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ERRATA

Page 28. line 7 - "4" should read "2".

line 8 - "2" should read "4".

line 9 - "3" should read "6".

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TERRAIN CONDITIONS IN THE CENTRAL CANADIAN ARCTIC

J. Brian Bird

Developments that will ultimately change the whole character of the country are now taking place in the Canadian North. The first major northward expansion is into the forested sub-arctic sections, but already some mines are being developed, and others planned, north of this zone. In 1953 construction was begun on a nickel mine at Rankin Inlet on the west side of Hudson Bay and 150 miles north of the tree line. Fundamental to the success of any building, transport, or mining development is an appreciation of the terrain conditions in the arctic. Although land forms may vary widely in detail within short distances, it is possible to make generalizations that are valid over broad areas.

In arctic Canada a number of controlling factors in terrain formation may be recognized. Rock, whether it is bare bedrock, has weathered into finer material, or has been transported by ice to form superficial deposits, forms the base for all but a minute proportion of the surface. Slopes, which have developed in consequence of the physiographic history of the area, control much of the drainage and mass movement. Climate is always an important factor, not so much because of the amount of precipitation but because the low temperatures are responsible for permanently frozen ground. The whole area discussed in this paper is underlain by permafrost. The depth of the active layer that melts in the summer is the most important feature of the permafrost in terrain studies, as it controls the depth of sub-surface drainage. West of Hudson Bay the active layer varies in depth from about 6 inches under peat to over 10 feet in coarse sandy soils. No comprehensive study of permafrost conditions in the Central Canadian Arctic[1] exists, despite research in the past few years. The most complete statement of permafrost conditions in Canada is still that of Jenness[2]. More rarely, vegetation is responsible for producing special terrain types, although normally vegetation is a result rather than a cause of terrain conditions.

In this paper the terrain characteristics of broad areas of the Central Canadian Arctic are examined. A physiographic approach is used because of the importance of the physiographic stage and process in terrain formation and because of the ease with which physiographic forms may be recognized on air photographs. In more detailed studies an ecological approach is valuable as the plant cover is a sensitive indicator of moisture conditions.

[1] The term Central Canadian Arctic is here used in a restricted sense for that part of the mainland of Canada north of the tree line that includes the coast west of Hudson Bay and the basins of Back, Thelon, Dubawnt, and Kazan Rivers and Southampton and Coats Islands.

[2] Jenness, J. L.: Permafrost in Canada; Arctic, vol. 2, 1949, pp. 13-27

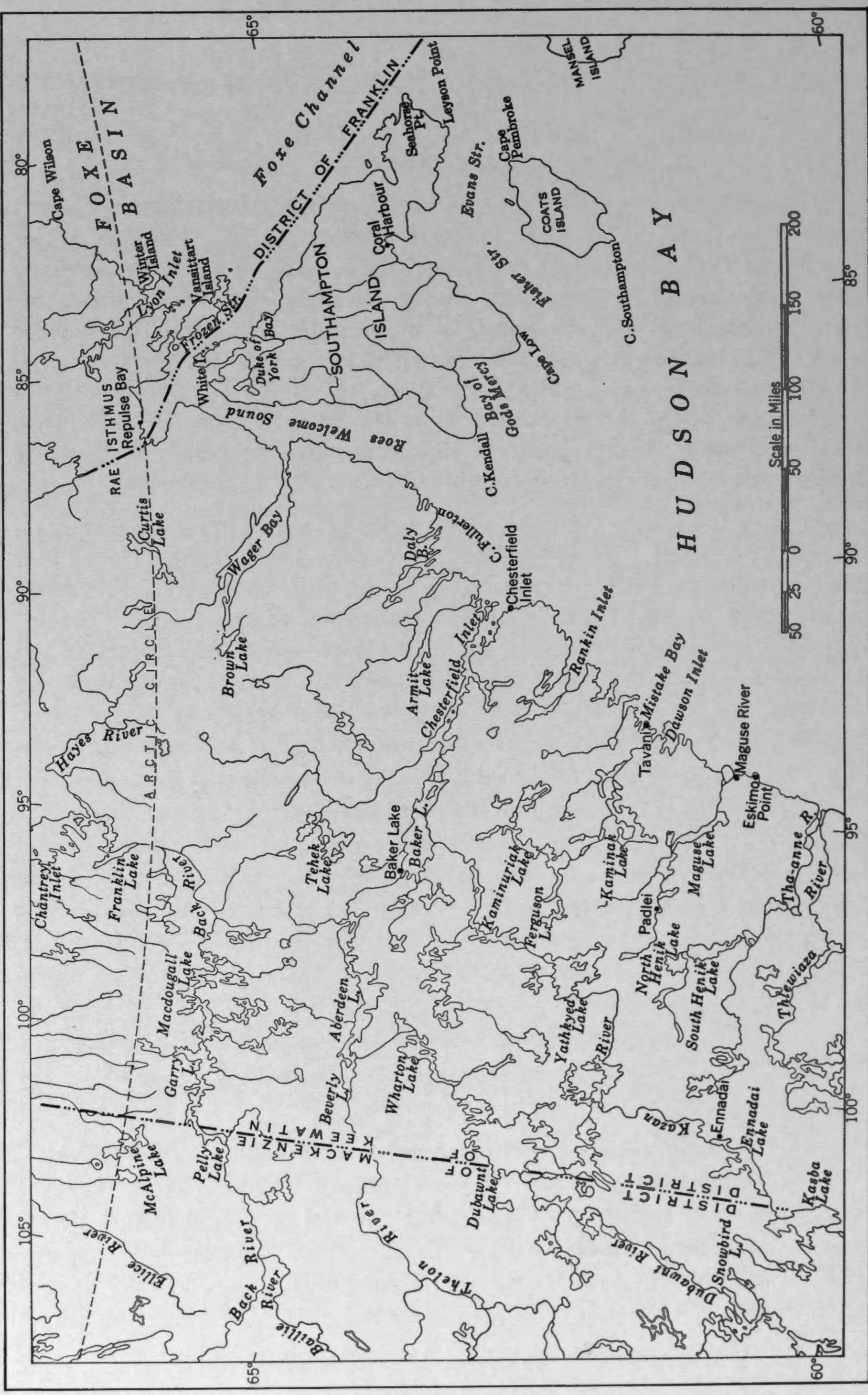

Figure 1. Location map of the central Canadian Arctic.

