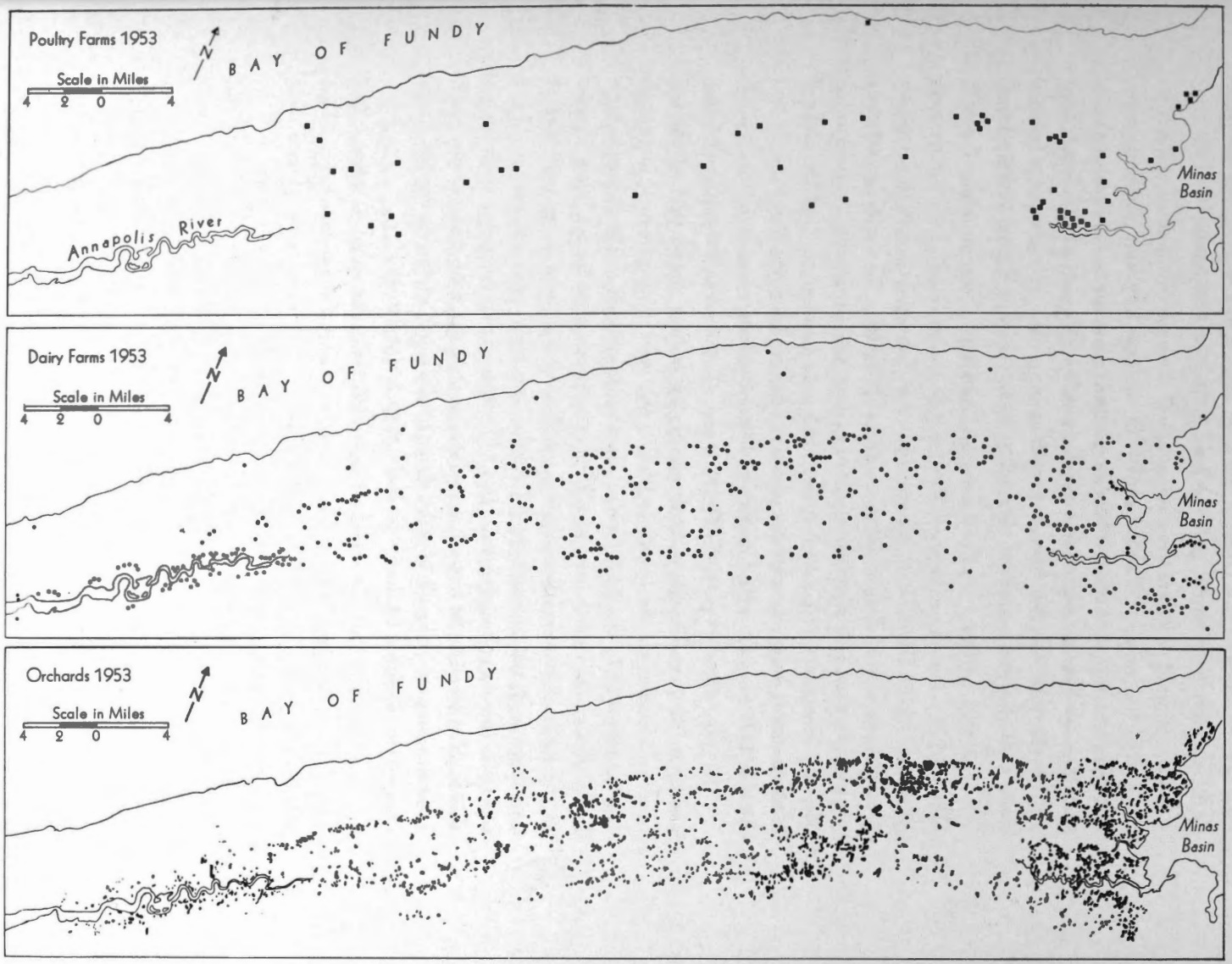

Figure 5. Distribution of poultry farms, dairy farms, and apple orchards, 1953.

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particularly suitable for the latter purpose because of the flatness of the land and the high moisture content, both of which aid greatly in winter flooding.

AGRICULTURAL IMPORTANCE OF THE AREA

A combination of soils that are generally suitable for agriculture, a temperate climate with a long growing season, accessible markets, adequate transportation facilities, and a long history of settlement have resulted in the Annapolis–Cornwallis Valley becoming the leading agricultural area of Nova Scotia.

To show as accurately as possible the importance of this area, certain statistics are taken from the 1951 Census of Canada. These are not available for the surveyed area alone, and figures for the whole of both Annapolis and Kings county have to be used. For some subjects dealt with in the original source, a more detailed division of each county is given. As this division is not used in all cases, and as the difference between entire counties and those parts most closely resembling the surveyed area is consistently only 3 per cent, figures for the whole county have been used.

The basic program throughout the area is one of mixed farming, consisting most commonly of hay, grain, root crops—usually potatoes—pasture, and live stock for beef and dairy purposes. With this type of program greater economic stability is assured than if a purely specialized one is attempted. However, superimposed on this mixed farming are the two specializations of poultry farming and fruit orchards. Rarely, if ever, is orchard culture the sole activity on a farm; it is rather an additional activity that provides much of the farm income. Poultry farming, on the other hand, which also forms a valuable part of a mixed farming economy, is, when conducted on a large scale, almost the sole function of the farm. Such field crops as are produced are used primarily for poultry feed.

Mixed farming, orchards, and poultry farming extend over the entire valley and are even found, to a lesser degree, over the two main sand areas. Nevertheless, certain areas of concentration can be delimited.

The westerly limit of mixed farming is shown as lying near Bridgetown, although mixed farming, dairy farming, orchards, and other specializations are found westward of this line. However, a combination of such factors as the rapidly decreasing width of the valley, the increased amount of woodland, smaller farm size, poor condition of dykelands, and an apparent lack of interest in farming, place this part of the valley outside the area of best mixed farming.

North Mountain is included within this area of mixed farming. Although farming on most of this upland does not compare with that of the lowland, what exists is of a mixed type.

The best area of mixed farming lies in the eastern end of the valley between North and South Mountains and extends from Wolfville to Kentville. Here sandy soils are at a minimum and rich, well-maintained marshland soils are at their maximum extent. In addition, relatively fertile soils cover the intervening ridges. The result is a concentration of mixed farming supplemented by orchards.

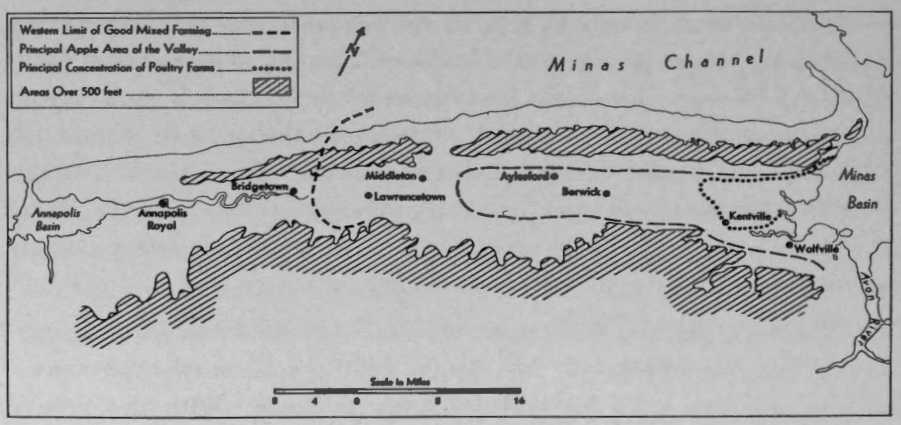

Figure 6. Agricultural areas.

West of Kentville, infertile sand interrupts the valley-wide spread of the better soils and reduces the area of mixed farming to narrow strips along the slopes on each side of the valley. In the vicinity of Berwick the strips unite to form a second, though smaller, valley-wide area of relatively fertile soils also largely used for mixed farming. Similar sands, starting near Aylesford, also cover the lowland and limit the best areas of mixed farming to narrow strips at the valley edge which come together at Lawrencetown. From here westward, soils on glacial-deposited parent material and dykelands are more common than the sandy type soils, but this is close to the poor agricultural area west of Bridgetown, where little advantage is being taken of the more fertile soils.

Figure 7 shows a comparison of several factors of the leading agricultural counties, including Annapolis and Kings counties combined, as this is the closest approximation for statistical purposes to the survey area.

The proportion of agricultural production of almost all commodities in the valley is high in terms of quantity and of gross revenue in comparison with the other agricultural counties. However, when gross revenue from

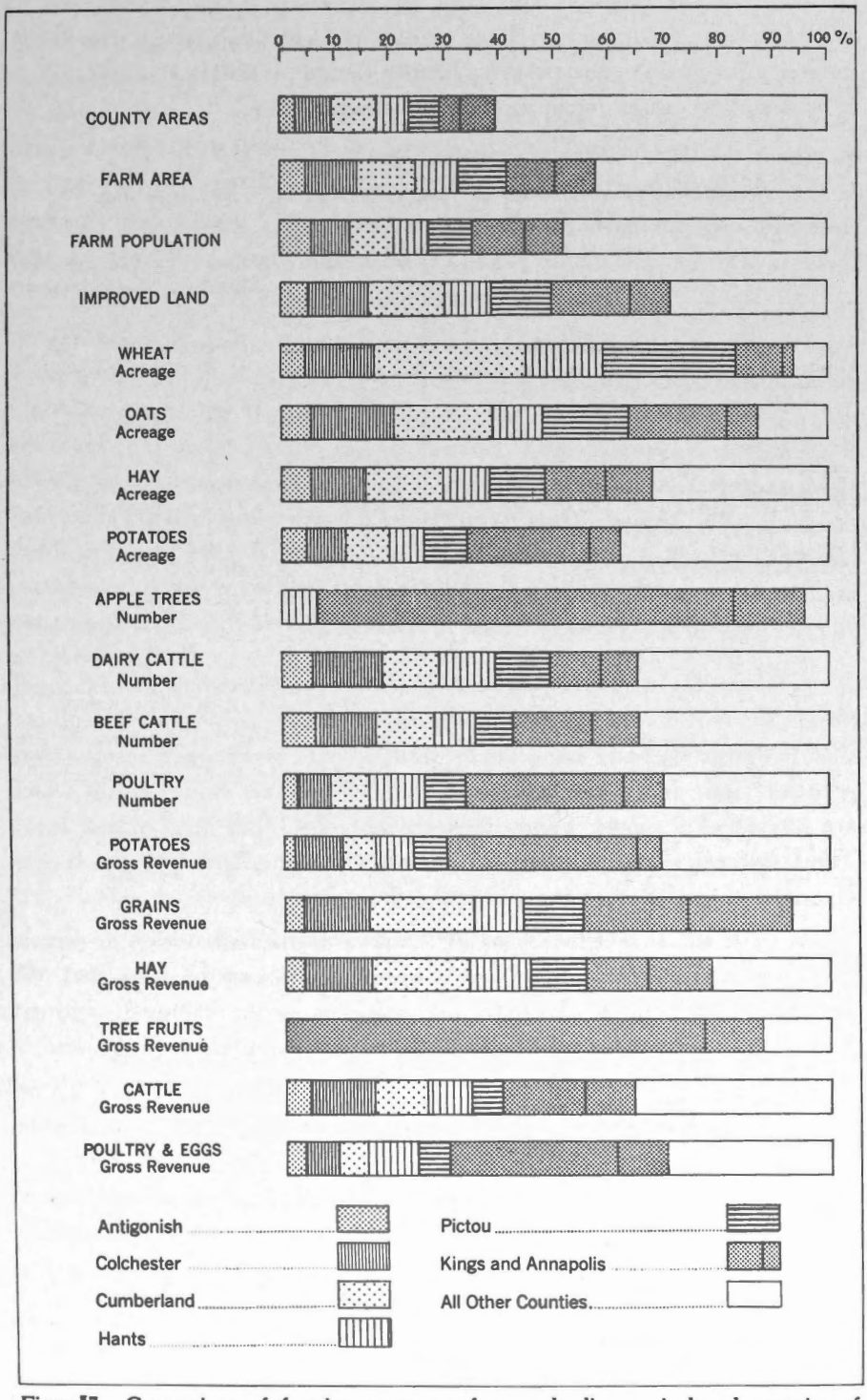

Figure 7. Comparison of farming economy of seven leading agricultural counties of Nova Scotia.

the principal agricultural products of Annapolis and Kings counties is calculated as a percentage of the gross income within the valley alone, (Table 3) it is clear that certain farming activities predominate.

TABLE 3.

Percentage of Gross Revenue from Various Sources within the Survey Area[1]

	Annapolis County	Kings County	Annapolis and Kings Counties
Grains	1·3	·6	·83
Hay and forage crops	1·9	·8	1·1
Potatoes, roots, and other field crops	1·5	5·3	4·1
Vegetables	2·3	2·3	2·3
Tree fruits	4·6	16·1	12·5
Small fruits	·8	2·1	1·7
Cattle	19·1	13·9	15·5
Dairy products	19·1	13·5	15·3
Poultry and eggs	13·8	21·2	18·9
Swine	5·3	8·2	7·3
Forest products	9·6	4·8	6·3
Products consumed on farms	20·1	10·6	13·6

[1] DBS Census, 1951.

The sources of income can be divided between the two types of farming programs, mixed farming and specialization. Cattle and dairy products, with the associated hay and grain for feed, plus the smaller percentages from potatoes, root and other field crops, vegetables, and swine—all of which are phases of a mixed program—contributed 45 per cent of the total. The remaining major portion—33 per cent—is contributed by the special activities of poultry farming and orchards.

An additional fact indicated by Table 3 is the distribution of certain farming activities between the two counties. It can be seen that the greatest concentration of cattle and dairying is in Annapolis county. Tree fruits and poultry, on the other hand, are definitely concentrated in Kings county.

The most obvious and one of the most valuable single uses of land in the Annapolis-Cornwallis Valley is for orchards. From the early days of apple exporting until World War II, there were two significant developments in the apple industry; an almost complete reliance on the United Kingdom as the major buyer and an increase, to approximately 200, in the number of varieties produced, many of which were almost unacceptable on the Canadian market.

The weakness of a large number of varieties, the fact that there were many old trees, plus the loss of the British market owing to the war, resulted

in 1939 in the start of a program of tree removal, and 881,189 trees had been removed by 1952. One result has been the elimination of less desirable varieties and a concentration on the better ones such as Wagener, McIntosh, Stark, Golden Russet and Delicious. A second result has been a reduction in acreage from 28,024 in 1939 to 17,395 in 1951. Despite this reduction orchards still occupy 13 per cent of the improved land, a figure exceeded only by hay (46 per cent) and pasture (17 per cent). Of the total acreage, 14,767 acres or 84 per cent is in Kings county.

Historically, Kings county has always been the major producer. This is accounted for partly by the fact that with the greater width of the valley there is more land suitable for orchards. On a basis of percentage of crop land devoted to orchards, Kings county, with 20 per cent, still leads Annapolis county with 7 per cent. A partial explanation is that much of Annapolis county is depressed agriculturally and in only a few categories can it compare with Kings county. In contrast, Kings county is an important contributor in almost all agricultural commodity groups and its leadership in orchard acreage, even in a region of concentration, should not be surprising.

Success in producing apples requires, in addition to skill, considerable capital investment, patience, work, and attention during three-quarters of the year as the following work-timetable shows:—

a. March and April—pruning
b. April—planting
c. April or early May—grafting
d. May to mid July—spraying
e. June and July—one or two grass cuttings
f. Late August to end of October—picking.

Climatic fluctuations can reduce or completely destroy the crop at any time during the crop year. Rain and fog in the spring and early summer can reduce blooming and keep down pollination; cloudy, moist weather during the summer can prevent ripening and may also induce disease; finally, winds at hurricane force can destroy both trees and fruit as happened in 1953 and 1954.

Despite all the handicaps, the Annapolis Valley continues as one of the major apple-producing areas of Canada, ranking fourth in area and gross revenue. The present, and probably the future, success of the Annapolis Valley may be attributed, in part, to the tree-removal program, which has resulted in greater emphasis on readily marketed varieties.

The largest single source of revenue, and the farm activity occupying the least land, is the poultry industry. A considerable impetus was given to this industry by the loss of the British apple market early in the war, just as the tree-removal program was getting under way.

Because of the mild spring climate, hatching is done in December, January, and February to permit outdoor ranging to start in March and April. Ranging is done in groups of about 100 birds, each group having its own shelter against rain and predatory pests. At five and one-half to six months the birds are moved inside for laying. Many poultry houses are converted barns or other buildings; in Kings county, however, there are five large aluminum-sided poultry houses each accommodating 15,000 birds, and two single-storey circular houses, one of 10,000 and the other of 15,000 capacity. All laying is done in these buildings and both feed and water are supplied automatically. Between eleven and thirteen months, usually starting in November, the birds are killed for meat.

Despite the general high level of agriculture in the valley, there are some practices that do not appear to be compatible with the degree of success and the amount of experience of valley farmers. There is, for example, a lack of interest in green silage except to a limited degree in eastern Kings county. In haying, baled hay is often stacked in the field and allowed to stand for several days, with the result that the bales often suffer from rain. Even if this does not happen. they must still be handled a second time when loading for removal to storage. Investigation failed to bring out an answer as to why, at the first handling, the bales were not loaded for transportation to the barn.

Dairying is an extremely valuable part of the farming economy; however, with very few exceptions, dairy herds are of mixed, rather than pure breeds. There appears to be no adequate explanation of this, as the dairy farmers generally admit the advantages of pure-bred herds.

MARKETING OF FARM PRODUCTS

Apples, poultry, and eggs are the only commodities produced in the area that are efficiently marketed, the apparent reason being because they are sold in competitive markets outside the province.

Apples

As a result of wartime marketing problems, all apples were sold until 1952 by the Apple Marketing Board. Since the 1952 crop, sales have been made through the United Fruit Company, the principal sales agency,

smaller fruit companies, co-operatives, or by the individual grower. Sales by the last-named have been from roadside stalls or, in a few cases, from trucks travelling over much of the province. A new cooperative sales program is being planned, and when put into effect should be of great advantage to apple producers.

Table 4 shows that, apart from sales to the United Kingdom in 1950, the largest market since 1948 has been Nova Scotia, followed by Quebec. Percentages of sales in these two provinces, and in market areas generally, have been marked by varying degrees of fluctuation, and in some cases by complete disappearance, thus clearly indicating failure to establish stable markets.

TABLE 4

Percentage Distribution of Fresh Apple Sales. 1949-52[1]

Market	1948–49	1949–50	1950–51	1951–52
Nova Scotia	35·3	12·8	36·8	41·1
New Brunswick	3·8	1·9	5·2	3·1
Prince Edward Island	·6	·2	·9	·6
Quebec	33·9	10·6	28·1	5·9
Ontario	4·4	·3	3·1	·2
British West Indies	1·3	·5	1·2	1·6
Newfoundland	9·2	4·1	12·9	12·7
United States	6·8	—	—	—
Manitoba	—	—	·9	1·4
United Kingdom	—	69·0	10·4	33·2
South Africa	·5	—	—	—
Belgium	3·6	—	—	—
Other	·6	·6	·5	·2

[1] Nova Scotia, Dept. Agriculture and Marketing; Annual Report for the year ending March 31, 1952; Halifax, 1952.

EGGS AND POULTRY

The growth of the egg and poultry industry of the valley is to a very large extent the result of the efforts of two men, a hatchery operator and a producer of fresh eggs and poultry meat, their enterprises to-day being the two largest of their kind in Canada. Table 5 shows an over-all increase in the production of both eggs and poultry meat from 1943 onward. Table 6, which covers the years 1947-1951 shows the principal markets, their growth, and the elimination of the less stable markets. The best markets at present are those towards which the province is oriented by sea—Bermuda, Newfoundland, and the West Indies. More recent figures are not available to show if Quebec is an expanding market. However, a certain percentage of production will inevitably find its way to Canadian markets, but it is apparent that those reached by relatively short, cheaper sea transport are more satisfactory than those reached by more expensive rail transport.

TABLE 5.