A large section of the region forms part of the geological and physiographic province of the Canadian Shield. Although most of the rocks in this part of the Shield are granites and granite-gneisses, there are many variations in rock type. In terrain evaluation the most conspicuous difference is found in the sandstones, conglomerates, and other rocks of late Proterozoic age that are found in the Thelon Basin and north from there to Back River. Responsible for even wider variations in terrain conditions are the Palæozoic limestones and dolomites found on Southampton Island, Coats Island, and Melville Peninsula.

The igneous and metamorphic rocks, of which the granites are part, support a wide variety of terrain types. Everywhere the overburden of glacial and marine deposits tends to be thin. Consequently, bare rock knobs and ridges are the rule, with the depressions between supporting a denser vegetation on the fine material that has wasted down from the higher points. The terrain on the south side of Chesterfield Inlet is typical of this granite-gneiss group. The land does not rise more than 100 feet above sea-level and yet all the ridges have been swept clear, exposing bare rock. The rock is weathering very slowly and the surface has not changed fundamentally since the disappearance of the continental ice. The depressions support marsh, hillock tundra, or heath, depending on the degree of drainage that is available. Nowhere are these plant communities extensive. Lakes are numerous, but are not deep, and many have been filled in since the emergence of the land from the post-glacial sea. A similar type of terrain is found on the west side of Roes Welcome Sound north of Wager Bay, on the south side of Queen Maud Bay, around Coral Harbour on Southampton Island, and on the east side of Coats Island. In these areas, as a consequence of more extensive glacial drift, the vegetation tends to be richer. The region under discussion, with the exception of the southwest corner, is north of the tree line. Isolated clumps of stunted spruce are, however, frequently seen many miles out on the tundra, particularly in dry sandy areas of the Thelon Basin above Aberdeen Lake. In the area north of the tree line, three major and a large number of minor plant associations may be recognized. The three more important associations are the rock and stone desert lichens, the heath tundra, and the hillock or wet tundra. The rock and stone desert is barren except for rock lichens and nowhere has a continuous vegetation cover. The dry heath tundra is dominated by mosses and lichens; in the damper parts, grasses, sedge, and stunted shrubs and birch are present. Grasses and sedges are dominant in the wet tundra. The vegetation forms tussocks which under the wettest conditions may have their tops only above water. This type is referred to in this paper as hillock tundra. In addition to the communities formed by mixing of the above types, there are special associations around snow patches, on the banks of streams in the south (willow and alder thickets), in the true marshes, and on the seashore.[1]

[1]Porsild, A. E.: Plant Life in the Arctic; Can. Geog. Jour., vol. 42, 1951, pp. 121-145; gives a general treatment of the topic. A detailed study of part of the east of the area is contained in Polunin, N.: Botany of the Canadian Eastern Arctic, pt. III; Nat. Mus., Canada, Bull. No. 104, 1948, p. 304.

Structural control in these lowland areas appears slight. In contrast, many of the schists and altered volcanic rocks (less frequently quartzites) show strong folding and foliation. When this occurs, as at Rankin Inlet, Pistol Bay, Cape Fullerton, and Bury Cove, ridges corresponding with resistant rock strata form strikingly curved ground patterns. They are rarely more than 20 feet high. Gentler folding over broad areas controls extensive higher ridges, as in the hilly country north of Schultz Lake (the eastern arm of Aberdeen Lake) towards Meadowbank River.

In areas of greater relief, the contrast in terrain between the upper surface of ridges and knobs and valleys becomes very striking. The summits are formed of bare or lichen-covered rock, whereas at lower elevations marsh and wet tundra is dominant around lakes, with heath tundra in the drier parts. As in the lowlands, the relief appears to have developed with varying dependence on structural control; its influence is particularly striking where the rocks are crossed by lines of weakness (variously faulting, jointing, and dyke systems) that form a rectangular pattern. The pattern is readily attacked by differential stream and glacial erosion and the result is seen in the landscape today as long straight valleys, rarely occupied by a continuous stream throughout their length, and parallel-sided, lake-filled, rock basins. The over-all linear pattern is at once evident when seen from the air (Figure 2). On the ground it often gives the impression of extraordinarily rugged country, although the local relief may not exceed 200 feet. Two areas of this linear pattern are particularly extensive in the region under discussion. One is on the south side of the Narrows at the entrance to Wager Bay, the other is on Rae Isthmus. In both cases the till cover is slight or absent and the pattern is clearly etched in the landscape.

Figure 2. Northern side of Rae Isthmus near Committee Bay. Drainage is controlled by structure. (RCAF photo.)