Egg and Poultry Production 1943-51

Year	Eggs	Poultry
	cases*	pounds
1943	37,825	402,748
1944	71,084	912,310
1945	74,968	556,228
1946	77,763	821,151
1947	125,432	1,232,774
1948	133,991	737,954
1949	111,326	991,568
1950	122,480	861,332
1951	151,482	1,226,087

* A case contains 30 dozen.

TABLE 6.

*Percentage Distribution of Shell Eggs 1947-51**

Market	1947	1948	1949	1950	1951
Bermuda	9·0	19·8	52·8	43·9	58·6
Newfoundland	27·9	18·3	20·7	23·0	10·4
United Kingdom	53·4	35·9	9·8	—	—
West Indies	7·0	6·9	4·4	8·0	7·2
New Brunswick	3·0	2·7	3·4	10·8	2·0
Ontario	—	13·7	5·3	—	—
Quebec	—	1·6	1·0	—	20·8
Manitoba	—	—	1·9	—	—
Miquelon	—	—	·2	—	·2
United States	—	—	—	7·3	—
St. Pierre	—	—	—	·4	—
Venezuela	—	—	—	1·3	—
Switzerland	—	—	—	2·7	—

* Nova Scotia, Dept. Agriculture and Marketing: *Op cit.*

MILK AND CREAM

The creameries or dairies at Annapolis Royal, Middleton, Kingston, and Kentville obtain milk and cream from local producers and are in competition with several dairies in Halifax. The result is keen competition over an area extending from Annapolis Royal to Wolfville and across the province to Lunenburg and Bridgewater. Over this area trucks of competing dairies follow each other, collecting produce often from widely separated farms.

BEEF CATTLE

For many years the Montreal market controlled the price of beef in Nova Scotia. However, in recent years under the auspices of the provincial Department of Agriculture and Marketing, cattle shipping clubs have been organized. Through the clubs the price per pound at Moncton has been

equalized with that at Montreal. Despite this advantage there are farmers in the region who sell to buyers in the farming areas for as much as 2 cents per pound less.

Fresh Vegetables

Halifax is a ready market for much of the market-garden produce of the area. There appears, however, to be no consistent sales program, as some farmers sell at the roadside, some to buyers who visit the valley regularly, while others transport their vegetables either to Halifax or to some other nearby market. There is not even individual consistency, as a farmer may dispose of his produce one way one week and a different way the next.

POPULATION DISTRIBUTION

According to the 1951 Census, the population of Kings and Annapolis Counties was 54,930. Of these, 78·6 per cent was rural or lived outside either incorporated or unincorporated settlements of 1,000 and over, and 21·4 per cent was urban. Of the rural population, farm-dwellers made up 42·7 per cent; the figure for the province as a whole was 37·7 per cent farm-dwellers and for Canada 52·6 per cent.

A close relationship exists between population density, as shown by the map, and certain features of terrain and land use. The lowest densities are on the south side of the area, on the slopes and upper level of South Mountain. They are lower than the figures for North Mountain largely because of poorer soils. The good soils of North Mountain permit a moderately high density figure, which is supplemented by the population of fishing villages and a number of workers who commute daily to towns in the valley.

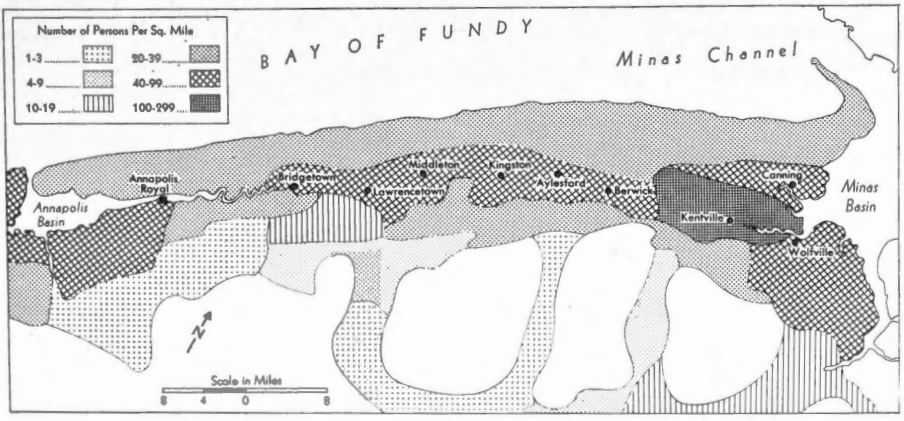

Figure 8. Population density, 1951.

The most densely populated area coincides with the most prosperous farming around Kentville. Eastward to the Avon Valley, north to Canning and the base of North Mountain, and westward through the lowland, extend areas of density second only to that of the Kentville area and coinciding closely with the further areas of successful land use. On the south side of Annapolis River, west from Bridgetown to Annapolis Royal in the area of depressed agriculture, the density is again low. The town of Annapolis Royal and H.M.C.S. Cornwallis on Annapolis Basin account for the higher figure westward from Annapolis Royal. The map does not show areas of very sparse population such as low-lying, damp dykelands and large expanses of infertile sandy soil.

Settlements

There are three types of settlements—towns, villages, and hamlets. The classification used in this study is based not on the legal aspects of incorporated settlements but rather on a basis of function and available services.[1]

For the purpose of this study a settlement requires more than one function to be classified as a town, the principal functions being administration, commerce, industry, secondary education, or tourism. Some of the requisites for town classification may be found in a settlement classified here as village. Villages, however, are smaller, with between 30 and 100 houses, a grocery store, and a post office. In addition, villages are single-function settlements.

The hamlet is identifiable as having less than the minimum requirements of a village. Some settlements, however, with more than 30 houses have been classed as hamlets. In such cases the other requirements are fulfilled, but there are instances of more than 30 houses extending over as much as four miles, thus destroying any tendency to concentration.

Some settlements named on the topographic maps of the area do not even qualify as hamlets. These are usually cross-road settlements, sometimes with a post office, or in some cases with a grouping of two or three farm homesteads, but with none of the services of a settlement. In other instances there are two or three houses close to an elementary school which serves a large rural area. Such places are not classed as settlements for the purposes of this study.

[1] For a town: 1. At least two grocery stores; 2. Auto or implement sales; 3. Specialty equipment—hardware, appliances, and furniture; 4. Specialty foods, meat, etc.; 5. Drugstore; 6. Clothing or shoes; 7. Bank; 8. Movie theatre; 9. Weekly newspaper; 10. Fire protection—volunteer or full-time; 11. High school; 12. At least two churches; 13. More than 100 houses.

Included in the study area are 57 settlements—7 towns, 11 villages, and 39 hamlets. All the towns are in the lowland and, with the exception of Berwick, are on the main highway and railway line. Apart from 1 village on the coast and 3 in the broad lowland of the eastern end of the valley, all the villages are also on the main lines of communication. The size of Margaretsville, the only village outside the lowland, is due to the fact that it is a summer resort settlement. The only portion of the area with a number of villages spread across the valley is the wide eastern end, the most successfully used portion of the region. The fact that there are 2 towns here, in addition to the 4 villages, is further evidence of the importance of this area.

Towns

There are 7 towns, Wolfville, Kentville, Berwick, Kingston, Middleton, Bridgetown, and Annapolis Royal. All fulfil the primary function of supply centres for the rural areas and each has tributary to it a trade zone of varying size, depending on the size of the town, its accessibility, and the multiplicity of its functions. The varying secondary functions and tributary areas are shown in Figure 9.

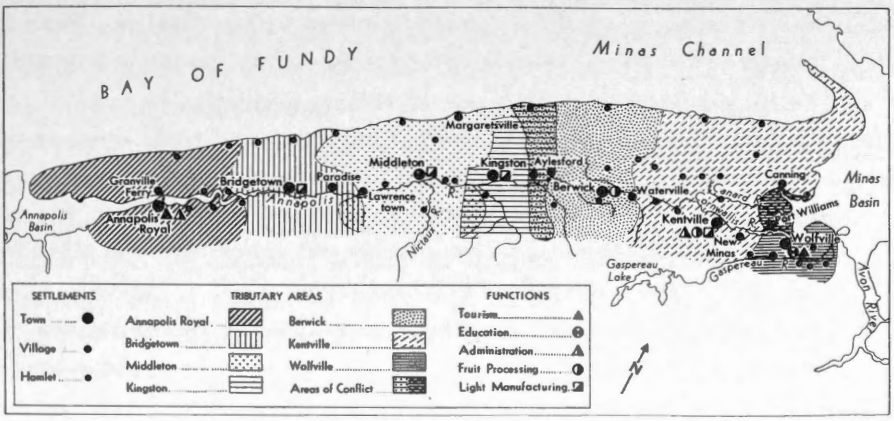

Figure 9. Settlements and their tributary areas.

With two exceptions, the towns are evenly spaced about 15 miles apart. The exceptions are Wolfville and Kentville, and Kingston and Middleton. In the first case, both are old settlements but have quite different secondary functions; in the second case, Kingston is the town for the R.C.A.F. base at Greenwood, and as such has had an abnormally rapid growth.

Table 7 shows population figures for the 7 towns. Population of settlements has been enumerated only since each has become incorporated.

TABLE 7.

Population of Towns[1]

Town	1891	1901	1911	1921	1931	1941	1951
Wolfville	—	1412	1458	1743	1818	1944	2313
Kentville	1686	1731	2304	2717	3033	3928	4240
Berwick	—	—	—	—	837	962	1045
Kingston[2]	—	—	—	—	—	—	1640
Middleton	—	—	827	875	904	1172	1506
Bridgetown	—	858	996	1086	1126	1020	1038
Annapolis Royal	—	1019	1019	836	739	782	784

[1] Canada, Dept. of Trade and Commerce; Census of Canada, 1951; vol. 1, Table 6.
[2] Personal communication with Regional Statistics Officer, Halifax.

VILLAGES AND HAMLETS

No attempt has been made to determine spheres of influence, if such exist, of the villages, which include Canning, Port Williams, Gaspereau, New Minas, Waterville, Aylesford, Auburn, Lawrencetown, Paradise, Granville Ferry, and Margaretsville. However, a study of the maps of population distribution and of settlements indicates some interesting factors. For example, each village is located in an area of farm and rural homes that lies outside those areas immediately adjacent to towns. This suggests that villages fill a need as subsidiary supply centres to the rural population. They function as supply centres without the secondary functions of towns

The second factor is the location of villages in relation to towns. Of the 11 villages, 5 are at points of contact between town trade zones or in areas of conflict; 3 are in intermediate, fairly evenly spaced positions between towns; 2 are in the favourable eastern end of the valley, one at the northern edge of concentrated population and agriculture, the other in the Gaspereau Valley; one is located on the coast.

The third factor is that the villages encompassing concentrations of houses do so, in all cases except Gaspereau and Granville Ferry, by extending into neighbouring town trade zones.

RELATIONSHIP BETWEEN SETTLEMENT AND LAND USE

All the settlements of the lowland are related to agricultural land use in that, regardless of size, they are supply centres for the rural areas. The single-function settlements fulfil this role as suppliers of immediate needs. For requirements other than feed, farm equipment, or repairs, the towns are adequate sources of supply.

The towns, too, are adequate for most of the needs of coastal settlements. In the case of the part-time fisherman-farmers or loggers, their

needs can be supplied from valley towns. For the fishermen, towns such as Digby, outside the area but having specialized supply facilities, are suitable.

Those towns with industries are also closely linked to agriculture, as the majority of the industries are based on farm produce. Most important are fruit and vegetable canneries, apple processing plants, egg-grading and storing warehouses, creameries, and meat-packing plants. Ancillary to these are wood-working, the production of barrels and boxes for fruit, and cold storage plants for apples. Two industries in the valley are based on land useless for farming. At Caribou Lake a peat-processing factory is based on a large area of non-agricultural land; in Middleton monuments are made from granite taken from an area almost useless for farming.

Kentville and Kingston have particular problems of specialized land use. On a sandy area of over two square miles west of Kentville, the Department of National Defence maintains an army camp. This is no loss in terms of farmland as it consists almost entirely of the poorest soil in the valley. The camp is so close to Kentville, however, that there are the usual problems of accommodation for families and recreational facilities.

An area of infertile, sandy soil near Kingston is used for an R.C.A.F. base. Here the problem is similar to that at Kentville, except that it is of much more recent origin and for that reason can perhaps be dealt with more readily. Fewer low-category houses exist, and there is evidence of expansion in the commercial area.

The excellence of the eastern end of the valley as an agricultural area has already been discussed. It has also been pointed out that the best area of mixed farming extends westward through the valley to Bridgetown. Observation and statistics appear to indicate that from Bridgetown to Annapolis Royal there is an area of agricultural depression. Finally, a close link has been established between agricultural land use and the towns of the valley.

In the light of all these factors, the data presented in Figure 10, based on the relationship between settlements and land use, are significant. It is easy to see the growing importance of the Wolfville-Kentville area (sample area 1); the steady increase in the Berwick area (sample area 2); and the sudden post-depression upswing at Middleton (sample area 3), which can be related to the tree-removal program and the increase in importance of dairying. Finally, the decline in the rate of growth at Bridgetown and Annapolis Royal (sample area 4) can only be taken as further evidence of a decline in the importance of agriculture ante-dating both the depression of 1929 and the tree-removal program. However, although

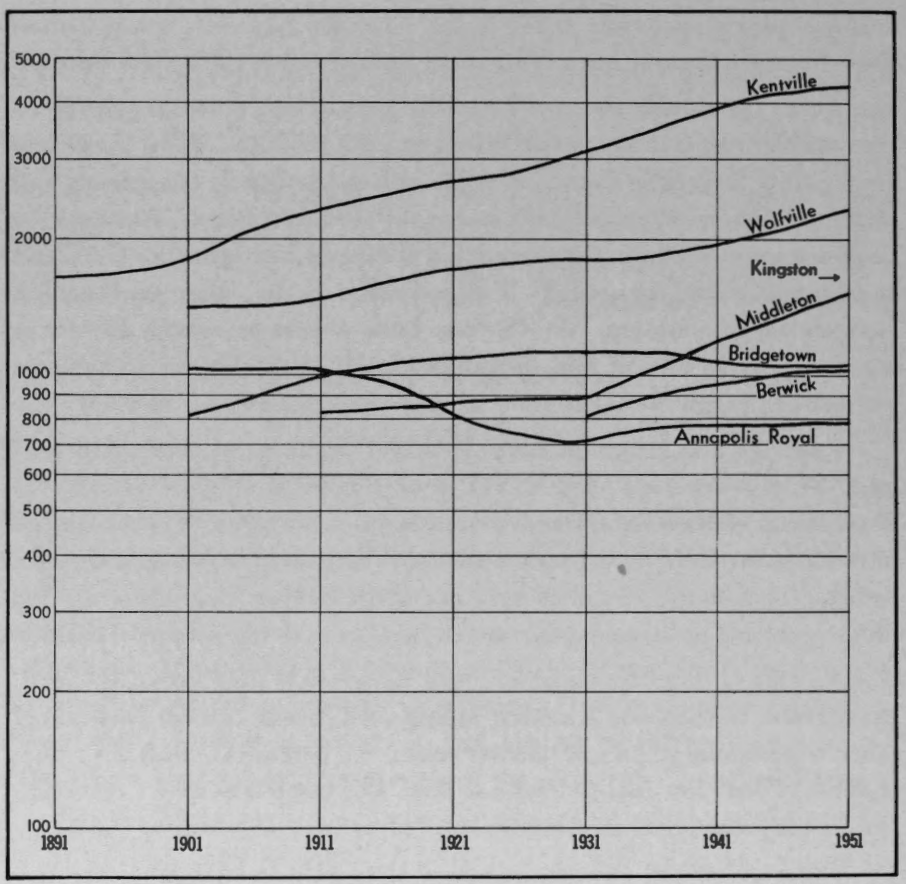

Figure 10. Comparative rates of growth of towns in Annapolis–Cornwallis Valley.

indications do not suggest that this area is likely to rival the Wolfville-Kentville area, it still has an environment that would permit a re-growth to a position of greater importance in the Annapolis Valley as a whole.

RÉSUMÉ

Les travaux exécutés par l'auteur dans la vallée d'Annapolis-Cornwallis, en Nouvelle-Écosse, durant l'été de 1953 avaient pour but de faire un relevé complet du mode d'utilisation du sol et d'établir la relation qui existe entre les centres urbains et leurs territoires de distribution. A cette fin, il a étudié la physiographie, le système d'écoulement des eaux, les sols et le climat en fonction de l'agriculture puis a fait un relevé systématique de chacun des genres d'utilisation du sol et évalué leur influence sur le milieu physique et humain.

L'article relate l'histoire de la région à partir du début du 17e siècle quand les premiers colons français commencèrent à y pratiquer l'agriculture.

Suit un rapprochement entre, d'une part, l'évolution de la population et de l'industrie agricole et, d'autre part, la variation dans les marchés et l'utilisation plus rationnelle du sol.

Afin de bien comprendre l'utilisation actuelle du sol, l'auteur a cartographié quatre secteurs types de la région et présente ici les résultats sous forme de cartes et de tableaux statistiques. Il analyse ces données en rapport avec les caractéristiques physiques et économiques puis étudie l'importance agricole de la vallée d'Annapolis en fonction de son marché et de ses recettes.

Les sources de revenus proviennent soit de l'agriculture mixe soit de l'agriculture spécialisée, cette dernière comprenant l'aviculture et la culture des fruits de verger et des petits fruits. Les vergers de pommiers constituent encore l'une des principales sources de revenus.

Se basant sur le recensement de 1951, l'auteur fait ressortir le rapport qui existe entre la distribution de la population et l'utilisation du sol.

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POPULATION DISTRIBUTION OF THE LABRADOR COAST, NEWFOUNDLAND

W. A. Black[1]

In the early days of colonization it was the practice of west European countries to view the resources of new lands as the property of the Crown. This practice applied to Labrador and the fisheries were regarded largely as a vast reservoir of resources available for exploitation by fish merchants from the West of England, and also as a training school for seamen. The establishment of a resident white population on the Labrador coast received no official sanction from Great Britain and regulations were designed primarily to maintain the fisheries as a preserve and to hinder the growth of a permanent white settlement. The growth of the population was strongly influenced by this policy. The purpose of this paper is to analyze the factors that influenced the growth and distribution of the Labrador population.

Population distribution on the coast of Labrador reflects the fundamental importance of the fisheries, as it is concentrated in coastal harbours close to the fishing grounds. Prior to and following the Napoleonic Wars, fish merchants were the chief means of bringing settlers as fishing crews to Labrador. At the end of the season the merchants left winter crews behind as 'residents' or caretakers of the fishing premises, and these people became the first permanent white residents.

As a result of official policy the population grew slowly. In 1785 there were 153 permanent residents on the coast, and in 1806 there were 489. Until 1830, most of the crews were attached to the merchant establishments, and as the number of crews was rigidly controlled to meet the needs of the merchants, the increase in permanent residents was very small during a period that extended over three-quarters of a century. By 1848 the population numbered 900, of which 400 were distributed along the southeast coast between Chateau Bay and Seal Islands. The remaining 500, mainly Eskimos and those who had intermarried with the Eskimos, were distributed northwards between Seal Islands and Cape Harrison. A rapid increase in population followed after 1848 owing to the breakdown of controls regulating the number of resident fishermen. The permanent population now

[1] W. A. Black, B.A., Western Ontario; M.A., Syracuse; geographer, Geographical Branch, Department of Mines and Technical Surveys. This paper is based on field work carried out by the author during the summer of 1950 and the autumn of 1952.

outnumbered the number of crews required by the merchants as winter caretakers. This population, exclusive of some 300 Eskimos on the coast between Blanc Sablon and Cape Harrison, increased to 2,062 by 1864 and to 2,179 by 1869.

A large proportion of the population consisted of Newfoundlanders who remained on the coast as caretakers of the fishing premises; the majority of the people, however, were descended from the earlier white residents and from those who had married Eskimo or Indian women. The former became known as 'liveyeres' from a corruption of 'they live here', and half-breeds became known as 'settlers'. From this mixture there developed a permanent population that was no longer attached to the merchant winter establishments. These people supported themselves by securing their own equipment and selling their fish to the merchant establishments. Their economic status was low from the first and the government regularly provided the necessaries of life. Thus the first major economic problem that confronted the people, and one that has continued in large measure to the present time, was to make the income derived from the two or three months of the summer fishery provide for the whole year. Only the caretakers of the fishing premises were not confronted with this problem. At the present time it is estimated that this group does not exceed 5 per cent of the total population, that is, a number less than the winter residents of 1806.