Terrain conditions in the Thelon Basin and northwards from there towards Back River are conspicuously different from those of the other parts of the Canadian Shield. The most extensive rock is sandstone, which is generally covered with thick deposits of sandy till and water-sorted sands. The surface of the rock is, consequently, below the active layer of the permafrost and has escaped post-glacial frost shattering. Streams are frequently incised as much as 100 feet into the overburden, and their beds are choked with sand. The landscape is one of low, rolling country with a marked grain developed during the glaciation. Away from the rivers small hills, formed from the more resistant sedimentary rocks, project through the lowlands. The terrain is dry on the tops of the swells and the hills and is covered with heath tundra, or often bare sandstone fragments. In the driest parts north of Aberdeen Lake, on Tibielik River, and on both sides of the Back River lakes the surface sand is actively moved by the wind and small patches of true desert with dunes result. Elsewhere in the depressions, where the finer sediments have been washed, conditions are damper and hillock tundra is found. Occasionally small lakes occur in the depressions but they are rare. On the eastern side of the sandstone outcrop, south of Schultz Lake, till is absent and frost shattering has littered the surface with sandstone slabs that are reminiscent of limestone terrain. Under such conditions the terrain becomes very dry during the summer and only rock lichens survive.

In the same area there is also conglomerate but it is not so abundant as the sandstone; as it is relatively resistant to erosion it forms hill ridges and is prominent in the landscape. At the northeast corner of Aberdeen Lake, a ridge formed in this way is washed directly by the lake and bluffs over 200 feet high have developed. Where the bases of scarps of this type are not subjected to water action, scree slopes form, as may be seen in a number of small valleys north of Aberdeen and Schultz Lakes. Farther north towards the Back River divide, low scarps rarely more than 50 feet high mark the presence of conglomerates outcropping through thick till. Where conglomerate is bare of till on horizontal surfaces, it has withstood weathering by frost shattering and the glaciated surface is still present.

The Palæozoic limestones and dolomites of the central Canadian Arctic are light yellow or buff in colour. The strata are horizontal or gently inclined. Minor differences in the resistance of the various beds to erosion produce low scarps, commonly 10 to 20 feet high, more rarely rising to 100 feet. The scarps originated before the last glaciation[1]. They were rejuvenated by wave action during the post-glacial marine submergence, since when many of them have been blanketed with scree. The scarps are clearly defined on the west side of Southampton Island where the coast rises in a series of steps to nearly 200 feet. Prominent limestone scarps near the coast elsewhere on Southampton Island (particularly on the east side of Bay of God's Mercy), on the north side of Coats Island and on the east

[1]Bird, J. B.: Southampton Island; Queen's Printe Ottawa, 1953, p. 47.

coast of Melville Peninsula separate marshy lagoon-covered coastal plains —rarely more than a few feet above sea-level—from the arid limestone uplands.

Figure 3. Upland surface on Coats Island. Bedrock controlled terrain with fault-line scarp, 35 feet high, in middle distance.

Under conditions of repeated freezing and thawing, limestone shatters readily to form flat plates about 12 inches in diameter. The zone of shattered rock may exceed 6 feet in thickness, and despite a complete absence of soil it may be impossible to find undisturbed rock outcrops. Immediately after the rock has shattered, the edges of the fragments are extremely sharp, although after a time they are dulled by solution and physical weathering, a process that is speeded up if snow banks in the vicinity remain late into summer. The production of fresh plates is, however, so rapid that when they stand on edge as a result of frost movement their sharp edges form a hazardous surface and will rip to pieces in a short time dog's pads, native boots, and even leather boots (Figure 4).

Unless the water-table is high, surface waters from melting snow and rain rapidly percolate through the zone of shattered rock. On the uplands, small lakes and patches of damp tundra that are common in the spring dry up and wilt by late summer. On a calm sunny day in summer, the dazzling, hot, broken rock and the absence of birds, animal life, green vegetation, and water combine to make the limestone uplands one of the least attractive parts of the Canadian Arctic. Under these circumstances the similarity with hot deserts may be carried even further, as there is often water below, a few feet underground, and it may be heard flowing below the shattered rock[1] although it is virtually impossible to reach it.

Closer to sea-level, where the drainage is not so complete, raised marine gravel bars hold back lagoons, and heath and marsh tundra are common. Near Cape Kendall and on the northwest coast of Coats Island,

[1] Although the absence of surface water and the presence of underground drainage is also typical of limestone areas in temperate latitudes, the causes are basically different and solution plays a role subsidiary to other processes under arctic conditions.

thin marine deposits cover the limestone and there are extensive areas of marsh and hillock tundra showing large polygonal forms and underlain by ice lenses.

In the limestone lowlands, the rivers flow in broad pre-Wisconsin valleys. Many of the rivers have distributaries and may be hundreds of yards across although only a foot or so deep; in contrast, the streams on the uplands flow in deep, vertical-sided gorges.

In most cases, unless the bedrock is buried beneath a deep overburden, it assumes a dominant role in the formation of terrain conditions. An exception is found in the remnants of upland erosion surfaces that are preserved in many parts of the region[1]. The rocks on which these plateaux are preserved differ widely in their characteristics, but in all cases the terrain is essentially the same. The undulating landscape of the uplands has a local relief of less than 200 feet. The surface is composed of deeply shattered rock showing a limited amount of sorting into polygonal forms. The unbroken bedrock is generally buried. At its fullest development there are neither streams nor lakes, a striking contrast to the normal arctic landscape. Vegetation is restricted almost entirely to rock lichens. The monotony of such a desert landscape is broken only by scattered semi-permanent snow banks and grey patches on rocks where snow banks that remained late into summer have recently disappeared.

Figure 4. Limestone gorge, Southampton Island. Lagoon coast in rear, beyond the edge of the upland.

Rock type only assumes so dominant a role in terrain constructions in areas where the continental ice has recently disappeared. In regions farther south that escaped glaciation the role of the rock type in terrain development is considerably less, and the role of relief and climate correspondingly

[1] Former erosion surfaces may be recognized at a number of different elevations throughout the region. The highest of these surfaces, at 900-1,600 feet in the Kirchoffer Upland of Southampton Island, 1,000-1,400 feet around Wager Bay, 800 feet on the south side of Aberdeen Lake, and 800 feet in Melville Peninsula, are the most conspicuous.

greater. Although the glaciation has for the most part enhanced the importance of the bedrock as a terrain factor, it has also obliterated it altogether in certain areas with glacial deposits.