With the exception of the winter caretakers, the fishermen, at the end of the fishing season, left their summer stations on the island fringe and moved into the upper arms of the bays, a practice that is continued by a large part of the present-day population. This migratory pattern was also practised by the Eskimo population. The only exception to this movement was on the Strait of Belle Isle where there are no arms of bays extending inland for the fishermen and their families to move into at the end of the fishing season.

The distribution of the Labrador population is localized in small settlements that are thinly distributed along an irregular coastline stretching over 10° of latitude, (Figure 1). The present population according to the 1951 Census is 7,847.

TABLE 1.

*Population Growth, Labrador District**

1901	1911	1921	1935	1945	1951	Percentage Increase, 1921-1951
3,902	3,896	3,749	4,716	5,525	7,847	107·9

* Census of Newfoundland, 1911 to 1945; Ninth Census of Canada, 1951.

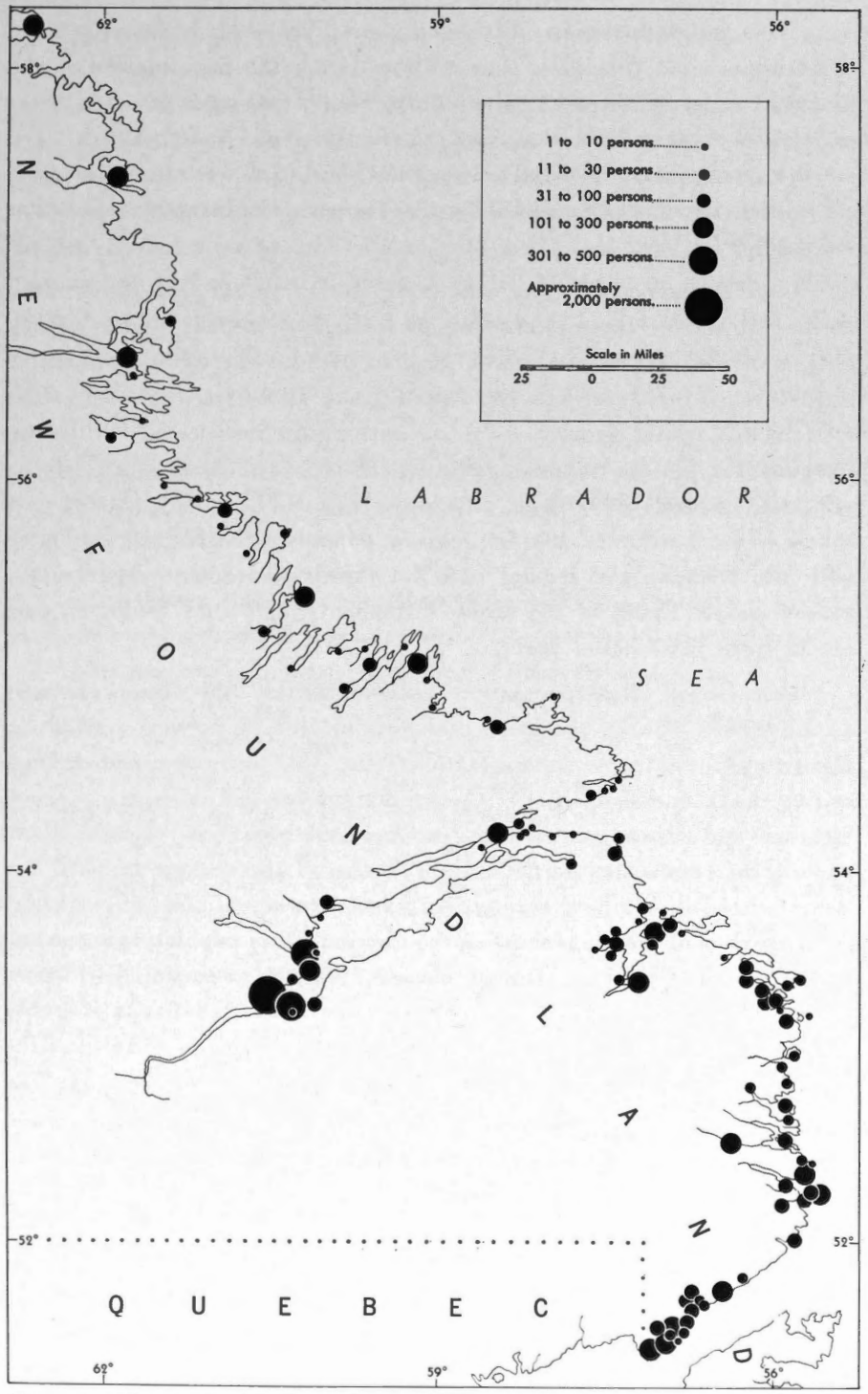

Figure 1. The distribution of population in Labrador, Newfoundland based on the 1951 Census of Canada

outnumbered the number of crews required by the merchants as winter caretakers. This population, exclusive of some 300 Eskimos on the coast between Blanc Sablon and Cape Harrison, increased to 2,062 by 1864 and to 2,179 by 1869.

A large proportion of the population consisted of Newfoundlanders who remained on the coast as caretakers of the fishing premises; the majority of the people, however, were descended from the earlier white residents and from those who had married Eskimo or Indian women. The former became known as 'liveyeres' from a corruption of 'they live here', and half-breeds became known as 'settlers'. From this mixture there developed a permanent population that was no longer attached to the merchant winter establishments. These people supported themselves by securing their own equipment and selling their fish to the merchant establishments. Their economic status was low from the first and the government regularly provided the necessaries of life. Thus the first major economic problem that confronted the people, and one that has continued in large measure to the present time, was to make the income derived from the two or three months of the summer fishery provide for the whole year. Only the caretakers of the fishing premises were not confronted with this problem. At the present time it is estimated that this group does not exceed 5 per cent of the total population, that is, a number less than the winter residents of 1806.

With the exception of the winter caretakers, the fishermen, at the end of the fishing season, left their summer stations on the island fringe and moved into the upper arms of the bays, a practice that is continued by a large part of the present-day population. This migratory pattern was also practised by the Eskimo population. The only exception to this movement was on the Strait of Belle Isle where there are no arms of bays extending inland for the fishermen and their families to move into at the end of the fishing season.

The distribution of the Labrador population is localized in small settlements that are thinly distributed along an irregular coastline stretching over 10° of latitude, (Figure 1). The present population according to the 1951 Census is 7,847.

TABLE 1.

*Population Growth, Labrador District**

1901	1911	1921	1935	1945	1951	Percentage Increase, 1921-1951
3,902	3,896	3,749	4,716	5,525	7,847	107·9

* Census of Newfoundland, 1911 to 1945; Ninth Census of Canada, 1951.

5,003 persons (74 per cent) are concentrated in some 14 villages with populations of 100 or more.* Another 1,312 person (19 per cent) are in 26 villages with populations between 25 and 100; the remaining 472 persons (7 per cent) are scattered among some 42 coves. This pattern of population distribution, with its orientation to village occupancy, is characteristic of economically retarded areas depending chiefly upon sea resources. The largest concentration of population is centered in four principal locations at the western end of Lake Melville; namely, Mud Lake, Hamilton River, Northwest River and Goose Bay, and numbers 3,038 or 39 per cent of the entire population of Labrador. In the neighbourhood of Hamilton Inlet live 80 Eskimos and near the western end of the Inlet 148 Montagnais Indians.

In many of the settlements there has not been a significant increase in population over a forty-year period (Table 2). The fishing zone that

TABLE 2.

Population Growth of Selected Settlements, 1911 and 1951†

Settlements on Strait of Belle Isle	1911	1951	Settlements on Atlantic Coast	1911	1951
L'Anse Eclair	114	152	Fox Cove	63	151
Forteau	177	190	Georges Cove	27	27
L'Anse a Loup	103	268	Batteau	30	15
W. St. Modiste	124	92	Cartwright	49	244
Red Bay	109	183	Paradise	7	132
Henley Harbour	48	85	Rigolet	26	129
Battle Harbour	110	107	West Bay	27	33

† Census of Newfoundland, 1911. Ninth Census of Canada, 1951.

bordered the regular shoreline of the Strait of Belle Isle is narrow and offers limited opportunities for fishing. In contrast, the east coast of Labrador is bordered by islands, promontories, and large bays that offer a width of 15 or more miles for an inshore fishery. Many of the fishing stations in this area are largely occupied during the open season by fishermen from the island of Newfoundland who are known as stationers. Population growth in this area took the form of increasing the number of settlements rather than a significant increase within each community. The chief exceptions to this form of increase are: Port Hope Simpson, a lumbering village, Cartwright, a hospital centre, and the settlements of Hamilton River and

* The 1951 Census credits Rigolet with a population of 129, whereas its actual all-year population is 20 (Table 4).

Northwest River[1] both of which owe their growth to the proximity of the new air terminal at Goose Bay. In addition, Northwest River is a hospital centre.

The seasonal movement of local population is a continuing characteristic of southeastern Labrador and is directly related to the fishery. The migratory pattern for this part of the coast is given in Tables 3 and 4. The area represented extends from Cape St. Charles (Lodge Bay) to Pottles Bay on the north shore of Groswater Bay. Owing to the difficulties of

TABLE 3.

*Distribution of Population: Southeastern Labrador, 1950**

Winter Station	All-year Residents	Winter Residents	Summer Residents	Summer Stations Occupied
Pottles Bay	—	18	—	2
Flat Water	—	18	—	2
West Bay	—	7	—	1
Rabbit Brook	—	18	—	1
Plants Bight	—	13	—	1
Main Tickle	—	7	—	1
Dove Brook	—	43	—	4
Cartwright	82	83	—	10
Paradise	—	114	—	3
Separation Point	18	11	—	3
White Bear River	—	7	—	1
North River	—	31	—	3
Muddy Bay	—	20	—	4
Goose Cove	—	43	—	3
Sandy Hill Bay	—	9	—	2
Bills Brook	—	41	—	2
Black Tickle	32	—	22	1
Reeds Pond	—	22	—	1
Mussel Brook	—	38	—	1
Porcupine Bay	—	53	—	2
Open Bay	—	28	—	1
Black Bear Bay	—	14	—	2
Shoal Bay	—	80	—	2
Comfort Bight	13	—	—	—
Hawkes Harbour	27	—	—	—
Norman Bay	—	12	—	1
Hawke Bay	9	—	—	—
Trout Brook	—	8	—	1
Newtown	—	36	—	2
St. Michaels Bay	—	24	—	2
Port Hope Simpson	106	116	—	4
Ricksons Cove	—	39	—	1
Fox Harbour	139	12	—	1
Indian Cove	71	—	—	—
Trap and Matthews Coves	90	—	34	2
St. Mary River	3	55	—	3
Battle Harbour	124	21	21	1
Lodge Bay	—	92	—	3
	714	1,133	77	74

[1] Population of Northwest River (1911)—137; (1951)—511. Population of Hamilton River, a new settlement (1951)—474.

* Source: Data collected by the author.

TABLE 4.

*Distribution of Population in the Rigolet Area 1950**

Winter Stations	All-year Residents	Winter Residents	Summer Residents	Summer Settlements
Kellick Point	—	9	5	Nat's Discovery, Kellick Point
Flat Water	—	18	—	Kellick Point, Fish Cove
Double Mer	—	1	—	Turners Bight
Valley Bight	—	7	—	Turners Head
Ticoralak	—	14	—	Rattlers Bight, Susie Point and Collingham Bight
Pompey Head	—	13	—	Mullins Cove, Rigolet
Backway	—	19	—	Tickle Point, Grassy Cove and Little Harbour
Ticoralak Bight	—	3	—	Tickle Islands
Rocky Cove	—	13	—	Collingham Bight, Ticoralak Point and Island
Johns Point	9	—	—	Johns Point
Northwest River	—	3	—	Lesters Point
Big Bight	—	4	—	Sand Bank
Peter Lewis Brook	—	9	—	Summer Cover, Porcupine to Hart Head and Pike Run to Big Island
Moliak	4	—	—	Moliak
English River	—	7	—	Lower Station
Goudies Cove	—	10	2	Rigolet, Whittle Point
Trout Cove	—	7	—	Rigolet
Rigolet	20	7	23	Connock Cove
Palliser Point	—	8	—	Goudies Cove, Burn Wood Cove
Peace Point	—	5	—	Juniper Point
Middlehouse	—	5	—	Fly Cove
Big Brook	—	2	—	Jewel Point
Fox Cove	—	3	—	Double Brook to Bluff Head
Ticoralak Point	3	—	—	Ticoralak Point
Black Brook	—	4	—	Winter Cove
Rattlers Bight	—	9	—	Winter Cove
	36	191	30	

* Source: Data collected by the author.

collecting information on the coast there may be omissions in the statistics presented; however, such omissions probably affect less than 2 per cent of the coastal population. For these tables, winter and all-year residents are selected as they occupy these stations over a longer period of time. The pattern of population movement is shown in Figure 2. In this area 1,970 people are recorded; of this number 714 (36·2 per cent) occupy 10 all-year settlements; 1,133 (57·5 per cent) are residents of some 32 winter stations and the remaining 77 (6·2 per cent) move into the all-year settlements as summer residents. The population of this area occupies approximately 74 summer fishing stations. For the area as a whole about 60 per cent of the population is migratory in habit, moving between winter and summer

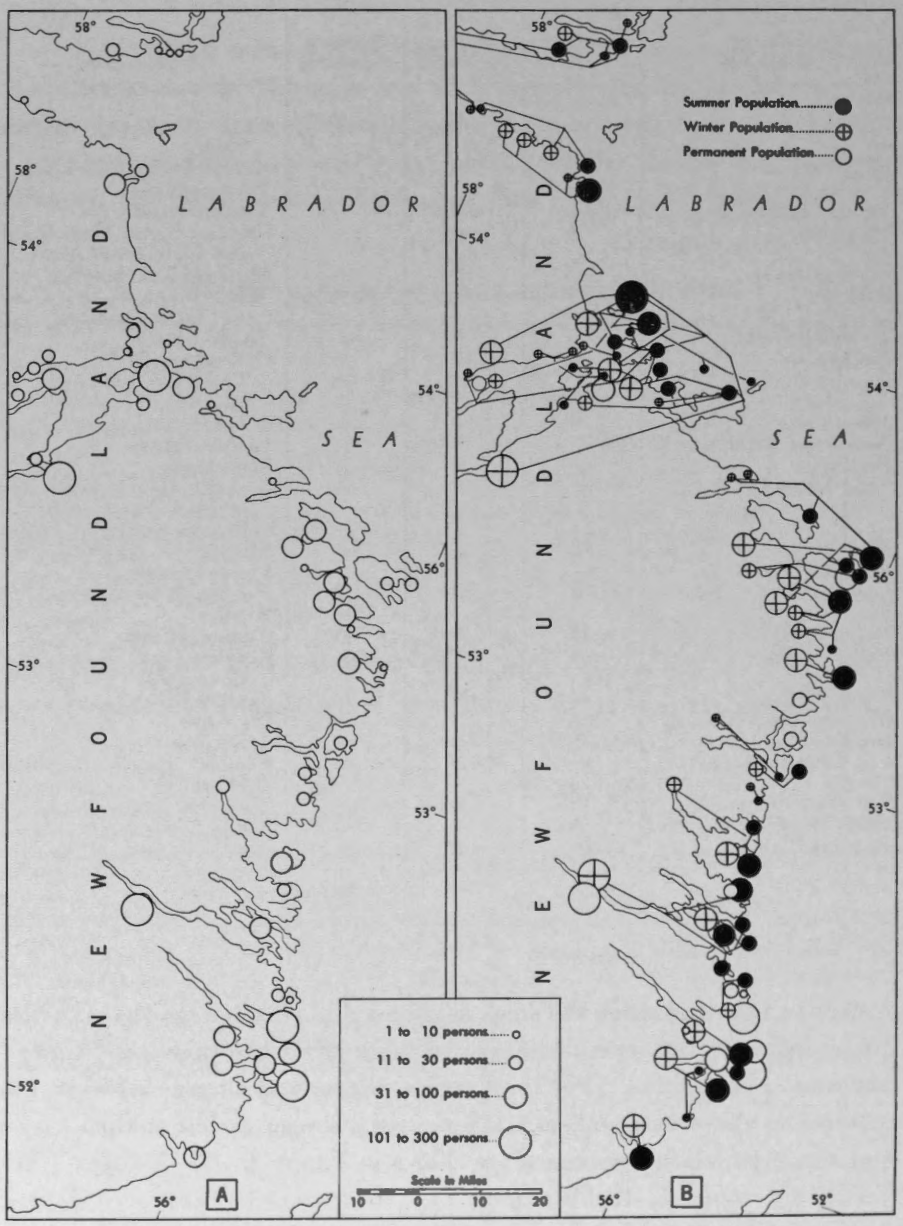

Figure 2. Southeast Labrador. (A). Population distribution according to the 1951 Census of Canada. (B). Population migrations 1950, based on information collected by the author.

stations. The remaining 40 per cent of the population engage in summer and winter activities from the all-year settlements.

In the Rigolet area the migratory pattern is indicated by Table 4 and Figure 3. Approximately 257 persons are recorded; 36 occupy 4 all-year residences; 191 occupy 24 winter stations and 30 occupy 3 summer stations. For the area as a whole approximately 221 migrate to summer stations. In doing so they occupy some 34 separate sites in Hamilton Inlet. The winter grouping is more scattered than the summer: the latter is concentrated closer to the Narrows—those passages between Henrietta Island at the southern entrance to Lake Melville and Pompey Island at the eastern entrance of Hamilton Inlet. These summer stations are occupied for the salmon fishery.

With the exception of the inhabitants of the Rigolet area, the people on the coast move seaward to the summer fishing stations. In the St. Michaels-Alexis-St. Lewis Bays area, one of the major cod-fishing grounds, a larger number of people migrate to fewer summer fishery stations than elsewhere on the coast. This area also possesses one of the largest concentrations of all-year population.

The dates of movement of the local population also reflect the importance of the local fisheries. These are given in Table 5 and represent the time when people move to their summer fishing stations. The table does not give seasonal variations arising from local conditions associated with the fisheries, fur-trapping, or climatic factors. All of these have a bearing on the specific time of migration. Essentially, village groups leave their winter settlements and return to them at approximately the same time.

There are two important periods associated with the dates of departure to the summer stations. In the northern part of the coastal region, from Hamilton Inlet to Sandwich Bay, winter settlements are vacated about June 1st. Activities associated with winter trapping have given way to preparations for the summer salmon fishery and are well advanced by the time of departure.