The action of the continental ice-sheet on the landscape has been complex, and it has tended to modify the pre-existing landscape rather than create a new one. The over-all erosive effect of the ice-sheet was remarkably small. Occasionally, there are found isolated hills that have borne the full brunt of the moving ice and in consequence show smoothing on one side and roughening on the other. Walrus Island, which stands 500 feet above the floor of Fisher Strait, shows glacial smoothing on the south-west side. On a smaller scale, *roches moutonnées* are not common, but may be numerous in certain localities, such as north of Schultz Lake. Although the general erosive power of the ice has been slight, it has, in places, considerably modified the landscape. Ice erosion in areas of rectilinear weakness in the Precambrian rocks has already been discussed, but it is also important where two rocks of widely different properties are in contact. Some of the larger lakes, such as Baker Lake, were produced in part by differential glacial erosion.

The transport of rock material and the deposition of drift by the Pleistocene ice-sheets has often completely changed the terrain characteristics of an area. The changes have been brought about by the creation of overburden rather than by rocks of one type being moved to an area of other rocks. Examination of the contact between dissimilar rocks, such as the sandstone-granite contact along the middle Thelon, or the limestone-gneiss contact on Coats Island, suggests that the bulk of the rock fragments was only moved a few hundred yards or less by the ice.

Where the till is thin and the underlying relief is slight, no clear pattern emerges in the landscape, and (as around Angikuni Lake) the terrain is gently rolling with poor drainage and consequently considerable areas of marsh and hillock tundra. When the rock relief is a little greater rock knobs stick through the till, which is normally washed down into the lower areas. When till is thicker, the surface often shows a regular pattern that may be imperceptible on the ground but is clearly recognizable from the air. The pattern is formed by numbers of elongated till ridges that vary in shape from the long pencil-like forms found on the sand plains of the upper Thelon (Figure 6) to the more typical, cigar-shaped, drumlinoid landforms, generally about half a mile long and 20 to 50 feet high, found in vast numbers on the Thelon-Back River divide and on the plains north of Wager Bay. Well-developed high drumlins are rare, but may be found on the Arctic slope north of middle Back River and west of Rae Isthmus[1]. The long axes of the drumlinoids are parallel over short distances and are

[1] The widespread occurrence of drumlinoid landforms in Canada has only been recognized since the inauguration of a Canada-wide program of air photography in 1945. A general study of their distribution west of Hudson Bay has been made by Dean, W. G.: The Drumlinoid Landforms of the Barren Grounds, N.W.T.; The Canadian Geographer, No. 3, 1953, pp. 19-30. Drumlinoids are also known to be present in large numbers in Labrador-Ungava, in parts of the Arctic Archipelago (Jenness, J. L.: Problems of Glaciation in the Western Islands of Arctic Canada, Bull. Geol. Soc. Amer., vol. 63, 1952, pp. 939-952), and in northern British Columbia (Armstrong, J. W., and Tipper, H. W.: Glaciation in North Central British Columbia Amer. Jour. Sci., vol. 246, 1948, pp. 283-310).