A number of fishermen carry on a combined salmon and cod fishery, notably on the south shore of Hamilton Inlet between Cullingham's Bight and Tinker Harbour. Later in the season, from August 7th, after the salmon fishery is over, a small number of fishermen move to cod-fishing stations that lie near the eastern entrance of the Inlet. A part of the Sandwich Bay and Sandy Hill Bay population also occupies salmon fishery stations and later in the season from August 1st to August 10th migrates to the cod stations on the island fringe. Most of the Sandwich Bay people

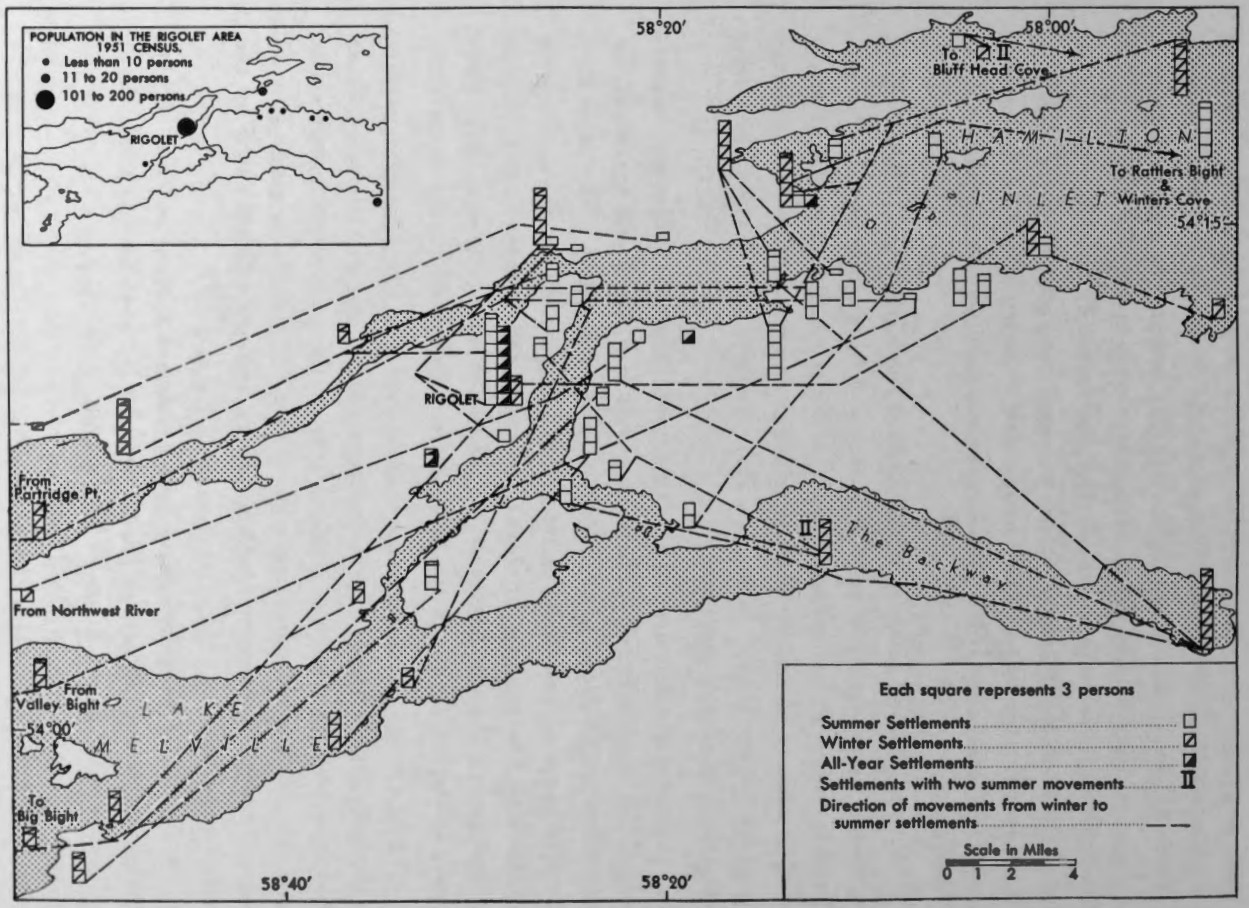

Figure 3. Population movement and distribution in the Rigolet area 1950, based on information collected by the author.

TABLE 5.

*Approximate Dates of Population Movement, 1949-50**

Winter Station	Departure from Winter Station	Summer Station	Departure from Summer Station
Rattlers Bight	June 1	Winters Cove	Sept. 30
Pottles Bay	June 1	Bluff Head Cove	Nov. 1
Rigolet area	June 1–16–Aug. 7	Rigolet area	Sept. 14–25
Cartwright	June 1–10	Packs Harbour area	Sept. 20–30
Dove Brook	June 1–Aug. 10	Packs Harbour area	Oct. 1– 7
Paradise	June 1–Aug. 1	Independent and Packs Harbours	Oct. 1– 7
North River	June 1–Aug. 1	Packs Harbour area	Oct. 1– 7
Goose Cove	June 1	Snack and North Coves	Oct. 1– 7
Muddy Bay	June 1–Aug. 7	Snack and North Coves	Oct. 1–10
Sandy Hill Bay	June 1–Aug. 7	Indian Tickle	Oct. 1
Rocky and Porcupine Bays	April 15	Spotted Islands	Oct. 7
Reeds Pond	March 15	Black Tickle and Salmon Bight	Jan. 1
Open Bay and Mussel Bk.	April 15	Batteau	Oct. 20
Black Bear Bay	April 10	Five Islands and Batteau	Oct. 20
Shoal Bay	April 15	Seal Islands	Oct. 15
Norman Bay	April 15	Venison Tickle	Oct. 15
Trout Brook	April 15	Snug Harbour	Oct. 15
St. Michaels Bay area	April 15–May 30	Triangle and Square Ids.	Oct. 15
Port Hope Simpson	June 1	Georges Harbour area	Oct. 30
Ricksons Cove	June 1	Williams Harbour	Oct. 15–30
St. Mary River	June 1	Battle Harbour area	Oct. 15–30
Lodge Bay	June 1	Pleasure and Chimney Harbours	Oct. 30
Pitts Arm	June 1	Cape St. Charles area	Oct. 15–30

* Data collected by the author.

depart about June 1st to carry on salmon fishery along with the summer cod fishery. From Spotted Island to St. Michaels Bay, the migrating population moves out in mid-April in preparation for the salmon fishery, which is carried on shoreward of the cod fishery. In the Alexis-St. Lewis Sound areas the fishermen move to summer stations about June 1. The people who migrate to summer stations in April usually come by dog team; later in the season they travel by boat.

There are two important periods evident in the dates of departure from summer stations. In the Hamilton Inlet and Sandwich Bay areas the fishermen depart after mid-September. On the remainder of the coast, departure dates are usually in October, after the fish have been cured and disposed of to the local merchant. In both coastal areas the summer stations are evacuated and winter stations occupied before the bays freeze over and winter closes in.

Distribution of Population in Northeast Labrador

The population in this area occupies the coast from Hamilton Inlet to Hebron Fiord and is chiefly settler and Eskimo. The 1951 Census enumerated 1,248 persons, or 16 per cent of the total for the entire Labrador district. Approximately 908 (72·7 per cent) of this number are concentrated in 5 villages with populations exceeding 100 persons each. However, though 665 persons are assigned to the three villages of Hebron, Nain, and Nutak, they should more properly be assigned to the administrative districts of the Moravian church at these points. Another 188 persons, 15 per cent of the population, occupy 3 villages of between 25 and 100; the remaining 151 (12·3 per cent) are scattered among 19 coves. The patterns of the Eskimo and settler settlements are similar to that of the 'liveyere' population in southeast Labrador. Included also are the 71 Naskaupi Indians located at Davis Inlet. Population distribution follows an erratic pattern.

The Census of 1911 gave the population north of Hamilton Inlet as 1,266, while the 1951 Census records 1,248 (Table 6).

Table 6.

*Population of Selected Settlements, 1911 and 1951**

Place	1911	1951	Place	1911	1951
Makkovik	168	101	Okkak	351	Nil
Hopedale	215	142	Hebron	196	196
Nain	230	285	Killinek	106	Nil

*Census of Newfoundland, 1911. Ninth Census of Canada, 1951.

During the influenza epidemic of 1918-1919, 210 persons died at Okkak and 140 at Hebron. The remainder of the Okkak people (94) moved to Nutak (1951 population 184). Because of reduction in population and also because of other adverse factors the settlements at Zoar, Killinek (Port Burwell) and Ramah were abandoned. The population has not yet recovered from the ravages of the influenza epidemic. Of the present population of 1,248 persons, 655 are listed as Eskimos, 522 as whites (predominantly settlers) and 71 as Naskaupi Indians residing at Davis Inlet. Concerning the total Eskimo population of 655 in this area, 632 reside within the area of Hebron, Nutak, Nain, and Hopedale. The whites and settlers are numerically greater along the coast south of Hopedale, and the pure-blooded Eskimo greater to the north of Hopedale. The impact of Newfoundlanders upon the Eskimo had the effect of increasing the number

of settlers. The proportion of settlers to Eskimo by community from south to north illustrates this change in racial mixing; Makkovik is 90 per cent white; Hopedale 60 per cent settler, 20 per cent white and 20 per cent Eskimo; Nain 47·2 per cent settler, 1·8 per cent white and 51 per cent Eskimo, and Hebron is almost 85 per cent Eskimo, with the remainder consisting of an equal proportion of settlers and whites. The population during the latter half of the last century numbered between 1,000 and 1,300 persons, and appears to be remaining relatively static, chiefly because of increased medical facilities. However, racial trends appear to be favouring the settler, as the population is increasing at the expense of the pure-blooded Eskimo.

The seasonal movement of the people of northeast Labrador is geared to the summer trout and cod fishery, and to a lesser extent to the seal fishery. The migratory pattern for this part of the coast is given in Table 7 and shown on Figure 4. In this area 1,275 people are recorded; 820 (64·3 per cent of the population) are winter residents and, therefore, move to summer fishing stations; 455 (35·7 per cent) are all-year residents. Approximately 220 (17 per cent of the population) leave winter settlements for stations that are occupied all year. The population in these communities is not stable, but varies considerably from year to year.

TABLE 7.

*Distribution of Population in Northeast Labrador, 1952**

Stations	All-year Residents	Winter Residents	Summer Residents	Summer Stations
Hebron Area				
Illuilek	—	10	—	—
Itterungnek	—	40	—	—
Tikkeratsuk	—	15	—	—
Hebron	20	130	88	Hebron
Kangeralukulluk	—	3	—	—
Shark Gut Tickle	—	20	—	—
Nutak Area				
Nutak	12	20	—	—
Ikkersaluk	—	15	—	—
Parkavik	—	4	—	—
Moores Harbour	10	—	60	Moores Harbour
Cut Throat Harbour	60	—	57	Cut Throat Harbour
Udlik	—	20	—	—
Amitok	—	6	—	—
Tessiujak	—	15	—	—
Ingeganekulluk	—	6	—	—
Hans' Island	—	3	—	—
Umiaktorvik	—	8	—	—
Okkak Bay	—	20	—	—

*Source: Data collected by the author.

TABLE 7—*Concluded*

Distribution of Population in Northeast Labrador, 1952—Concluded

Stations	All-year Residents	Winter Residents	Summer Residents	Summer Stations
Nain Area				
Nain	51	183	13	12 Stations
Webbs Bay	—	13	—	Nain
Voiseys Bay (2)	21	—	—	—
Karmarsuk	10	—	—	—
Kauk Harbour	2	—	—	—
Black Island	24	—	—	—
Pamgnanisick	12	—	—	—
Davis Inlet Area				
Davis Inlet	73	—	2	—
Merryfield Bay	—	2	—	Red Id., Nfld. Harbour
Big Bay	8	—	—	—
Flowers Bay	—	7	—	Red Id., Nfld. Harbour
Sango	2	7	—	" "
Kanagatok	—	2	—	Double Island
Hopedale	51	91	—	Goose, Double Islands
Adlatok	15	—	—	—
Adlivik	—	9	—	Strawberry Harbour
Bens Cove	—	6	—	West Turnavik
Big Bight	—	5	—	Strawberry Harbour
Cape Harrison	8	—	—	—
Island Harbour	—	5	—	East Turnavik
Kippokok	—	80	—	Ailik
Lance Ground	11	—	—	—
Little Rattle	5	—	—	—
Lucyville	35	—	—	—
Paimilok	4	—	—	—
Three Rapids	—	12	—	Ailik
Makkovik	21	80	—	Ironbound, Ikeys Pt., Ailik
Tukkerarsuk	—	6	—	Malta
Little Bay	—	4	—	Malta
	455	820	220	

In the area between Groswater Bay and Nain the migratory population occupies 21 summer stations and totals 512. Northward, the population of the Hebron and Nutak districts follows a different pattern, with the exception of 12 all-year residents at Nutak and 30 trout fishermen. The remaining 157 people occupy Cut Throat and Moores Harbours for the summer cod fishery. The Hebron area has a population of 238, of whom 188 move from winter quarters to the trout stations in spring. When the trout fishing is over the entire population assembles at Hebron for the cod fishery. In leaving the summer stations the people move to winter quarters, originally the locations for the winter seal fishery; at the present time, however, the seal fishery is relatively unimportant. The population on the northeast coast is more scattered than in southeastern Labrador, chiefly because the bays and fiords are longer and a wider island screen borders the coast. The Hebron people migrate the farthest, northwards to Nachvak Fiord and southwards to Shark Gut Tickle, a range of 70 miles. Though

their winter stations are centered around Hebron and Napartok Bays, the summer trout fishery takes them as far north as Nachvak.

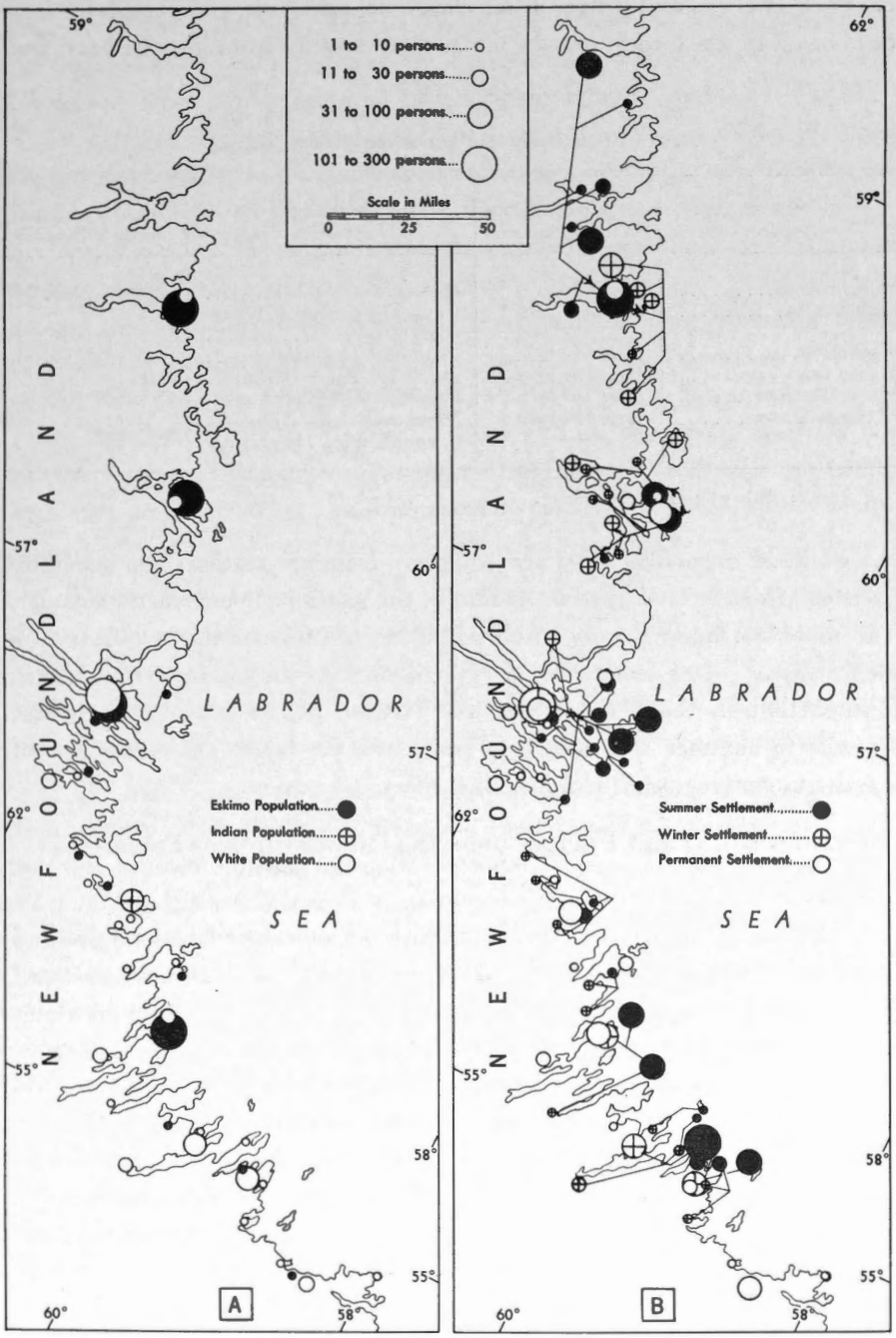

Figure 4. Northeast Labrador. (A). Population distribution according to 1951 Census of Canada. (B). Population migrations 1952, based on information collected by the author.

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The migration dates of the local population are given in Table 8. The people leave their winter stations when the ice has left the bays and channels of the island fringe, usually between mid-June and July 1st. The date of disappearance of the ice varies considerably from year to year, and

TABLE 8.

*Approximate Dates of Population Movement, 1952**

Winter Station	Departure from Winter Station	Summer Station	Departure from Summer Station
Hebron area	June 15–July 1	Hebron-Nachvak area	Oct. 14–Nov. 14
Okkak area	June 15–July 1	Cut Throat and Moores Harbours	Oct. 14–Nov. 1
Nain area	June 15–July 1	Nain and 11 stations	Oct. 14–Nov. 1
Davis Inlet area	June 15–July 1	Davis Inlet and Red Id.	Oct. 14
Hopedale area	June 15–July 1	Hopedale-Double Id. area	Oct. 14
Makkovik area	June 15–July 1	Makkovik-Ailik-Iron-bound area	Oct. 14

* Source: Data collected by the author.

the dates of departure vary accordingly. Summer stations are generally vacated after the visit in mid-October of the last scheduled coastal steamer. The more northerly people reach winter stations later in the Nutak and Hebron area—often as late as mid-November. As the summer trout fishery is important in the Hebron area the Hebron people move from winter stations to summer trout stations and leave the latter about the end of August to congregate at Hebron for a short cod season.

INFLUENCE OF OTHER FACTORS UPON THE DISTRIBUTION OF POPULATION

a) Trapping

The migratory patterns associated with the fisheries became established at an early date. At approximately the same time migratory patterns associated with fur-trapping also became established. In this migration, however, there is no movement of families such as occurs in the movement from winter to summer stations; only the men are involved. The settlers and Eskimo, who formerly depended upon the autumn seal fishery, in recent years have come to depend primarily upon fox trapping, which is restricted chiefly to the island fringe and to the extensive barrens in the northern part of the district. A number of trappers in the region between Makkovik and Cape Harrison, trapping water furs in the upper reaches of the rivers, leave their winter settlements about October 1st to take up trapping grounds before the rivers freeze over. In northeast Labrador the majority of trappers go into the interior after freeze-up in late November.

The movement to winter quarters in the Rigolet area, usually takes place between September 20 and 25, when preparations for trapping begin. The trappers of the Lake Melville area occupy permanent villages, and leave for the interior at two different periods. The hunters who trap beyond Grand Falls leave from September 1 to 10 before the interior streams freeze over. Those hunters who trap the Hamilton River below Grand Falls, the Nascaupi, the Kenamu, and other large rivers, leave for these trapping grounds from September 20 to 30. The outstanding importance of the Lake Melville drainage pattern is that it provides a means for trappers to cover an extensive area. The trappers of the Sandwich Bay drainage area usually work around the shoreline of the bays until the rivers freeze over, after which they proceed into the interior between mid-November and December 1. Only on the Paradise River do the trappers go to their grounds before freeze-up. From Spotted Islands to Battle Harbour and on the Strait of Belle Isle the fox is trapped along the shore and on the islands; the trapping of water furs such as mink, otter, and muskrat is carried on from winter settlements. After the rivers freeze over, the trappers usually proceed inland.

The trappers normally return to winter stations for two to three weeks during the Christmas season, except for the few who trap the farthest limits of the range. With the closing of the season about April 1, the inland trappers return across the ice to their winter settlements. The majority, depending on the success of their winter's operations, return by mid-April.

The Montagnais Indians at Northwest River follow a different migration pattern. The Indian hunters and their families leave this settlement for the interior hunting grounds between August 21 and September 7. The band splits into three parties, a Naskaupi River group striking northwestward into the interior from Grand Lake, a Hamilton group heading westward up the Hamilton, and a Kenamu group moving southwards via the Kenamu River. Both the Hamilton and the Naskaupi River groups return to Northwest River from May 1 to 10 prior to the break-up of river ice; the Kenamu group returns to Northwest River from June 15 to 30, after the spring floods have passed. In recent years, as the value of furs has seriously declined and as relief measures have replaced the need for hunting, the Montagnais during the winter have remained within a range of 40 miles from Northwest River.