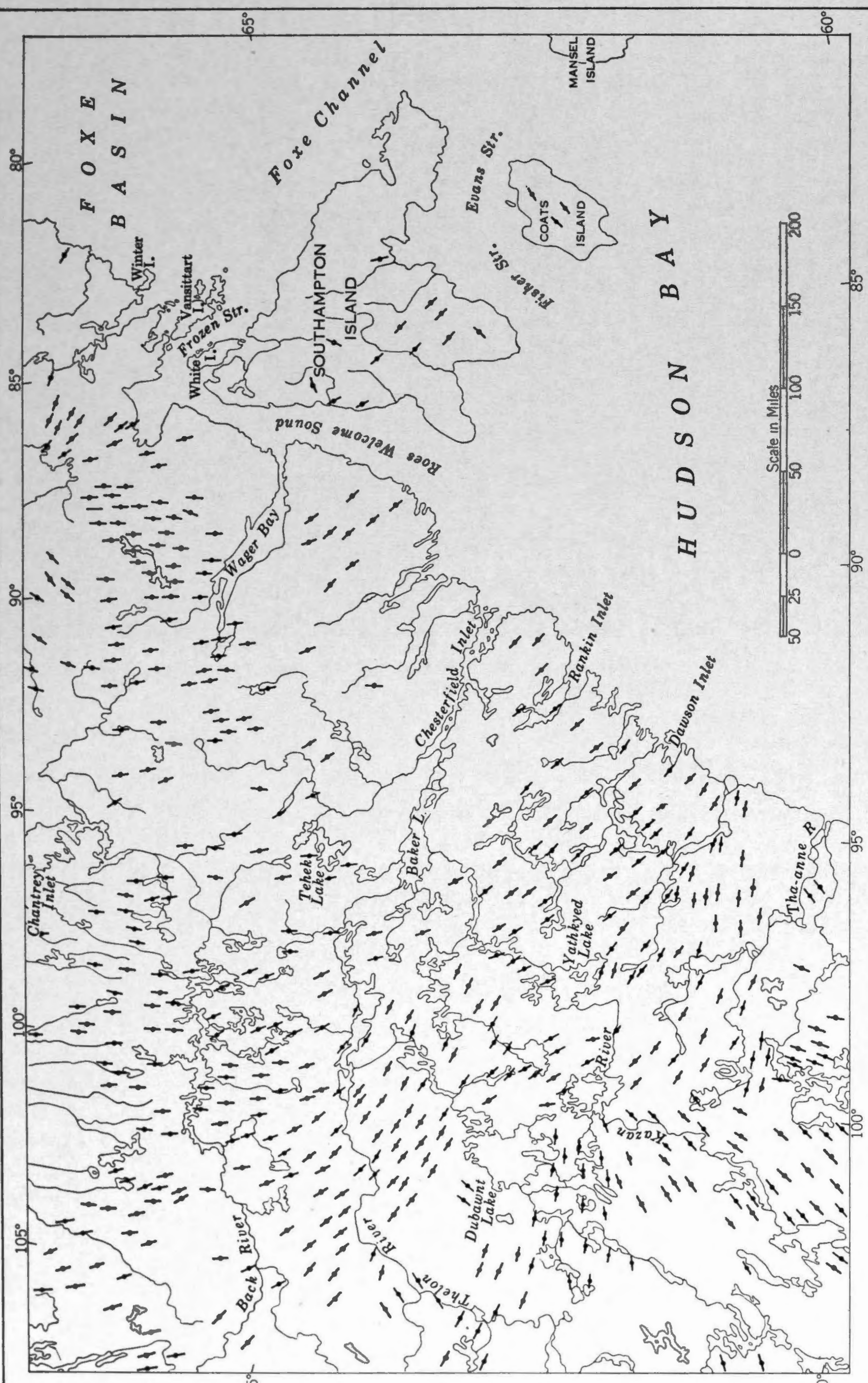

Figure 5. Distribution of drumlinoids in the central Canadian Arctic. The density of symbols corresponds with the frequency of drumlinoids on the ground.

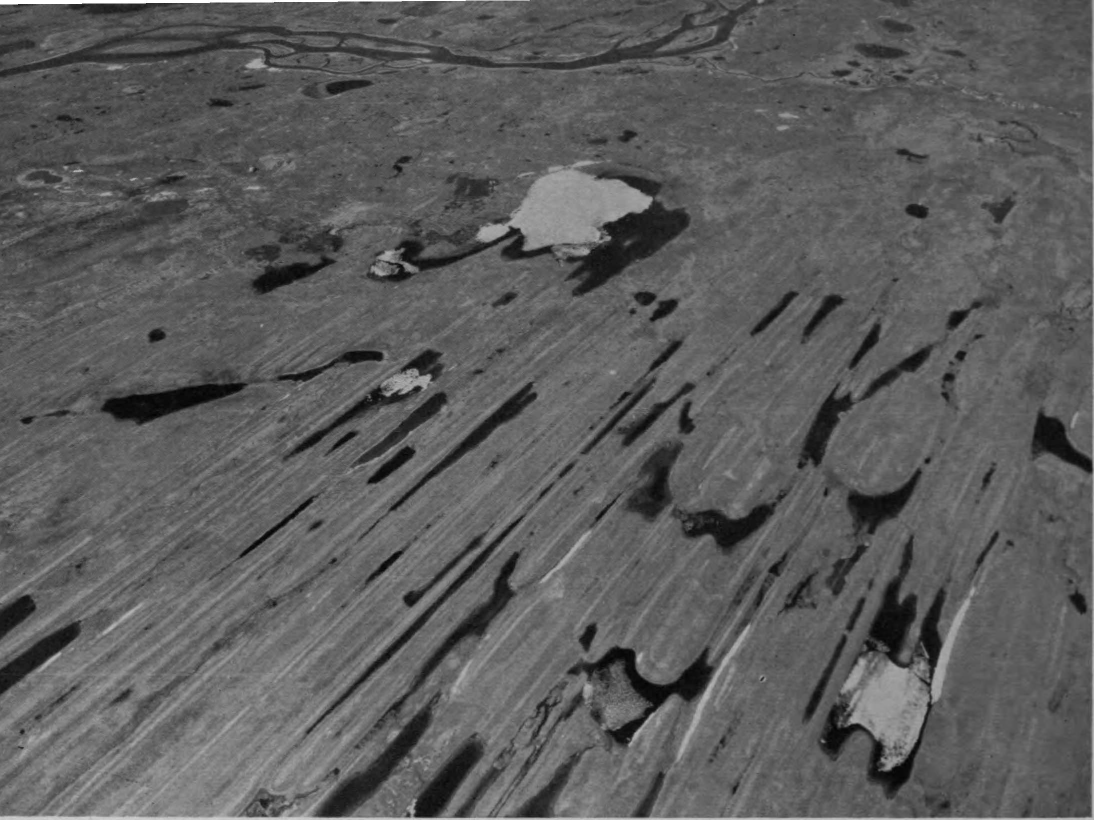

Figure 6. Sand plain of Upper Thelon River. Note the extreme development of drumlinoids in the foreground. (RCAF photo.)

Figure 7. Headwaters of Hayes River. Multiple eskers occupy much of the photograph. (RCAF photo.)

also parallel to the regional flow of the ice-sheet as deduced from striæ, grooves, and boulder movement. When the over-all relief is slight in an area of drumlinoids they exert a controlling influence on the landscape, giving the country a marked grain that dominates the stream and lake patterns. The orientation of drumlinoids in the central Canadian Arctic, as indicated by air photographs, is shown in Figure 5.

Morainic deposits are not as widespread as till. End moraines are not prominent features of the landscape, and although they have been reported from some areas[1,2] it has not proved possible to map them from air photographs. Terrain developed on ground moraine is, however, common west of Dubawnt Lake, on both sides of the Back River lakes, and north of Wager Bay. Ground moraine forms sandy areas in which the broken topography has a relief of less than 150 feet and where there are many small water-filled depressions. Occasionally low, parallel, sinuous ridges may be observed around the ground moraine areas, oriented at right angles to the direction of ice movement. A similar morainic pattern south of Duke of York Bay, Southampton Island, marks the southern edge of a former ice-lobe. In areas of ground moraine, terrain conditions are generally drier than elsewhere, the active layer in the permafrost is deeper[3], movement on foot in summer is easier, and the vegetation is sparser. In fact, where the quantities of sand become extreme, the plant cover is insufficient to fix the sand, and dunes result.

One of the most spectacular forms that glacial drift assumes is the esker. Two types are found in the region. The more prominent is the embankment esker, which consists of a single, sinuous ridge of sand and gravel, unbroken except where lakes and streams cut its path. It may reach 150 feet in height and be virtually continuous for as far as 125 miles. In the region under discussion embankment eskers reach their greatest development near Kaleet River. They are unrelated to the underlying topography and appear to have been let down onto the land from the ice. The second type is the multiple esker, formed from lower ridges of stratified material and rarely continuous for more than 3 miles, when the ridge merges into the general surface and another similar ridge rises a short distance away. The whole rather complicated pattern is enclosed between low parallel bluffs marking the edge of unchanged till on either side. Within the borders, in addition to the esker ridges, are quantities of sand, small kettle lakes, and depressions. The whole 'valley' is about half a mile wide and frequently occupies a former rock valley. Multiple eskers are numerous in the ground moraine areas south of Back River and in the Hayes River basin (Figure 7). Intermediate in type between embankment and multiple eskers are the short valley eskers found on the west coast of Hudson Bay. They are associated with local valley trains in which they often become lost.

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[1] Tyrrell, J. B.: Report on the Dubawnt, Kazan and Ferguson Rivers; Geol. Surv., Canada, Ann. Rept., 1896, p. 184f.

[2] Bird, J. B.: op. cit., p. 17.

[3] Measurements made on Tibielik River in 1948 showed that the active layer was from 5 to 8 times as deep in sandy ground moraine as in nearby till, and reached more than 10 feet in one observation.

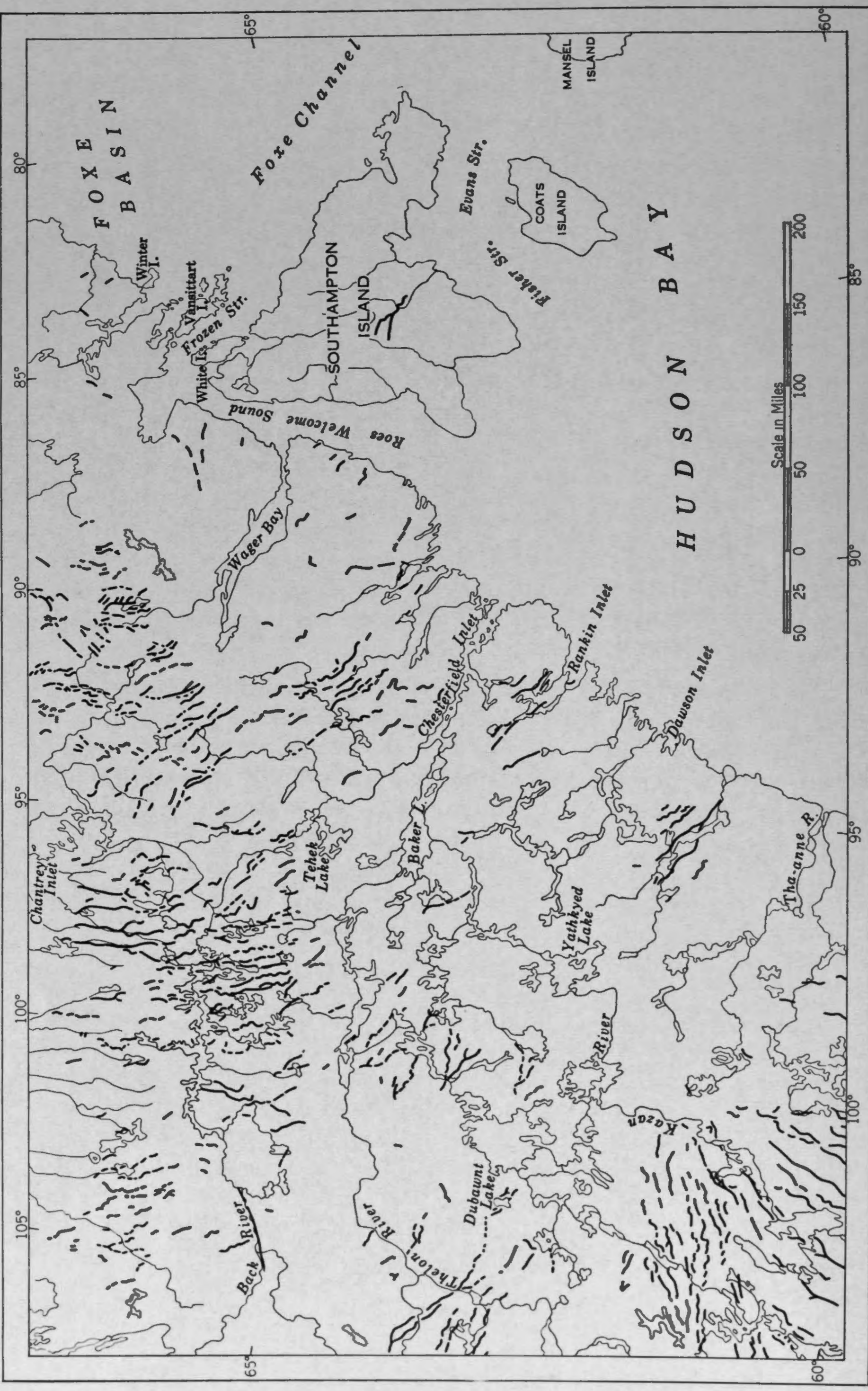

Figure 8. Distribution of eskers in the central Canadian Arctic.