The migration of the Naskaupi Indians or the Davis Inlet band follows a somewhat different pattern. Part of the band moves into the fur-trapping areas about the end of October and returns before spring break-up, whereas the remaining part resides permanently at Davis Inlet. The men

who go into the interior hunt for periods of two to three weeks. In August 1948, the Newfoundland Government transported the entire band of 74 persons to new hunting grounds in Okkak Bay, but within a few years the entire band returned to Davis Inlet.

Following World War II there has been a considerable reduction in the demand for furs from the 'dollar' area. This condition has brought about a decline in trapping on the coast, and this in turn has had a marked effect upon the movements of the local population. Construction work on parts of the coast in 1952 has also tended to divert men from trapping; no men engaged in trapping at Hebron, Nain, Hopedale, Makkovik, and Cartwright.

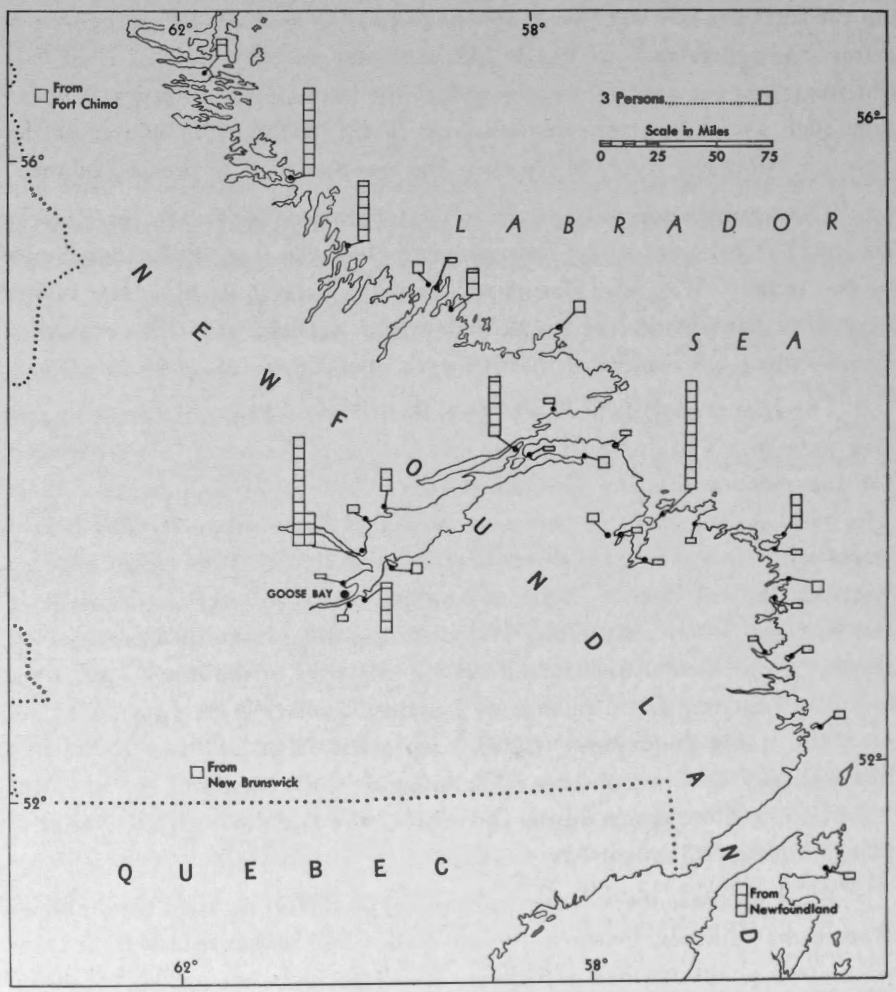

Figure 5. Sources of labour supply at Goose Bay air terminal, 1952.

b) Goose Bay Air Terminal

In 1952 the Labrador labour force employed at Goose Bay air terminal numbered approximately 200 persons (Figure 5); 66 originally came from the western end of Lake Melville, 46 from the Davis Inlet–Hopedale–Makkovik area, 38 from the Sandwich Bay area, 28 from the Rigolet area, and the remaining 22 chiefly from small coves scattered along the coast between Nain and Battle Harbour. Over 90 per cent of these people have taken up residence at Hamilton River village, the remainder at Goose Bay.

The population of Hamilton River village in 1952 numbered 621, an increase of 31 per cent over the 1951 Census figures. Its population is steadily increasing; in the spring of 1953 it was reported to have reached 800 persons. The origin of the village population is shown in Figure 6; and indicates that Eskimo, settlers, and 'liveyeres' are well represented. Of the present residents, 166 were born in the settlement. In time this group is likely to identify itself with the urban complex rather than with the trapping and fishing tradition. The growth in population that has taken place at Hamilton River has, to a lesser extent, been paralleled at Northwest River and Mud Lake.

c) Lumber Operations

The unsuccessful lumber operations at Port Hope Simpson, Mud Lake and Kippokok had one aspect in common, namely to draw members of the coastal population into new communities. Though these operations added regional stability, the labour force was fairly unstable, turnovers exceeding 400 to 500 per cent. The Eskimo, however, being incapable of sustained effort of this nature, usually returned to their settlements after two or three months. When the operations failed, the coastal people returned to their home communities. The fishing and hunting population lacked the cultural discipline for other economic activities.

d) Northern Labrador Trading Operations

When the Hudson's Bay Company decided in 1942 to close its posts at Makkovik, Hopedale, Davis Inlet, Nain, Nutak, and Hebron—all north of Cape Harrison—the Newfoundland Government established the Northern Labrador Trading Operations to take their place. During the 21-year period ending 1942, world demand for furs had deprived the Eskimo of seals. Prior to this time, the seal fishery was carried on during the autumn and winter months, and the movement to the winter stations was actually a movement to the sealing places. With emphasis upon furs, the Eskimo established trap lines. In recent years the decline in the value of furs,

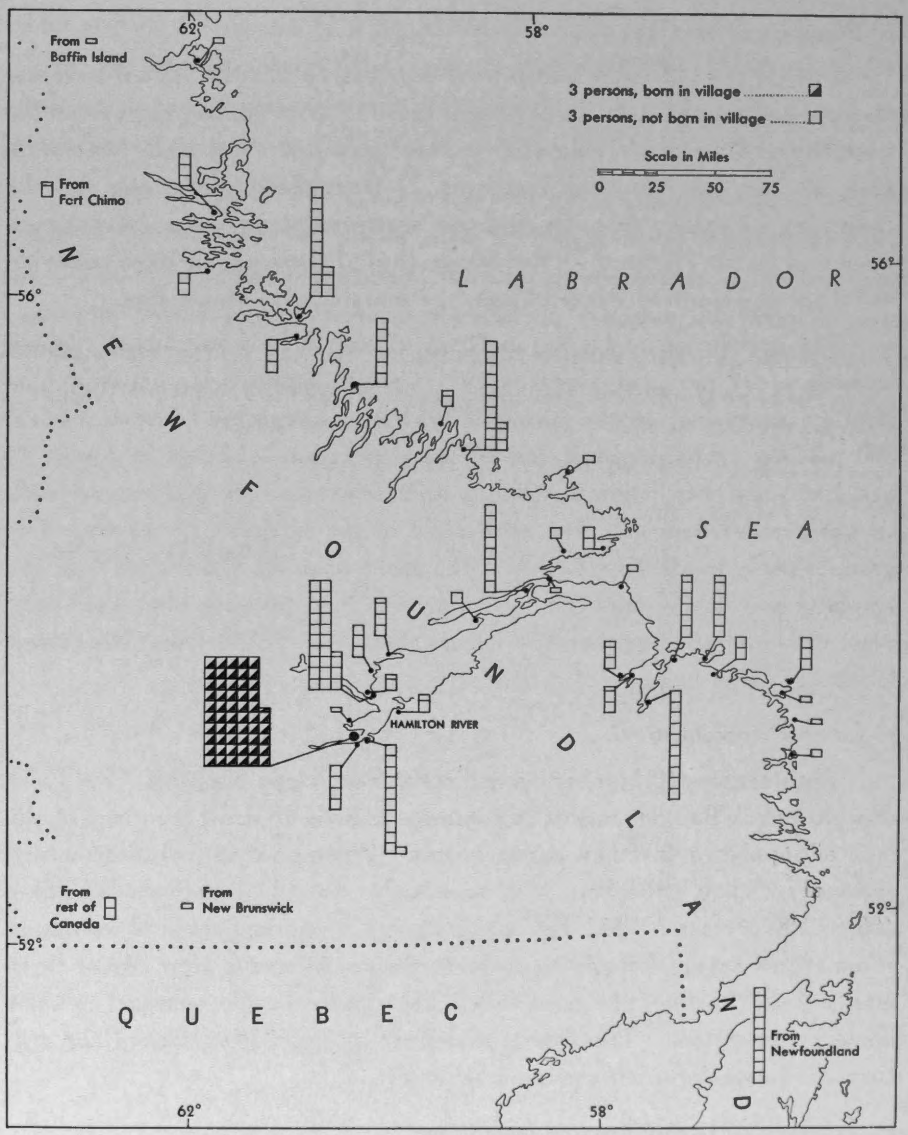

Figure 6. Origins of population, Hamilton River village, 1951.

particularly the long-haired furs such as fox, has been so serious that no attempt is being made to encourage trapping. The provincial government, however, in its attempt to rehabilitate the Eskimo, is encouraging the revival of sealing and the trout fisheries. Formerly these resources were used by the Eskimo and fitted into his migration pattern.

e) Moravian and Grenfell Missions

The first successful Moravian mission station was established among the Eskimo at Nain in 1771. By 1904, stations were established at Okkak,

Hopedale, Hebron, Zoar, Ramah, Makkovik, and Killinek. Contact with the Newfoundland fishermen introduced diseases, chiefly measles, whooping cough, and 'Spanish flu,' which severely reduced the Eskimo population. As a result, the 3,000 Eskimo the Moravians estimate were on the coast at the beginning of their work are now reduced to fewer than 1,000 individuals, and Moravian stations are now maintained at Hebron, Nain, Hopedale, and Makkovik only. The chief aim of the Moravians has been to encourage the Eskimo in the utilization of those resources that are in harmony with their mode of life rather than the production of one or two commercial articles, and to encourage friendly relations between the Eskimo and the white population, particularly with the Newfoundland fishermen. The result of this policy is that the only Eskimo on the coast now reside north of Hamilton Inlet, within the influence of the Mission.

The International Grenfell Association maintains regional hospitals on the coast at Cartwright and Northwest River and nursing stations at Forteau Bay, St. Mary River, Hamilton River, Nain, and Spotted Islands. In addition, a regular summer inspection of the coast is made by the motor vessel *Maraval*. A systematic inspection is made by the nurses within the limits served by their respective stations. Northwest River hospital serves the northeast coast north of Hamilton Inlet and Cartwright the southeast. The effect of the Association's medical policy 'to distribute medical benefits equally over the population'*, of its boarding and day schools, and of its handicraft shops has aided the population to lead healthier and more effective lives and to make use of supplementary local resources. The epidemics that formerly ravaged the Eskimo and 'liveyere' population with fatal consequences in the past have rarely occurred in recent times. With the assistance of radio communications and aircraft, medical facilities have contributed in large measure to the increase in the local population.

CONCLUSION

Formerly, the white population on the Labrador coast was rigidly controlled by Great Britain in the interests of the fish merchants. The caretakers at the merchant fishing establishments formed the first resident white population. The number of the resident group was relatively static. Increase in their numbers came from the establishment of mission and hospital centres, from the fur-trapping communities of the Lake Melville area, and from settlements where both summer and winter activities could be carried on.

* Dr. Charles Curtis: Supt. of International Grenfell Association, personal interview, July 1950, St. Anthony, Nfld.

An excess of population, more than was required by the merchant establishments, had developed by the middle of the nineteenth century. These people carried on sealing, fishing, and fur-trapping from different places, and as a result began the migratory cycle that has continued to the present time.

Because of racial mixing between whites and Eskimo, a large part of the population consists of mixed bloods. The pure-blooded Eskimo have continued to decline in numbers; they are now found chiefly along the northeast coast between Nain and Hebron. In addition two small Indian bands reside on the coast. Both the Indians and Eskimo follow a cycle of migration.

The introduction of lumbering, fish processing, building construction, or any other salaried activity tends to draw the population to centres of settlement—the failure of an operation results in the population returning home. Modern medical services and government financial assistance have been additional factors in stabilizing the population. As the population depends chiefly upon the salt cod fishery for its livelihood, the migratory pattern is likely to continue indefinitely. However, because of the interest governments are taking in their native and backward populations, the modern trend is against a migratory population residing in seasonally occupied houses or villages, and towards stabilized communities the benefits of which are likely to add materially to the coastal population.

RÉSUMÉ

L'auteur étudie ici l'évolution historique du peuplement de la côte est du Labrador ainsi que la répartition actuelle de la population.

La grande majorité de celle-ci est groupée dans de petits ports de mer, sur la côte, tout près des bancs de pêche dont elle vit principalement. Elle est composée de blancs, d'Esquimaux et de métis.

La distribution de cette population permanente varie d'une saison à l'autre suivant que la principale activité est la pêche ou la chasse des animaux à fourrure. Les recensements ne fournissent donc que les données propres à une saison en particulier; l'auteur, pour obtenir des chiffres plus représentatifs, a basé son étude sur le recensement de 1951 ainsi que sur les statistiques recueillies sur place entre les saisons de migration.

Les mouvements de population sont relevés avec soin et illustrent bien les différentes dates auxquelles ils s'opèrent suivant les facteurs du gel et du dégel, de la pêche à la morue et au saumon, enfin de la chasse aux pièges. Un facteur récent de migration a été l'établissement d'une importante base aérienne à Goose Bay, qui forme maintenant une agglomération de plus de 800 personnes aux origines diverses.

PHYSIOGRAPHIC FEATURES
OF THE
GOOSE BAY AREA
PROVINCE OF NEWFOUNDLAND

Mt. Elizabeth
Mt. Sawyer
Naskaupi River
Red Wine River
Crooked River
Susan River
Beaver River
Porcupine Hill 140'
15'
20'
45'
Sebaskachu River
Mokami Hill
Sebaskachu Bay
Wattie's Cove
GRAND LAKE
Cape Caribou
50'
10'
Cape Caribou River
53°30'N
61°00'N
Goose River
53°30'
60°30'W
Little L.
65'
60'
Northwest River
Salt Water Pond
GOOSE BAY
Sandy Pt.
85'
85'
150'
Terrington Basin
+150'
75'
144'
145'+
149'
+50'
50'
Mud Lake
Hamilton River
200'
Muskrat Falls
Gull Island Lake
TRUE NORTH
MAGNETIC NORTH
33°24'

Sand-bars
Sand Dunes
Terraces
Raised Beaches and Strandlines
Boundary of Terraces and Hills
Drumlins and Drumlinoids
Eskers
End Moraines
Height in feet above sea level (Approx.) 790

Scale in Miles
2 0 2 4 6 8 10

LANDFORMS AND TOPOGRAPHY OF THE LAKE MELVILLE AREA, LABRADOR, NEWFOUNDLAND

Weston Blake, Jr.[1]

The principal purpose of this study is to describe in detail the origin and physical characteristics of the surficial deposits of the Lake Melville area. It forms part of a project carried out for the Defence Research Board in 1952 and 1953 under the supervision of Professor F. K. Hare to interpret vegetation and physiography from aerial photographs.

Lake Melville is the largest lake in Labrador and the depression it occupies is a graben, or downfaulted block, while the nearby Mealy Mountain Range is a horst, or uplifted block, of anorthosite-gabbro intrusives. Most of the rocks in the area are Archean gneisses, and much faulting has occurred, resulting in such valleys as those of Grand Lake and the Hamilton River. The trend of the Goose and Beaver Rivers, and the circular pattern of the lakes between these rivers and Grand Lake, give the impression that the area just west of the lake is a dome. This region has undergone successive upwarpings and peneplanations, accompanied by faulting, and the greatest uplift was in the Pliocene just before the area was glaciated. Many of the large river valleys, such as that of the Hamilton, were developed at this time and later enlarged by the glaciers.

The dominant feature of the area is the Mealy Mountain Range, lying on the south side of the lake. Several peaks of this range are over 3,000 feet[2], and the highest point is about 4,300 feet. The range becomes more of a rolling upland south of Goose Bay, with heights between 1,000 and 2,000 feet, although farther south toward the headwaters of the Kenamu River peaks may attain 3,000 feet. The mountains continue westward to join the inland lake-plateau and form the hills on the south side of the Hamilton River. The even surface is broken by the V-shaped gap of the Kenamu River. The landscape to the west and north of Lake Melville is rolling country at 1,000-1,500 feet.

Several distinctive monadnocks are present to the north of the lake, of which the most prominent is Mokami Hill, a sharp 1,590-foot rock knob a few miles north of Sebaskachu Bay. This is visible for many miles in all

[1] Weston Blake, Jr.: A.B., Dartmouth College; M.Sc., McGill University, "Vegetation and Physiography of the Goose Bay Area, Labrador," (unpublished Master's degree thesis McGill University, Montreal, 1953), 175 pp.

[2] All heights are approximate elevations above sea level.

Figure 1. View east from Sandy Point across Lake Melville to the Mealy Mountain scarp. Kenamu and Kenemich Rivers flow across the forest and bog-covered sand plain, the Kenemich emptying into Carter Basin and the Kenamu into the lake itself.

(R.C.A.F. Photo)

directions. Twenty-two miles above the mouth of the Naskaupi River are two distinctive hills, each over 1,200 feet, Mt. Sawyer on the west side of the river and Mt. Elizabeth on the east.

Hydrography

Lake Melville is tidal and is connected with Hamilton Inlet by The Narrows, a 15-mile-long channel varying from one-half to one mile in width, and with minimum depths of 36 and 60 feet where it divides to join Lake Melville. Lake Melville itself extends 90 miles inland from the Narrows, and gradually widens so that at its western end it is over 20 miles wide. It quickly deepens inland from the sill of The Narrows, and although estimates of maximum depth vary, it appears to be somewhere between 700 and 900 feet.[3,4] The deepest parts are on the south side, near the fault scarp of the Mealy Mountains. Goose Bay at the western end of Lake Melville is 15 miles long and 8 miles wide and it terminates in the small and shallow Terrington Basin. The greatest depth of Goose Bay is 204 feet, but it is mostly between 60 and 120 feet deep. The silted-up margins are often less than 6 feet deep for a mile offshore. The Backway, which extends over 25 miles eastward from the Narrows, has an uneven bottom but deepens toward the eastern end, reaching depths of 350 feet and 600 feet in separate basins.[5] Double Mer extends 52 miles inland from the head of Hamilton Inlet and has a maximum known depth of 276 feet.[3]

At the northwest end of Lake Melville the North West River enters the lake from Little Lake, a shallow expansion 2 miles long and 1½ miles wide. North West River carries the waters of all the rivers that flow into Grand Lake. Between Little Lake and Grand Lake are rapids marking the upper limit of tidal influence. Grand Lake itself is 40 miles long and 2 to 2½ miles wide. It is very deep (over 400 feet), and is a glacially deepened, pre-glacial valley, although there has been some faulting also. The hills rise in sharp bluffs on the west side of the lake to over 1,000 feet, and Cape Caribou is the most prominent landmark with its 500-foot cliffs. On the east side of the lake the hills rise more gently to slightly lower heights.

At the head of this lake two small rivers, the Beaver and the Susan, enter the lake on either side of Porcupine Hill (1,000 feet). The chief river entering the lake is the Naskaupi which, with its tributary the Crooked River, flows in from the north 5 miles to the east of the Beaver. The

[3] E. M. Kindle: "Geography and Geology of Lake Melville District, Labrador Peninsula," *Geol. Surv., Canada*, Mem. 141, 1924.

[4] D. C. Nutt, "Certain Aspects of Oceanography in the Coastal Waters of Labrador," *J. Fisheries Res. Bd. Can.*, vol. X, No. 4, 1953, p. 180.

[5] L. K. Coachman, *et al.*, "Oceanographic Field Report," Annex B to D. C. Nutt, "Blue Dolphin Labrador Expedition, 1952;" (unpublished Field Report, Hanover, N. H., 1952), pp. 1–4.

Figure 2. View northwest up the trough of Grand Lake. North West River, which drains the lake, cuts through a moraine damming the lake at its southern end. Note the steeper hills and bluffs, probably due to faulting, on the west side of the lake.

(R.C.A.F. Photo)

Cape Caribou is a small stream entering the lake on the west side about 10 miles above the rapids to Little Lake. Grand Lake is separated from Little Lake, and this in turn from Lake Melville, by an end moraine stretching across the valley.

The Goose River flows into Goose Bay from the west and is building a large delta, which has almost closed off Terrington Basin. The channel into the basin past this delta is only 40 feet deep and is rapidly filling with sand and mud brought down by the river.

Various small streams and rivers enter the south side of Lake Melville after flowing down from the Mealy Mountains, but of these only the two large ones at the western end of the lake need be mentioned. The Kenamu and Kenemich Rivers rise in the Mealies, the Kenamu being the larger of the two. Both flow rapidly down from the mountains and then across the flat sand plain into the lake. The Kenemich rises to the east in the Mealies and flows southwestwards along a joint or fault parallel to the scarp facing Lake Melville. Then it turns to the north and plunges down to the lower plain near the Kenamu. As noted before, the V-shaped gap of the Kenamu is the only major break in the even skyline of the country south of the lake. This river flows due north for most of its course from the mountains to Lake Melville.

The largest river in the area and on the whole eastern coast is the Hamilton. It rises at about 1,700 feet on the central lake-plateau and flows generally southeastwards to its junction with the Minipi, then heads northeastwards into Goose Bay. South of Lake Michikamau and 230 miles from its mouth are the famous Grand Falls, where the river drops 245 feet; in a 16-mile stretch, including rapids above the falls and spectacular Bowdoin Canyon below, the river drops 1,038 feet. The Hamilton drains a total area of about 30,000 square miles, and with a summer volume at its mouth of about 100,000 cubic feet per second is a great potential source for hydroelectric power. According to Low, Grand Falls divides the Hamilton into two parts, the upper one where the river wanders through the hilly terrain of the plateau, and the section below the falls where it flows in a distinct valley.[6]

Marine and River Terraces

All the river valleys in this area are filled with sandy deposits that were washed out from the till and re-deposited in late-glacial and post-glacial times. Much of this sand has since been carried out into Lake Melville and

[6] A. P. Low: "Report on Explorations in the Labrador Peninsula, along the East Main, Koksoak, Hamilton, Manicuagan, and Portions of Other Rivers, in 1892–93–94–95," *Annual Rep. (New Ser.), Geol. Surv., Canada*, Vol. VII, Rep. L, 1895, Ottawa (1897).

Hamilton Inlet and has been reworked into a series of marine terraces by lake and sea currents. In most areas the sands overlie beds of fossiliferous marine clays, attesting still further the part played by the sea. In the valleys many terraces and cusps have been formed by the downcutting rivers, and these merge with the marine terraces. Farther upstream kame terraces and ice-lake terraces join the stream terraces.

Figure 3. A large, 50-75 foot high marine terrace near the mouth of Hamilton River. The top of this terrace is 150 feet above sea level, and it is part of an ancient elevated delta of this river.

The mature valley of the Hamilton River is from 2 to 5 miles wide from its mouth to Muskrat Falls, 27 miles upstream, and the hills rise several hundred feet above the river on either side. The stream gradient is very gentle, and highest spring tides may extend upriver as far as the falls. According to local reports, the upper tide limit is less than 2 miles above the river mouth. At the mouth of the river there is a series of terraces rising to 150 feet above sea level. This is an ancient delta of the Hamilton River, deposited with the rest of the sand when the river was much enlarged owing to glacial meltwater. Hamilton River is still forming a delta at a lower level, and sand-bars are common along the lower course of the river. Particularly prominent is the top 150-foot terrace level, and according to Tanner this is the highest level of marine action at the western

end of the lake.[7] Here the land slopes gently up from Terrington Basin until a steep terrace rises 50 to 100 feet to the top of the level sand plain.

On the Hamilton River, Low[6] believed the marine terraces to extend upstream for about 70 miles to Gull Island Rapids. The writer obtained the marine mollusks *Mytilus edulis* L. and *Saxicava arctica* L. from marine clays at Muskrat Falls which Cary[8] describes as Champlain clays. Kindle collected fossils, including *Mytilus*, from this locality and several others around Lake Melville in 1921.[3] The clay section is up to 50 feet thick in the basin just below Muskrat Falls and in adjacent parts of the river, with 150 feet of sand on top. Considerable erosion, gullying, and slumping has occurred. Often whole sections of forest have slumped into the river, while in other places large stream-cut channels occur in the clay beds.

At Muskrat Falls the river runs between the hills on the south side of the valley and a residual rock knob in mid-valley, and is only 100 yards wide. There are two falls, each of about 25 feet, with a quarter of a mile of rapids between, the total drop being about 70 feet. From this 515-foot rock knob an extensive sand terrace stretches northward to the hills. Following the river upstream, the top terrace level gradually rises from 150 feet at the mouth to over 200 feet at Muskrat Falls. There are terraces at many other levels on this lower part of the river, but those at 12, 25, 40, 60, 85, and 100 feet (approximate) are most common.

The wide valley and terraces continue on for another 33 miles to Gull Island Lake[6], with the most prominent terrace being the one at 200 feet. However, according to Cary[8], the terraces reach heights of 400-500 feet on this lake. If this is so they are lake terraces, not marine, as this is far above the level of marine action in this area. Above Gull Island Lake the river changes direction several times and the valley becomes narrow and rocky with few terraces, but these again reappear along the sides of deep (over 400 feet) Lake Winokapau, 65 miles upstream. Cooke[9] has suggested that the Hamilton River Valley, for the first 70 miles before it changes direction, is a continuation of the rift in which Lake Melville and the Backway lie.

A large sand terrace, or sand plain, also lies against the scarp of the Mealy Mountains on the south side of Goose Bay and Lake Melville, and the Kenamu and Kenemich Rivers flow across this plain in their lower reaches.

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[7] V. Tanner: "Outline of the Geography, Life, and Customs of Newfoundland-Labrador," *Acta Geographica*, 8, N : 1, Helsinki, 1944, p. 245.

[8] A. Cary: "Geological Facts Noted on Grand River, Labrador," *Am. J. Sci.*, Vol. 42, No. 251, 1891, p. 420.

[9] H. C. Cooke: "Studies in the Physiography of the Canadian Shield, Part I, Mature Valleys of the Labrador Peninsula," *Trans. Roy. Soc. Can.*, Ser. 3, Vol. XXIII, Sect. IV, 1929, pp. 91–120.

The terrace is up to 50 feet high at the lake's edge and gradually rises toward the mountains.

Sand terraces are found in the Goose River valley and extend up it for many miles. Near the mouth are abandoned channels and oxbow lakes formed by the river in its meanderings. This river also contains many sand bars. The highest terrace level on the north side for the first 15 miles is at 85 feet and others are at 20-25 and 30-40 feet. On the south side of the river the terraces join those of the Hamilton. The lowest terrace in the delta at the mouth of the Goose River is at 5 feet.

Between the Goose and North West Rivers lies another vast sand plain covered by forests and bogs. At the Goose River this terrace is at about 40 feet, and it rises slightly to the eastward, reaching 50 feet west of Salt Water Pond and 60-65 feet west of North West River, but it slopes off gradually toward Goose Bay. This plain is flat and monotonous and is cut only by a few sluggishly meandering streams. It terminates on the north against the scarp of rocky hills extending from Grand Lake to Goose River. At Sandy Point it stretches some 10 miles to the southeast to form the enclosure of Goose Bay. It appears from an examination of the aerial photographs that Sandy Point itself is part of an end moraine similar to those at North West River. Low, poorly developed terraces extend around Little Lake between the two end moraines, and the terrace on the west side of this lake is a continuation of the large sand plain north of Goose Bay.

The terraces continue for a few miles northeast of North West River, and prominent levels are at 40 to 65 feet against the end moraine. Beyond this the hills extend to the lake edge, and there are only scattered patches of terraces. The valley of the Sebaskachu River is another deeply excavated valley filled with Pleistocene sands. This small river rises in the uplands northeast of Grand Lake and has endless meanders, abandoned channels, and oxbow lakes.

Terraces are scarce along the west side of Grand Lake, as in most places the rocky bluffs extend to the water's edge. However, terraces are found at 10, 20, and 50 feet in the deltaic deposits at the mouth of the Cape Caribou River. This river falls quickly and with many rapids from the plateau west of Grand Lake, and the valley widens out only a short distance from the lake. Small terraces are also found in a few other stream valleys along this side of the lake. On the east side terraces lie against the low hills at the southern end of the lake, and at Wattie's Cove, midway up the lake.

The Beaver River is separated from the head of Grand Lake by a 50-foot terrace that has been shaped by lake currents. This terrace is part of

the large delta this river has built out into the lake. The Beaver and Susan Rivers now both enter a small lake 1½ miles in diameter, and then flow in a narrow channel around the delta out into Grand Lake. The highest terrace observed on the Beaver River is at 140 feet on the side of Porcupine Hill. Other terrace levels are at approximately 10, 30, 40-50, 85, and 100 feet. Well-developed foreset beds of the delta are now visible along the river at several places. The river is shallow, with many sand bars, and the first of many rapids is seven miles above its mouth. The valley is about 1½ miles wide at Porcupine Hill, and gradually narrows until 25 miles upstream the river forks into two narrow fault gorges. The river is braided for much of the distance below this point, and then meanders through its sand-filled valley and delta.

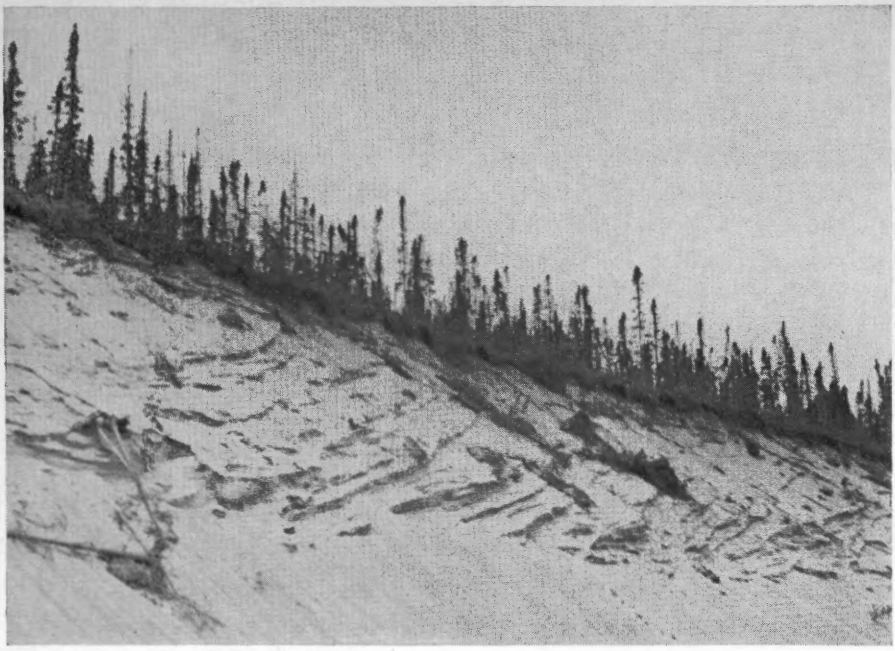

Figure 4. Foreset and topset beds in the delta of Beaver River, with spruce-fir forest developed on top of the terrace.

The Susan River enters the small lake mentioned above after meandering through a sand-filled valley one-half mile wide. Oxbows and cusps are abundant in the lower 10 miles, and the main terrace at the mouth has an elevation of 15 feet. Above this lower section the river narrows and has many rapids as it flows down from the higher land to the west.

The best development of terraces around Grand Lake is in the Naskaupi River Valley. When the land was lower, Grand Lake was one arm of an

enlarged Lake Melville, and this lake extended well up into the Naskaupi Valley. This valley is pre-glacial for 25 miles above its mouth, and for this distance the valley is 2 to 3 miles wide. Above this point the river is a series of rapids and flows in a narrow valley. Rocky hills rise to 600 to 1,000 feet all along the course of the river. The Naskaupi has its source in Lake Michikamau on the lake-plateau, from which it flows northeastwards into Seal Lake in the midst of the Naskaupi Ranges, and then southeastwards into Grand Lake. Two tributaries, the Crooked River, which enters one mile above Grand Lake on the east side, and the Red Wine River, which flows in from the west 18 miles upstream, also exhibit extensive terraces. The valley widens to 6 miles where the Crooked River and Naskaupi are flowing side by side, but above this the Crooked River is in a narrow valley. The valley of the Red Wine River is deep and up to 1½ miles wide for 16 miles above its junction with the Naskaupi.

The terraces at the mouth of the Naskaupi River are at 15 feet on the west side and 30 feet on the east. This is an old delta of the river, and at the head of the lake (particularly on the east side) extensive sand bars and shoals are being built up by the river's deposits. Other terraces are at 10, 20, and 50 feet on the Crooked River. The terrace level rises upstream and terraces are found at 70, 90, and 120 feet. At the mouth of the Red Wine River, Kindle[10] reports the remnants of a sand terrace at 200 feet and a top level of 280 feet 6 miles up the Red Wine. The Naskaupi terraces are composed of basal clays with overlying sand beds. Much gullying has occurred here, as was the case on the Hamilton. Considerable gullying has also taken place in the large terrace between the Crooked and Naskaupi Rivers.

Varved Clays

Just above its junction with the Red Wine River, the Naskaupi widens into a lake about 7 miles long and up to half a mile wide. Cobble beaches and rock outcrops are common along the shore, but are not found farther donwstream as the valley deepens toward the trough of Grand Lake. Terraces are found on both sides of this lake, but here the lower beds are varved clays. On the west side of the lake a continuous section of varved clays was observed from lake level to 150 feet. The varves here are alternating layers of fine brown clay one-fourth to one-half an inch thick, and fine light gray clay one sixteenth to one-eighth of an inch thick. Gullying is common here as elsewhere. The top terrace level was found to be over 300 feet on the west side of the lake, with layers of sand overlying the clays.

[10] E. M. Kindle: "The Terraces of the Lake Melville District, Labrador," *Geog. Rev.*, Vol. XIV, No. 4, 1924, p. 601.

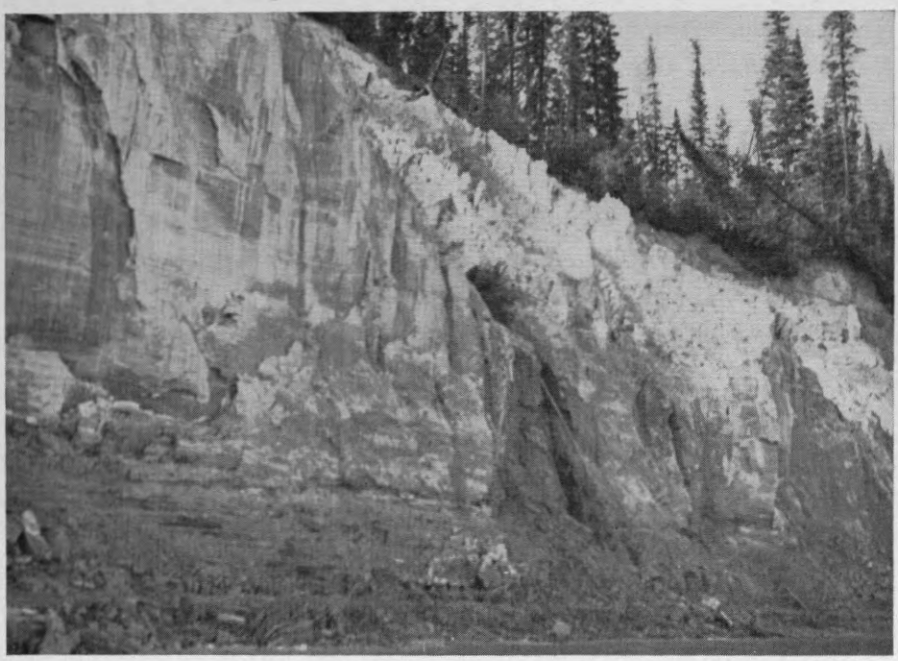

Figure 5. Section of varved clays exposed in a terrace along the lake-expansion in Naskaupi River.

In a section 10 miles up the Red Wine River, Kindle counted 178 laminae in 10 feet, and these varied in thickness between one-eighth of an inch and three inches. This section contained 35 feet of laminated fine clay, a layer of coarse gravel up to 6 feet thick, and a final 100-foot series of sand and laminated silt beds.[3]

As the ice retreated, the upper Naskaupi Valley was dammed by moraine or ice somewhere just south of the junction of the Red Wine River. The varved clays were then deposited in a glacier-edge lake. After this large amounts of sand were brought down by the river and deposited over the varved clays.

Nearer the mouth of the river are other clay beds, which are also covered by sand, as noted before. These clays are not varved and, although no fossils were found, are probably marine since they are at the same level as the marine clays on the Hamilton River.

Concretions

Among the varved clays are many concretions, and on the west side of the Naskaupi lake-expansion they are present throughout most of the clay layers. They are usually flattened spheroids in this locality, although they occasionally occur in other shapes, such as elongated rods or as two

spherical concretions joined together. Most of those examined had no visible nuclei, but a few were found to have been formed around coniferous needles and other plant remains.

Concretions were also found in the laminated clay banks in the basin below Muskrat Falls. Here they assumed many odd shapes such as "doughnuts" and flat discs as well as the usual spherical forms. These concretions usually contained plant remains, and in many the layering was visible, showing how they were built up in the layers of clay.

Kindle[11] has divided the Labrador Pleistocene beds into three horizons: 1) a basal, laminated, fine-textured clay with abundant marine fauna; 2) similar beds, but with no fauna and more pronounced laminations; and 3) the Pleistocene sands as the top layer. Kindle does not refer to any of the clays as being varved, but all the river clays observed by the author had a different appearance or lamination from those on the upper Naskaupi. However, the clays observed by Kindle on the Red Wine River appear to be identical with those seen on the Naskaupi. Although the clays around Muskrat Falls are laminated and contain concretions, the presence of marine fossils shows that these clays were deposited in a tidal lake or estuary and hence cannot be varved clays.

In many of the clays, sand layers or beds of gravel were found with the clay, such as on the Susan and Cape Caribou Rivers, where pebbles occur in foreset beds of the river deltas; on the Susan the pebbles were cemented together by iron oxide deposits. Kindle found that some concretions contained shells, but none with shell nuclei were observed by the author. Kindle's collections of concretions were made at Muskrat Falls, 7 miles below the falls on the Hamilton, on the Kenemich River, and at Long Point on the south side of Lake Melville. The presence of iron oxide (limonite) was noted in many clay, sand, and gravel beds by both Kindle and the author, and this probably represents a hardpan layer formed by soil leaching.

Fossil Trees

Fossil trees are another interesting feature of the terraces. A single buried tree was found projecting from the bank on the Susan River, just above the limonite-cemented pebbles already mentioned. This tree was about 5 feet above the river, with one foot of sand overyling it, plus a thin layer of soil, humus, and moss, and then the spruce forest. Kindle[3] discovered a similar fossil tree in a bank of the Mulligan River, the lower reaches of which are filled with extensive Pleistocene sand terraces.

[11] E. M. Kindle: "Range and Distribution of certain types of Canadian Pleistocene Concretions," *Bull. Geol. Soc. Amer.*, Vol. 34, No. 3, 1923, pp. 614-615.

Both Hare and the author have also found individual fossil trees in the banks of the Goose River.