Isolated small eskers are found in all parts of the central Canadian Arctic. The map of eskers (Figure 8) shows that there is a tendency for them to be found grouped in certain areas. The most conspicuous are those in the vicinity of the Back River-Arctic slope, Hayes River, and upper Dubawnt. The areas without eskers were either submerged by the post-glacial sea, have hilly terrain, or are underlain by limestone. There are even exceptions to these broad generalizations, as is shown by the group of eskers near the Thelon-Dubawnt confluence.

Where there are numerous eskers, particularly of the embankment variety, they provide natural routes across the country. During the summer, their shape and deep active layer combine to form dry, heath-covered paths across damper terrain. Although little used today, their vast potential as a source of sand and gravel for construction purposes may yet be utilized as mining development and communications move north into the area.

As an indirect result of glaciation, the seas transgressed coastal areas, reaching in some parts at least 600 feet higher than at present. In addition to post-glacial marine submergence, proglacial lakes were extensive, particularly in the Thelon-Dubawnt-Kazan basins[1]. The various water bodies were at specific heights for short periods only. Their erosive effect in consequence was slight and over wide areas was virtually non-existent. In limestone areas the sea rejuvenated former scarps and in sandstone and conglomerate areas the proglacial lakes have left low bluffs. Elsewhere the only erosive water action has been in tills and unconsolidated sands, where solifluction and slumping have subsequently masked signs of it.

Important changes in the terrain have resulted from the sea and lakes reworking earlier deposits. The finest materials formed in this way are bluish, *saxicava* clays that are found in the lower Thelon gorge, at the mouth of North Pole River on Rae Isthmus, and in a number of valleys on the east side of Southampton Island. When not covered by sands, the clays often contain ground ice. They support a damp, hillock tundra terrain. Marine and lake sands are more numerous, particularly in the sandstone region of central Keewatin, although they are also widespread wherever streams debouched into glacial lakes in the Proto-Hudson Bay, or the Proto-Arctic Ocean north of Back River, to form deltas.

The largest amount of material that has been re-sorted is ground moraine. This is evident in the limestone areas where the combination of vast quantities of limestone debris, together with very low relief and receding sea, has produced broad belts of raised, but progressively lower offshore bars. They form ridges of limestone fragments, a few feet high, often with complex recurved spits at their ends, and are separated by lakes (former lagoons) and marshy depressions. The ridges are dry and may be bare of plants or support poor heath tundra. On the lowlands of Coats

[1] Bird, J. B.: Postglacial Marine Submergence in Central Arctic Canada; Geol. Soc. Amer. Bull., vol. 65 1954, pp. 457-464.

Island, on Southampton Island, and on the east side of Melville Peninsula raised shorelines are ubiquitous. On the Precambrian rocks of the mainland, with considerably less available debris and steeper slopes, raised shorelines were not formed so easily, and over wide areas are rare. They are commonest on the west side of Roes Welcome Sound north of Wager Bay, and also south of Chesterfield Inlet, where many lakes have resulted from valley damming by shorelines.

Storm ridges are found below the upper marine limit on steep slopes, particularly when they have an open aspect. They are numerous on the western scarp of the Southampton Island upland, on the edges of the plateau of northeast Coats Island, around Wager Bay, and on the sides of hills in central Keewatin. Formed mainly from well-rounded pebbles and boulders, they are bare of vegetation except for rock lichens.

Since the region was deglaciated and the sea retreated, the normal processes of erosion have been modifying the terrain conditions. Frost shattering has been the most important of the weathering agencies, although with the exception of the limestone and some of the sandstone areas the amount has been slight. Akin to frost shattering is the lifting of stone blocks by water freezing in joints—a process that may be observed in lowland granite and gneiss areas[1]. Solifluction is the main medium of mass movement of waste. It reaches greatest proportions in areas of clay-rich till and where slopes are steep. Many solifluction stripes may be seen on the sides of many of the drumlinoids and a general smoothing of slopes is evident in all hilly areas.

[1] Yardley, D. H.: Frost Thrusting in the Northwest Territories; Jour. Geol., vol. 59, 1951, pp. 65-69.

Figure 9. Boulder pavement showing incipient rock polygons at Brown Lake west of Wager Bay.

On horizontal ground, sorting processes have produced rock, soil, and vegetation patterns that are often very striking, especially in air photographs. They assume special significance as they are indicators of the moisture content of the soil. The patterns take many forms, of which a regular polygonal shape is the most frequent[1]. These may be found in shattered rock (as on limestone lowlands or on upland surfaces), on marine alluvium, or in peat. Non-sorted irregular soil patterns are common in areas washed over by the post-glacial sea, where they form roughly circular water-logged mud patches. They are often found associated with fissures cut through raised beaches[2].

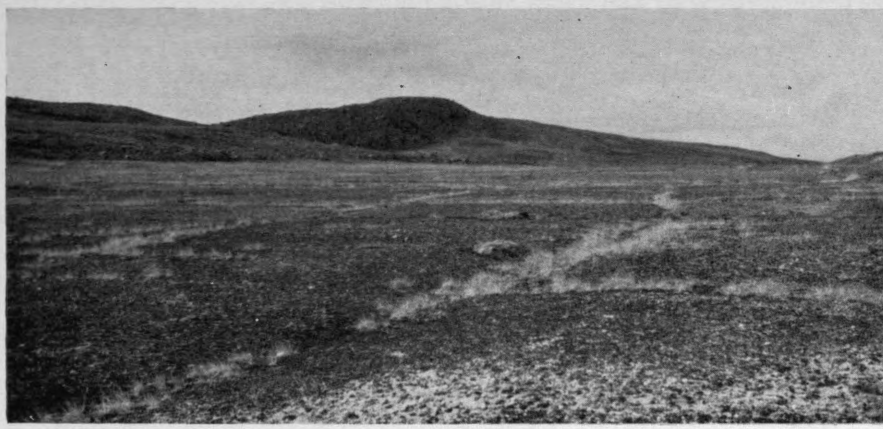

Figure 10. Fine gravel beach at 150 feet above sea-level near Wager Bay. Polygonal markings are shown by the vegetation pattern.