The best example of buried trees was on the Crooked River about 1½ miles above its junction with the Naskaupi. The trees are embedded in the terrace that separates the two rivers at this point. There are over 100 trees in this deposit and all are lying horizontally. They have recently been exposed by the river cutting back the bank. The trees are in a bed about 5 feet thick which is 15 feet above the river level and 25 to 35 feet above the present sea level. There is 10 feet of sand above the trees to the top of the terrace. The bedded material below and around the trees is part clay, part sand. The trees vary in size from small sticks to logs over a foot in diameter, and some appear to have been burned, but the wood has been perfectly preserved in the damp clay and sand. The trees have not been specifically identified, but they are large and massive, indicating vigorous growth.

Figure 6. Large bed of fossil trees on Crooked River. These trees have recently been exposed as the river cut into the 50-foot clay and sand terrace.

Several samples of the wood were taken for dating by the radio-carbon method. The results on three different portions of the samples gave age values of 2022 ± 195, 2110 ± 245, and 1611 ± 217 years. The average age was 1914 ± 127 years, according to Prof. K. J. McCallum, Dept. of Chemistry, University of Saskatchewan. Thus the sand and clay layers at

this point are approximately the same age, since the trees would have rotted rapidly had they not been covered soon after they were deposited.

Terrace Age and the Rate of Uplift

Wenner[12] has attempted to date the terraces (or strandlines, as he calls them) around Lake Melville by relating them to pollen diagrams and by comparison with similar conditions in Fennoscandia. He concludes that the strandline at 7 metres cannot be more recent than the latter part of Sub-Boreal time (2300-600 B.C.), the strandlines at 16-25 metres formed in this time or earlier, and the predominant 30 metre strandline formed in Atlantic time (before 2300 B.C.). The strandlines at 40-50 metres on the coast do not continue into the Lake Melville area. This may be due to the fact that the ice sheet probably lingered longer in the interior than on the coast, where it disappeared in Finiglacial time (8000-6000 B.C.).

From the examination of many bogs Wenner states that the withdrawal of the Pleistocene ice sheet was followed by a tundra phase, with some birch and alder forests. The coniferous forests then spread out, and the birch and alder thickets moved farther north. With the conifers came moisture-retaining vegetation (such as the sphagnum mosses), and five wet and dry periods are believed to have occurred in the area. Each wet-dry-wet series indicates growth, culmination, and decreasing growth of the forests in this sensitive zone bordering the tundra. Since the third (dry) heath layer there seems to have been more paludification than before, indicating a "climatic deterioration", probably after the climatic optimum. Wenner places the sub-arctic alder forests in Atlantic time ending about 2300 B.C., followed by the greatest development of the conifers in Sub-Boreal time about 1200 B.C. The recent work of Potzger and Courtemanche[13] near James Bay gives a date of 2350 $\pm$ 200 years as marking the beginning of pollen and organic deposition from conifers (incl. white pine) and southern broad leaved genera during the warm-dry pre-glacial period. After 600 B.C. increased paludification coincided with the climatic deterioration of Sub-Atlantic time. As the third heath layer (end of Sub-Boreal time, about 600 B.C.) occurs at sites as low as 4·5 and 10 metres above sea level, Wenner concludes that the land has only risen a few metres in the last 2500 years.

From the dating of the fossil trees described in the preceding section, it appears that the uplift has been rather slight in this area. The average age for the trees was determined to be 1914 $\pm$ 127 years, so that they grew

[12] C.-G. Wenner: "Pollen Diagrams from Labrador," *Geografiska Annaler*, Årg. XXIX. Häft. 3–4, Stockholm 1947, pp. 297–298.

[13] J. E. Potzger and A. Courtemanche, "A Radiocarbon Date of Peat from James Bay in Quebec," *Science*, vol. 119, No. 3104, p. 908.

at the beginning of the climatic deterioration of Sub-Atlantic time. Since it is likely that the trees died in situ as a result of the increased paludification accompanying this climatic change, then the total uplift in this particular area has been about 25-30 feet in the last 1900 years[14]. This supports Wenner's conclusions. Even in the event that the trees were deposited underwater or on a sand bar, the uplift has only been slightly greater.

However, although upwarping of the land has been slow in this area, it must have been even slower at first to allow the large marine terrace between Goose Bay and the Hamilton River to form. If, as Kindle[3] claims, formation of this terrace is due to tidal influences and not to river action (which seems unlikely in view of the orientation of the terrace), then there must have been a differential rate of upwarping with stillstands during which the large terraces such as this, and those in Moliak Cove were formed.

Raised Beaches

Raised beaches are common in this area and are particularly plentiful around Mud Lake, Little Lake, and on the lowlands near Northwest River. They are rarely visible on the ground, and when seen they consist of small ridges of sand and gravel 1 to 2 feet high; they may also appear as slight steepenings or terraces in the gentle upward slope of the land. They show up well on aerial photographs, however, and appear as lines of thicker vegetation (spruce, etc.) concentrically aligned around the water bodies and parallel to the present shoreline. The trees grow better on these slight ridges, which are well drained, while the area between them is often swampy.

Sand Dunes

On the high sand terrace north of Muskrat Falls, numerous sand dunes have formed, and an examination of the aerial photographs shows them to be even more extensive on this terrace level farther upstream. They are of the parabolic or crescentic type, with the horns pointing against the direction of the prevailing wind, as opposed to barchans, in which the horns point with the wind. In places the parabolic dunes have combined to make a compound dune presenting a scalloped appearance. These compound dunes form at right angles to the wind, but cannot be called true transverse dunes, as these are the result of coalescing barchans and only exist in areas where the supply of sand is great enough to destroy all the vegetation[15], which is not the case in this area. A very few small longitudinal dunes, (i.e., dunes parallel to the prevailing wind direction) are also present in the area.

[14] Weston Blake, Jr.: "Note on the Dating of Terraces in the Lake Melville District, Labrador," *Science*, Vol. 121, No. 3134, 1955, p. 112.

[15] J. T. Hack: "Dunes of the Western Navajo Country," *Geog. Rev.*, Vol. XXXI, No. 2, 1941, pp. 240–243.

Figure 7. Raised beaches concentrically aligned around Little Lake and indicated by lines of darker vegetation. Grand Lake is separated from Little Lake, and this in turn from Lake Melville, by an end moraine. These two moraines have been cut by North West River, and the settlement of North West River is situated on the moraine where the river enters Lake Melville.

(R.C.A.F. Photo)

Figure 8. Parabolic sand dunes on the terraces of Hamilton River above Muskrat Falls. The dunes are convex downstream, and the steep, convex side is outlined by dark vegetation. (R.C.A.F. Photo)

The parabolic dunes occur singly and in series. Some have horns of equal length while others have one horn much longer than the other, thus indicating a shift in the prevailing wind direction after partial stabilization by vegetation.

The dunes are up to 70 feet high, their inner sides being gentle slopes, and the outer short, steep bluffs. These dunes are now stabilized by vegetation except in a few spots where blowouts occur. The vegetation on the inner sides is the same as that of the surrounding sand plain. It consists of widely spaced trees of black spruce with some white spruce and white birch. The ground vegetation consists predominantly of lichens of the Cladonia family (*Cladonia spp.*), commonly known as "reindeer mosses". Bushes present are the dwarf birch (*Betula glandulosa*), Labrador tea (*Ledum groenlandicum*), and dwarf juniper (*Juniperus communis*). On the steep sides of the dunes the trees are much closer, and alder (*Alnus rugosa var. americana*) grows thickly. Feather mosses (*Hylocomium splendens*, etc.) grow on the damper soil and in the shade of the trees. The dunes consist of pure sand with a high percentage of quartz.

Smaller parabolic dunes are found on the sand terraces on the north side of the river a few miles downstream from Muskrat Falls. Here they are covered by a much denser stand of forest, and barely show up on the aerial photographs.

All these dunes have evidently been formed by the prevailing winds that are funnelled down the Hamilton River Valley, thus increasing their force and effectiveness in eroding the sand terraces. All reports from this region indicate that the dominant winds are southwesterly, westerly, and northwesterly.

Parabolic dunes are a common feature in glaciated areas, and they are known to occur in a great many localities in Canada, the United States, and northern Europe. Similar dunes have been reported from many other parts of Labrador-Ungava. Drummond[16] found them on the Romaine River, and also in several sandy areas between Lake Melville and the Ashuanipi River on the lake-plateau. Norman[17] states that in the Chibougamau District the crescentic (parabolic) dunes indicate prevailing southwesterly and northwesterly winds in late-glacial times; and, as these are the prevailing winds today in that area, this situation is similar to that along the Hamilton River. In this way the stabilized dunes give a clue as

[16] R. N. Drummond: "A Traverse of the Romaine River," (unpublished Master's degree thesis, McGill University, Montreal, 1950), pp. xxii(c) and xxxiii(d). Personal communication from R. N. Drummond.

[17] G. W. H. Norman: "The Last Pleistocene Ice Front in Chibougamau District, Quebec," *Trans. Roy. Soc. Can.*, Ser. 3, Vol. XXXII, Sect. IV, 1938, p. 79.

to post-glacial climates. Kranck[18] describes parabolic dunes from the Great Whale River and Port Harrison Area, but some of these are "active" dunes, whereas those on the Hamilton are "fixed."

Drumlins and Drumlinoids

Most of the area except the sand-filled river valleys is covered with till, which in many places has been moulded into drumlins. These occur in two main groups on either side of Grand Lake, and there are several hundred in the area. To the east of Grand Lake the drumlins are found between Crooked River and Lake Melville, and all have their long axes parallel to Grand Lake. Inland from the hills bordering Grand Lake the country becomes level and drumlins are found everywhere. The other group is mainly located between Goose and Red Wine Rivers to the west of Grand Lake, although some are found between the Goose and the Hamilton and to the north of Red Wine River. These also are aligned parallel to Grand Lake for the most part; that is, roughly NW–SE. However, some divergence occurs in the western part of the area. South of Goose River the drumlins trend WSW—ENE, between the Goose and the Susan they are oriented W–E, and north of the Susan they trend NW–SE. This indicates the coalescence of different ice lobes as they reached Grand Lake and the Lake Melville trough.

The origin of drumlins is not definitely agreed upon, but they are probably formed by a combination of factors, including the deposition of till around protuberances and the grooving and fluting of till surfaces. They are undoubtedly formed in different ways in different areas according to local conditions. None were seen in cross-section in the area mapped. The drumlins are composed mainly of sand—the chief material in the till of this region—with some clay, boulders, and rock fragments. In some areas, particularly near rock outcrops, it is likely that drumlins are formed by till being plastered around a rock core, and these are called "rock drumlins". However, the writer believes most of the drumlins to be formed solely of till in the Goose Bay area, although some of them may have cores of older resistant till.

Very few of these drumlins exhibit the ideal form, which has been described as "half-elliptical and resembling the inverted bowl of a spoon",[19] but are generally more elongated. In many parts of the area, particularly north of Beaver River, the drumlins assume a cigar-like form which is

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[18] E. H. Kranck: "On The Geology of the East Coast of Hudson Bay and James Bay," *Acta Geographica*, 11, N : 2, 1951, pp. 29–37.

[19] R. F. Flint: *Glacial Geology and the Pleistocene Epoch*, (New York: John Wiley and Sons, 1947), 3rd printing 1949, pp. 235–237.

Figure 7. Raised beaches concentrically aligned around Little Lake and indicated by lines of darker vegetation. Grand Lake is separated from Little Lake, and this in turn from Lake Melville, by an end moraine. These two moraines have been cut by North West River, and the settlement of North West River is situated on the moraine where the river enters Lake Melville.

(R.C.A.F. Photo)

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Figure 10. A large "embankment" type esker crossing a lake on the plateau west of Goose Bay. It runs approximately east-west.

(R.C.A.F. Photo)

usually referred to as drumlinoid. In this area drumlinoid is taken to mean a definite elongated ridge, but one lacking the ovoid form of a true drumlin. It does not include till furrows and other aligned hills, as the term has been applied by some writers. These forms are occasionally found in this area, often associated with the drumlinoids. These drumlinoids are developed to the extreme in the country north of Red Wine River. They are up to 2 miles long and 100 feet in height and in general are only a few yards wide. They closely resemble what Tyrrell[20] described as "ispatinows" from the Cree Lake District of northern Saskatchewan, and which also occur in Manitoba and Keewatin. However, these "ispatinows" were composed of unsorted rock flour and boulders and did not appear to be compacted by the ice. Tyrrell believed them to have formed in cracks in a glacier entering a lake, but in this area the drumlinoids are usually found between river valleys on the higher land, which was never covered by a lake as far as is known. Bird[21] and Dean[22] have reported similar drumlinoid features from the Dubawnt and Thelon River areas of Keewatin. Dean suggests that the drumlinoid features have developed in sandy areas where there is a lack of clayey till necessary for the formation of true drumlins. This hypothesis would apply to the Goose Bay area also, where the drift is composed almost completely of sandy till. Some of the drumlinoids may possibly be "crag and tail" features.

True drumlinoids are best illustrated in the area immediately south of Beaver River. These drumlins are covered by a much thicker growth of trees than the drumlinoids. Species common here are black spruce and balsam fir, with some white spruce, tamarack, and white birch. This would suggest a slightly more clayey (and therefore more moisture-retaining) soil than that of the drumlinoids, and this would agree with their formation as discussed in the last paragraph.

In most cases the stoss ends of the drumlins face westward, thus indicating a glacial advance from this direction. However, some drumlins exhibit steeper ends toward the east, and sometimes adjacent drumlins appear to have been formed from different directions. The drumlins occur singly and in innumerable combinations. They are arranged in series adjacent to one another, with the tail of one leading into the stoss end or flank of the next.

One drumlinoid examined east of Grand Lake had a large gully excavated in its top. This particular drumlinoid was 200 feet high, about a

[20] J. B. Tyrrell and D. B. Dowling: "Report on the Country between Athabaska Lake and Churchill River," *Annual Rep., (New Ser.), Geol. Surv., Canada*, Vol. VIII, Rep. D, 1895 (published 1896, 1897), p. 23.

[21] J. B. Bird: "The Glaciation of Central Keewatin, Northwest Territories, Canada," *Am. J. Sci.*, Vol. 251, 1953, pp. 221–222.

[22] W. G. Dean, "The Drumlinoid Landforms of the Barren Grounds, N.W.T.", *Can. Geog.* No. 3, 1953, p. 19.

mile long, and a quarter to half a mile wide at its base. The top was a flattened ridge 50 to 100 yards wide, and the surface material was mostly sand and rock fragments. Large boulders were present in the gully, which was 100 yards long and 30 feet wide, and this gully was apparently sometimes occupied by a small pond. Grooved drumlinoids were observed in other areas also. Many drumlinoids are greater than a mile in length, but are usually narrower than the one described above. They occur on the rolling uplands, and sometimes control the direction of stream flow, as on the upper Red Wine River. They are often separated by bogs and till furrows. Occasionally they are found in the valleys or on the flanks of hills. Hare believes some of the drumlinoids in the Sebaskachu River Valley to be water-worn, and they are certainly of more moderate relief than usual. Some have been gullied by erosion or breached by streams, and therefore present a wide variety of forms.

Eskers

Eskers are not very plentiful in this area compared with their widespread occurrence on the inland lake-plateau. When they do occur they are in small upland valleys or on the plateau itself, and not in the larger valleys that are filled with Pleistocene sands. They are of both the "embankment"

Figure 11. Close-up aerial view of drumlinoids and snow-covered lakes east of Grand Lake.

type—a single sinuous ridge, and the "outwash" type—multiple ridges[23]. Some of the multiple eskers cross and re-cross each other, while others occur as parallel ridges. In this area the multiple eskers form smaller ridges than the sinuous variety. Both are often found crossing lakes and bogs on the plateau.

In general the eskers are parallel to the direction of glaciation, except where they follow the trend of a valley. However, in this area a few are at right angles to the drumlins. Some also cross the hills and, in fact, die out before reaching the valleys below. It is generally agreed that eskers form in stream channels at the snouts of glaciers (which may or may not end in a lake), where rushing streams deposit sand, gravel, and cobbles in a series of overlapping beds that eventually form sinuous ridges as the glacier retreats. In view of this, it is rather hard to explain eskers running over ridges, particularly at right angles to the direction of glaciation. However, it is conceivable that an esker could be deposited over a gentle hill if the stream was under great hydrostatic pressure, but an esker so formed would still tend to parallel the direction of glaciation. It is suggested that perhaps these features were deposited as "ice-crack" moraines[24] or crevasse fillings. Streams running in crevasses near the edge of the ice sheet and depositing or reworking debris would give the proper orientation to the resulting ridges. That the ridges are left as remnants on the hills only can be explained by the erosive action of the streams in the valleys.

End Moraines

Two end moraines occur on either side of Little Lake, and both are cut by North West River, flowing from Grand Lake. They are oriented NE–SW at right angles to the trough of Grand Lake, and they appear to have been deposited by a glacier retreating northwestwards up this valley. The one nearest Grand Lake extends 4 miles between the hills on either side of the lake and is 50 feet high where the river cuts through. Here there are deep rapids over the boulders of the moraine. This moraine is mostly sand with some gravel and boulders.

The second moraine stretches 10 miles from the hills northeast of North West River to the sand plain on the west side of the river, and here it gradually dies out. It is 80 feet high at the river and rises to 190 feet toward the northeast. It too is composed mostly of sand and small stones, but large boulders of anorthosite, granite-gneiss, and other rocks are scattered

[23] J. T. Wilson: "Eskers Northeast of Great Slave Lake," *Trans. Roy. Soc. Can.*, Ser. 3, Vol. XXXIII, Sect. IV, 1939, p. 123.

[24] J. C. Sproule: "The Pleistocene Geology of the Cree Lake Region, Saskatchewan," *Trans. Roy. Soc. Can.*, Ser. 3, Vol. XXXIII, Sect. IV, 1939, p. 104.

throughout. Both ridges are rounded, and the one at North West River is 50 to 100 feet wide at the top by the river. However, to the west of the river this moraine has a flattened top with a concentration of boulders. This is due to the erosive action of the lake when the land was lower, the water having washed the fine sand out of the top of the moraine.

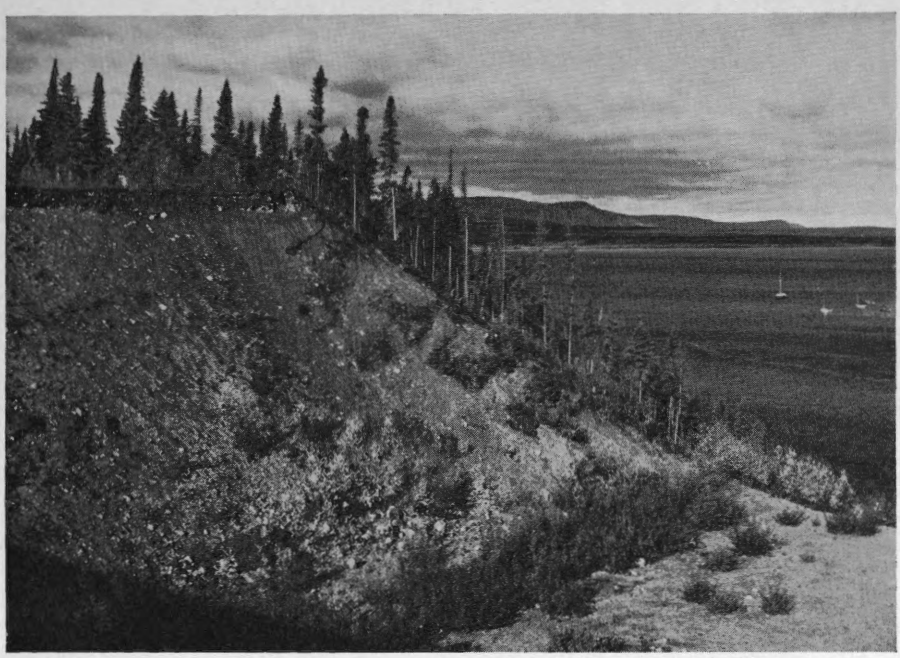

Figure 12. The end moraine at North West River looking northwest toward Little Lake and the hills west of Grand Lake. The top of this moraine has been reworked and terraced by water action.

From inspection of the aerial photographs it appears that a third end moraine 5 miles long is present at Sandy Point and is parallel to the other two. This moraine is joined to the hills by the sand plain to the north of the lake. Raised beaches and terraces have developed on the sides of all the moraines. The moraines are all as thickly wooded with the various coniferous species as are the nearby hills and sand plains.

Other Glacial Landforms

Kames are present in several places, often together with the eskers, while in some of the area around the upper Red Wine and Sebaskachu Rivers the landscape is pitted and exhibits a typical kame and kettle topography. Between the drumlins the land surface is sometimes hummocky ground moraine, and erratics are common everywhere on the uplands,

although they are often covered by vegetation. Till furrows and flutings occur in the country north of Red Wine River, where there is a thin till cover.

Some of the higher terraces on the rivers such as the Goose are either kame terraces or terraces formed in ice or moraine-dammed lakes. In one place on the upper Crooked River, high above the valley terraces, there is a terrace which is cut by various channels. These are believed to be lateral drainage channels that have dissected a kame terrace, such as those described by Mannerfelt[25] from northern Norway and Sweden.

RÉSUMÉ

Cet article traite de l'origine et des caractéristiques physiques des dépôts subaériens de la région du lac Melville, Labrador. Il fait partie d'une étude du Conseil de recherches pour la défense exécutée sous la direction du professeur F. K. Hare en vue d'établir une méthode d'interprétation, à partir de photographies aériennes, de la végétation et de la physiographie.

Le lac Melville, relié à l'océan Atlantique dont il subit les marées, occupe un graben, ou fossé tectonique. Le Mealy Mountain Range, au sud, par contre est un horst, ou butoir. La région, d'une façon générale, est formée de gneiss archéens à structure fortement faillée. Le principal cours d'eau est le fleuve Hamilton auquel s'ajoutent les rivières North West, Goose, Kenanu et Kenemich.

Presque toutes les vallées sont occupées par des terrasses d'origine marine et fluviale formées de sable et d'argile à blocaux. D'autre part, les rivages du lac Grand, à l'embouchure de la rivière Naskaupi, sont formés d'argiles varvées déposées lors de la retraite des glaciers du pléistocène. Des caractéristiques intéressantes de ces terrasses sont les arbres fossiles et les concrétions qu'elles renferment.

Il est établi, d'après les recherches faites, que l'âge de ces arbres est d'environ 2,000 ans et que durant cette période l'élévation du terrain fut de 25 à 30 pieds.

La région renferme un grand nombre de dunes de sable du type parabolique; leur forme résulte de la direction et de l'intensité des vents dominants et la plupart sont maintenant fixées par la végétation.

Les principales formes de topographie glaciaire sont les drumlins et *drumlinoïdes*, les eskers, les moraines frontales et les kames.

[25] C. M. Mannerfelt: "Några Glacialmorfologiska Formelement," *Geografiska Annaler*, Årg. XXVII, Häft. 1–2, 1945, pp. 85, 88, 101, etc.

BOOK NOTES

SASKATCHEWAN ROYAL COMMISSION ON AGRICULTURE AND RURAL LIFE. Report No. 1. The scope and character of the investigation. Regina, 1955, 122 pp.

Interim report. Crown Land settlement in north-eastern Saskatchewan. Regina, January, 1954, 52 pp., appendix.

The Saskatchewan Royal Commission on Agriculture and Rural Life was appointed in 1952 to study the maintenance of a sound farm economy and the improvement of rural amenities and social conditions. These two publications comprise one of the preliminary reports and the first of a series of 15 final reports to be issued by the Commission.

The scope and character of the investigation discusses the progress of the Commission's work, the techniques used for gathering information, and the scope of each of the reports to follow. Some of these reports will be of particular interest to geographers. Among these is one dealing with the nature of internal migration in Saskatchewan, the responsible economic and social forces, regional differences in movement, the resultant problems, and future population prospects.

Some of the other reports to be issued include studies of land tenure, farm mechanization, rural roads and local government, and rural education.

Crown Land settlement in north-eastern Saskatchewan deals with 6 established and 3 projected settlement areas in the northeastern part of the province. These settlements have special problems (e.g. lack of drainage) that were felt to be of considerable urgency.

Particular attention is paid to the difficulties arising from development on the traditional pattern of prairie roads (1 mile apart east and west, 2 miles apart north and south). In order to effect economies and provide greater convenience, the Commission recommends that future farmsteads be located along a minimum number of routes. Maps and a table in the appendix contrast the patterns and costs of settlements based on the traditional survey and on a planned line settlement.

Before such developments are undertaken in future, the Commission urges that comprehensive surveys be made of physical factors, costs of development and administration, and the anticipated benefits of such expenditure. Before settlers are located, it is recommended that road and drainage projects be constructed on the basis of the topography and settlement plan, rather than on the traditional land survey. Recommendations are also made regarding credit facilities for farmers and communities, selection of settlers, and provision of trade and other services.

[M.H.M.]

CANADA AND THE UNITED NATIONS—THE RECORD AFTER TEN YEARS. External Affairs Vol. 7, No. 5, May 55, pp. 150–158.

The Department of External Affairs reviews in its monthly publications the role played by Canada in the first ten years of existence of the United Nations. The Canadian Delegation took an important part in drafting the charter of the United Nations, in serving through its representatives in most of the main offices of the organization, in serving as a mediator in international disputes, in efforts to promote disarmament, higher standards of living, improved health, extension of economic co-operation, respect for human rights, and recognition of accepted standards of international law. Finally, Canada is sixth in the list of contributors to the budget of the United Nations.

[P.C.]

CANADIAN FOREIGN TRADE ROUTES. Canada, Dept. of Trade and Commerce, Transportation and Communication Section, Ottawa, 1955, 112 pp.

The Department of Trade and Commerce has published a new edition of a directory of services related to Canadian shipping which is very useful to steamship companies, shipping agents, importers and other specialized agencies. This directory includes two

indexes, one of foreign ports of discharge, and the other of steamship companies and agents in Canada. In another part of the report, the steamship services are listed for eastern and western Canadian ports. Among the useful data to be noticed are the frequency of sailings and the space accommodation offered by each steamship company.

[P.C.]

RANCHING IN THE SOUTHERN INTERIOR PLATEAU OF BRITISH COLUMBIA. By T. R. Weir. Canada, Dept. of Mines and Tech. Surv., Geog. Br., Mem. 4, Ottawa, 1955, 121 pp., maps., illus. Price $1.75.

One of the programs of the United Nations Economic, Social, and Cultural Organization concerns planned surveys of the arid zones of the world. In connection with Canada's participation in this work, the Geographical Branch is carrying out surveys of the arid and semi-arid areas of the country to determine the geographical boundaries of these areas, to examine their influence on occupation and settlement, and to record their geographical relationships with other districts.

This memoir fulfils a part of this program. It was prepared from field work carried out by the author during 1949 and 1950 within the southern area of the Interior Plateau of British Columbia and is concerned with ranching as the leading industry and type of land use. Primarily it is a study in economic geography, and its main objects are to describe the influence of physiography on ranching practices, and to analyse the distribution of range-use patterns, the factors of their development, and the present-day function of the range.

The memoir is illustrated with 31 maps and diagrams, and 18 photographs.

[B.V.G.]

THE LOWER MACKENZIE RIVER AREA, NORTHWEST TERRITORIES AND YUKON. By G. S. Hume. Canada, Dept. of Mines and Tech. Surv., Geol. Surv. of Canada, Ottawa, 1954, 118 pp., maps, tables, diags., illus.

In his introduction, the author states "The northward exploration for oil and gas resulting from the discoveries in the Prairie Provinces since 1947 . . . make it desirable to include all available geological information in a single report . . .". With the exception of short sections dealing with location, access, early exploration and a résumé of the Canol Project, the report covers the stratigraphy, structure, and economic geology of a large region centred around Norman Wells on the Mackenzie River.

[B.C.]

SOUTHEAST CAPE BRETON ISLAND, NOVA SCOTIA. By L. J. Weeks. Canada, Dept. of Mines and Tech. Surv., Geol. Surv. of Canada, Ottawa, 1954, 112 pp., maps, tables.

The main part of this report is devoted to a detailed description of the geology of Southeast Cape Breton Island, and is supplemented by maps, diagrams, and tables. The final chapter describing the economic geology is probably of wider appeal, as it deals with the copper, lead-zinc, molybdenite, manganese, iron, coal, gypsum, and talc deposits of the area.

[B.C.]

GAZETTEER OF CANADA (MANITOBA). Canadian Board on Geographical Names, Ottawa, 1955, 60 pp., map. Price $1.00.

This publication is the third volume of the Gazetteer of Canada series prepared by the Canadian Board on Geographical Names. The names of geographic features and populated places in the province of Manitoba are listed in alphabetical order together with their position in geographical terms by latitude and longitude, or by section, township, and range. A map of the province is included showing township and range lines, the more prominent water features, and a few urban settlements.

[M.R.D.]

RESEARCH ON IMMIGRANT ADJUSTMENT AND ETHNIC GROUPS, ANNUAL BIBLIOGRAPHY. June 1953-1954. Canada, Dept. of Citizenship and Immigration, Canadian Citizenship Br., Research Div., Ottawa, 1954, 53 pp.

The material in this bibliography is divided into two sections—the first lists by subject and author those studies dealing with immigration, citizenship, ethnic groups, and inter-ethnic relations in Canada that are in progress or completed since June 1953; the second lists by author unpublished theses that were completed between 1920 and 1953. Wherever possible, abstracts of these studies have been included under each item.

[M.R.D.]

THE CANADIAN COMMERCIAL FISHERIES OF THE GREAT LAKES. Canada, Department of Fisheries, Markets and Economics Service, Ottawa, May 1955, pp. 215, statistics, graphs, maps and appendix.

This is the second of a series of statistical tabulations, entitled basebooks, presenting information on Canadian fisheries. The purpose is to make available compilations, analyses, and general references for those interested in the fisheries. The report is divided into three sections:— Section A, Miscellaneous Economic and Geographic Information concerning the Canadian Commercial Fisheries of the Great Lakes; Section B, Commercial Landings, Canada, for the Great Lakes, by Lakes and by Species, 1867-1953; Section C, Landed Value of Fish Landed in the Canadian Commercial Fisheries of the Great Lakes by Species and by Lake, 1945-53.

[W.A.B.]

LABRADOR AND HUDSON BAY PILOT. Canada, Dept. of Mines and Tech. Surv., Can. Hydrographic Serv., Ottawa, 1955, 356 pp. tables.

This is the first Canadian edition of the Labrador and Hudson Bay Pilot. Although it is based on the British Admiralty and United States Navy Hydrographic Office Pilots, it includes the latest information provided by the Canadian Hydrographic Service vessels that have operated in this area during recent seasons. The descriptions cover the Strait of Belle Isle and approaches in addition to the Labrador coast, Hudson Strait, and Hudson Bay.

[C.N.F.]

THE GENERAL OCEANOGRAPHY OF THE STRAIT OF BELLE ISLE. By A. G. Huntsman, *et al.* Jour. Fisheries Research Bd. of Canada, Vol. 11, No. 3, 1954, pp. 198–260, maps, graphs.

The chief results of past investigations of oceanographical conditions in the Strait of Belle Isle have been brought together in this comprehensive report. A detailed treatment of tides, currents, water temperature, salinity and density is given. Following the physical oceanography is a final section on plankton and fish species found in the area. The text is well illustrated with maps and charts.

[C.N.F.]

THE WATERS OF THE I.C.N.A.F. CONVENTION AREA. By H. B. Hachey, *et al.* Joint Committee on Oceanography, St. Andrews, N.B. 1954, 47 pp., graphs, biblio.

This report was prepared for the Hydrographic Sub-Committee of the International Commission for Northwest Atlantic Fisheries. It contains a review of the general physical characteristics of the waters of the Western North Atlantic that make up the I.C.N.A.F. Convention area.

[W.A.B.]

OFFSHORE WATERS OF THE CANADIAN PACIFIC COAST. By L. A. E. Doe. Jour. Fisheries Research Bd. of Canada, Vol. 12, No. 1, 1955, pp. 1–34, maps, graphs.

Here is presented a summary of the results of four oceanographic surveys undertaken between 1950 and 1952. The data collected enabled the determination of temperature, salinity, density structure, and the water currents. In connection with the currents it was found that upwelling played an important part in the water circulation along the British Columbia coast. The origins and circulation of the water in surface and lower zones are also discussed.

[C.N.F.]

THE MARKET FOR FARM PRODUCTS IN NEWFOUNDLAND, 1948-1950. By W. C. Shipley. Canada, Dept. of Agriculture, Marketing Serv., Economic Div., Ottawa, 1954, 81 pp., diags., tables.

The main object of this study is to determine the extent of the market for farm products in Newfoundland. In a province where the fishing industry has long overshadowed agriculture, and where the agricultural potential has only recently been recognized, this investigation is a pioneer study. The report is well supported by statistical data and presents an analysis of the proportion of the total market requirements over a two-year period. Further, the market as it existed during the year before Newfoundland became a province is compared with that of the year following, with special attention devoted to the sources of origin of farm products. Sampling period seems very short.

[C.N.F.]

MOIRA CONSERVATION REPORT. Ontario, Dept. of Planning and Development, Toronto, 1955, 123 pp., illus., graphs, maps.

In 1950 the full Moira Report was published. The present volume is the second edition of a summary form of the report. Its six sections deal with History, Land, Forest, Water, Wildlife, and Recreation. Each of these topics is covered sufficiently to trace development or exploitation up to the present, and to outline the main problems connected with each. Specific recommendations include the preservation of certain historical sites, the setting up of a pilot farm to encourage good land use practices, reforestation and the establishment of publicly-owned forests, the construction of dams to prevent flooding, the improvement of the habitat for sport fish, and the acquisition of certain areas by the Conservation Authority as recreation sites. The report contains many good photographs illustrating its main points.

[L.L.P.]

GENERAL INDEX TO THE REPORTS OF THE ONTARIO DEPARTMENT OF MINES, Vols. L to LIX (1941-1950). Ontario, Dept. of Mines, Toronto, 1954, 333 pp.

The ten-year period 1941-1950 witnessed a number of important developments in the mining industry in Ontario. These include the effect of wartime needs upon gold mining, post-war expansion of the nickel-copper industry, and iron mining developments at Michipicoten, Steep Rock, and Marmora. The reports of the Ontario Department of Mines covering this period are of wide scope, and this index should be of considerable value to anyone interested in geology and mining.

[L.L.P.]

INDUSTRIAL SURVEY OF METROPOLITAN WINNIPEG. Manitoba, Dept. of Industry and Commerce, The Bureau of Industrial Development, Winnipeg, 1955, 112 pp., tables, maps, illus.

Designed as a compendium of industrial location data of interest to business men, this publication presents a wealth of factual detail on the eight communities, West Kildonan, Fort Garry, St. Boniface, St. James, St. Vital, Transcona, East Kildonan, and Winnipeg, that make up Metropolitan Winnipeg.

Part I gives a detailed breakdown of the physical, economic, civil, and cultural constitution of the metropolitan area and also a general picture of its hinterland and resource base, past and present. Part II presents similar information on each of the eight constituent communities.

Interspersed throughout the text are 89 statistical tables on a wide variety of subjects, and many photographs. A fold map of residential areas and existing and potential industry, at the scale of 1000 feet to the inch, is included with the publication. [G.F.]

THE NATURAL HISTORY OF THE FORBIDDEN PLATEAU AREA. By George A. Hardy. British Columbia, Provincial Museum of Natural History and Anthropology, Report for the year 1954, Victoria, 1955, 39 pp. map, illus.

The purpose of this article is to provide a check list of the flora and fauna of the Forbidden Plateau area of Vancouver Island. Short descriptions of the location, size, topography, geology, and climate of the area are included and the report is illustrated by a number of photographs and a map showing relief by contours and hill-shading.

[R.H.D.]

PRELIMINARY INVESTIGATION OF THE BARREN GROUND CARIBOU. By A. W. F. Banfield. Canada, Dept. of Northern Affairs and National Resources, Nat. Parks Br., Wildlife Serv., Series 1, No. 10A and 10B, 1954.

The volume, 10A, deals mainly with history, status past and present, range, and migrations of the caribou. Other aspects of the study, including physical description, behaviour, food requirements, vital statistics, and human utilization are dealt with in a second volume published concurrently in this series as Number 10B. [J.N.]

NORTHERN AFFAIRS BULLETIN. Canada, Department of Northern Affairs and National Resources, Ottawa, Vol. 1, Nos. 1–12, 1954 and Vol. 2, Nos. 1–8, 1955. Mimeo.

This bulletin, now in its second year of publication, contains much information of interest both to members of the Department of Northern Affairs and to the white and native population of the north. Short semi-technical articles on northern development and planning are supplemented by brief biographical sketches of Northern Affairs office and field personnel. News items of interest are included, as are social announcements and book reviews.

An article on Whitehorse, Y.T. (Vol. 2, No. 5, pp. 8–10), for example, discusses briefly the history of the town since its founding as a transhipment point on the route from Skagway to Dawson during the gold prospecting era. The article further discusses the development and extension of the town since it became the Yukon territorial capital in 1953. A new sub-division of 200 residential lots has been laid out on the right (east) bank of the Yukon River. A bridge is to be built across the river and a new hospital will be constructed in the subdivision. [V.W.S.]

PERMAFROST INVESTIGATIONS AT AKLAVIK: 1953 (DRILLING AND SAMPLING). By J. A. Pihlainen and G. H. Johnston. Canada, National Research Council, Div. of Building Research, Tech. Paper No. 16, Ottawa, 1954, 16 pp. appendices, tables, illus. graphs.

During the summer of 1953, officers of the Division of Building Research, with the co-operation of the Department of Northern Affairs, carried out investigations at Aklavik, N.W.T. on methods of drilling and sampling soils in permafrost areas. At the same time observations were commenced to examine the effects of building construction on underlying permafrost conditions.

The first part of this paper is a technical account of the drilling equipment used, techniques employed in obtaining and preserving drill core samples, and classifications found useful in describing the soil and ice constituents of the samples. The second part of the paper includes an analysis of the texture, moisture content, organic content, and unit weight of the soil samples. A number of photographs and descriptions of typical cores are included in the appendices, and also a presentation of the U.S. Army Corps of Engineers proposed method of describing and classifying frozen soil.

[V.W.S.]

DISTRIBUTION OF ICE IN BAFFIN BAY AND DAVIS STRAIT. By Henry S. Kaminski. U.S. Navy Hydrographic Office, Misc. tech. rept. 15891, Washington, D.C., 1954.

Sea ice and ice of land origin is the chief concern of this report. In detail, the characteristics of ice behaviour described involve an examination of dynamic and kinematic forces, determination of the thermohaline structure of waters, an account of long-range aerial surveys of ice, and the formation and growth of ice as a function of oceanographic and meteorological variables.

[W.A.B.]

THE USE OF PLANT MATERIAL IN THE RECOGNITION OF NORTHERN ORGANIC TERRAIN CHARACTERISTICS. By Norman W. Radforth. Canada, National Res. Council, Associate Committee on Snow and Soil Mechanics, Tech. Memorandum No. 28, Ottawa, 1954, 19 pp., tables, graphs, illus.

In an effort to determine the relationship between characteristics of surface and subsurface organic terrain, the author has conducted research on recognition of botanical relationships through the profile of development. In conjunction with his previous work on muskeg classification, this book will help in the interpretation of terrain conditions over large areas.

[J.K.S.]

BOTANICAL STUDIES AT BEAR'S COVE POINT, SOUTHAMPTON ISLAND, NORTHWEST TERRITORIES, CANADA. By D. K. Brown. Canada, Dept. of National Defence, Defence Research Board, D.R.N.L., Tech. Paper No. 20, Ottawa, 1954, 45 pp., tables, illus.

This paper is an account of botanical studies made during July 1951 at Bear's Cove Point, Southampton Island. A discussion is included of the effect of topography, climate, water and wind erosion, and frost action on plant distribution. Detailed material on typical plant communities is also presented together with lists of the primary and secondary botanical species found in these communities. The final, and largest, section of the report presents an annotated list of the lichens, mosses, ferns, hepatics and flowering plants collected in the area.

[V.W.S.]

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