Although no quantitative measurements of the distribution of these various forms in the region have been made, it is clear that although they are common in the coastal areas they are not as numerous in the inland part of the Thelon and Back basins as in other arctic areas. This is partly due to the climate and partly to the sandy nature of the ground[3].

From this study of terrain conditions in the central Canadian Arctic it is evident that a general appreciation of terrain may be formed from a reconnaissance survey of the physiography and a knowledge of permafrost principles. On a larger scale, a close examination of air photographs enables detail of the terrain to be studied from the texture and pattern of the vegetation. Ultimately, however, actual examination of the terrain in the field is essential if the microterrain and microclimate, which are so important in the location of new settlements, are to be studied.

[1] Washburn, A. L.: Patterned Ground; Rev. Can. Geog., vol. 4, 1950, pp. 5-59.

[2] Mackay, J. Ross: Fissures and Mud Circles on Cornwallis Island, N.W.T.; The Canadian Geographer, No. 3, 1953, pp. 31-37.

[3] Bird, J. B.: The Physiography of the Middle and Lower Thelon Basin; Geog. Bull. No. 1, 1951, pp. 23, 25.

RÉSUMÉ

Quelques généralisations sur l'état du terrain dans l'Arctique central canadien sont présentées ici comme contributions à la connaissance générale de ce territoire, situé à l'ouest de la côte de la baie d'Hudson et au nord de la limite septentrionale de la forêt boréale, et incluant les bassins des rivières Back, Thelon, Dubawnt et Kazan, et les îles Southampton et Coats.

L'étude physiographique de la région s'est avérée la meilleure méthode pour déterminer l'état du terrain en général tandis que l'étude écologique est préférable dans l'examen détaillé.

Parmi ces généralisations mentionnons que le permafrost est présent à peu près partout, qu'une grande partie de la région appartient à la province géologique et physiographique dite du bouclier canadien, que les associations botaniques passent du désert de roches et de pierres à la toundra sèche des mousses et lichens ou à la toundra humide des herbes et laîches, que les effets de la glaciation sont complexes, modifiant le paysage au lieu d'en créer un nouveau, que les eskers sont nombreux, en particulier l'esker-remblai et l'esker-multiple, que les sols polygonaux et le phénomène de solifluction se retrouvent là comme dans d'autres régions de l'Arctique canadien, etc.

Une étude plus détaillée des photographies aériennes et, surtout, de nombreuses excursions sur le terrain sont indispensables à une connaissance plus approfondie de ce territoire.

PHYSICAL CHARACTERISTICS OF THE UNGAVA BAY AREA

R. H. Drinnan and L. Prior[1]

Interest in a little-known part of Canada has recently been aroused by the development of extensive deposits of iron-bearing rocks. That such rocks existed in the area south and west of Ungava Bay has been known since the turn of the century, when geological reconnaissance revealed their presence. The proving of large deposits of iron ore in the Knob Lake area to the south intensified mineral exploration in Labrador and New Quebec, the iron-bearing rocks in which they occur extending in a "trough" from the Knob Lake area northwards along the west coast of Ungava Bay. Concessions have been granted from the area that is presently being developed at Burnt Creek (Schefferville) as far north as Payne Bay, and exploratory geological work is continuing north of there.

The Knob Lake deposits are connected by rail with the port of Sept Iles on the St. Lawrence. Those in the vicinity of Ungava Bay, however, will probably have to depend on ocean shipping.

The purpose of this article, therefore, is to shed more light on the physical characteristics of a region that is likely to become the centre of new iron-ore developments, contingent upon the shipping and navigation conditions in Ungava Bay and Hudson Strait.

HISTORICAL BACKGROUND

Ungava Bay was probably discovered by Henry Hudson on his voyage in 1610-11[2], although George Weymouth may have entered the bay in 1602[3]. While searching for Hudson, Sir Thomas Button discovered and named Cape Hopes Advance. Jens Munk entered Ungava Bay in 1619. The bay was then little explored for 200 years, until interest was renewed by Kohlmeister and Kmoch's voyage from Okak to Ungava Bay in 1814[4]. These two missionaries explored and mapped the coast of the bay as far west as Koksoak River and included detail north of Hopes Advance Bay. They made a number of geological observations and located possible sites for posts on George and Koksoak Rivers. Their report, published in 1814, brought the resources of the Ungava Bay area to the attention of the Hudson's Bay Company, and led to the expedition of William Hendry, who in 1828 crossed the Ungava Peninsula from Moose Factory and descended Koksoak River, selecting a site at its mouth for a Hudson's Bay Company post. This post, Fort Chimo, was erected in 1830 and has operated continuously since then with the exception of the period from 1842 to 1866[5].

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[1] R. H. Drinnan, B.A., British Columbia, and L. Prior, B.A., McMaster, are geographers in the Geographical Branch, Dept. of Mines and Technical Surveys, Ottawa.

[2] Asher, G. M., ed.: Henry Hudson the Navigator; London, Hakluyt Soc., 1860, pp. 93-185.

[3] Purchas, S.: Purchas His Pilgrims; vol. XIV, Glasgow, MacLehose, 1906, pp. 306-318.

[4] Kohlmeister, B., and Kmoch, G.: Journal of a Voyage from Okkak on the Coast of Labrador to Ungava Bay; London, McDowall, 1814.

[5] Voorhis, Ernest: Historic Forts and Trading Posts; Dept. of the Interior, Ottawa, 1930, p. 52.

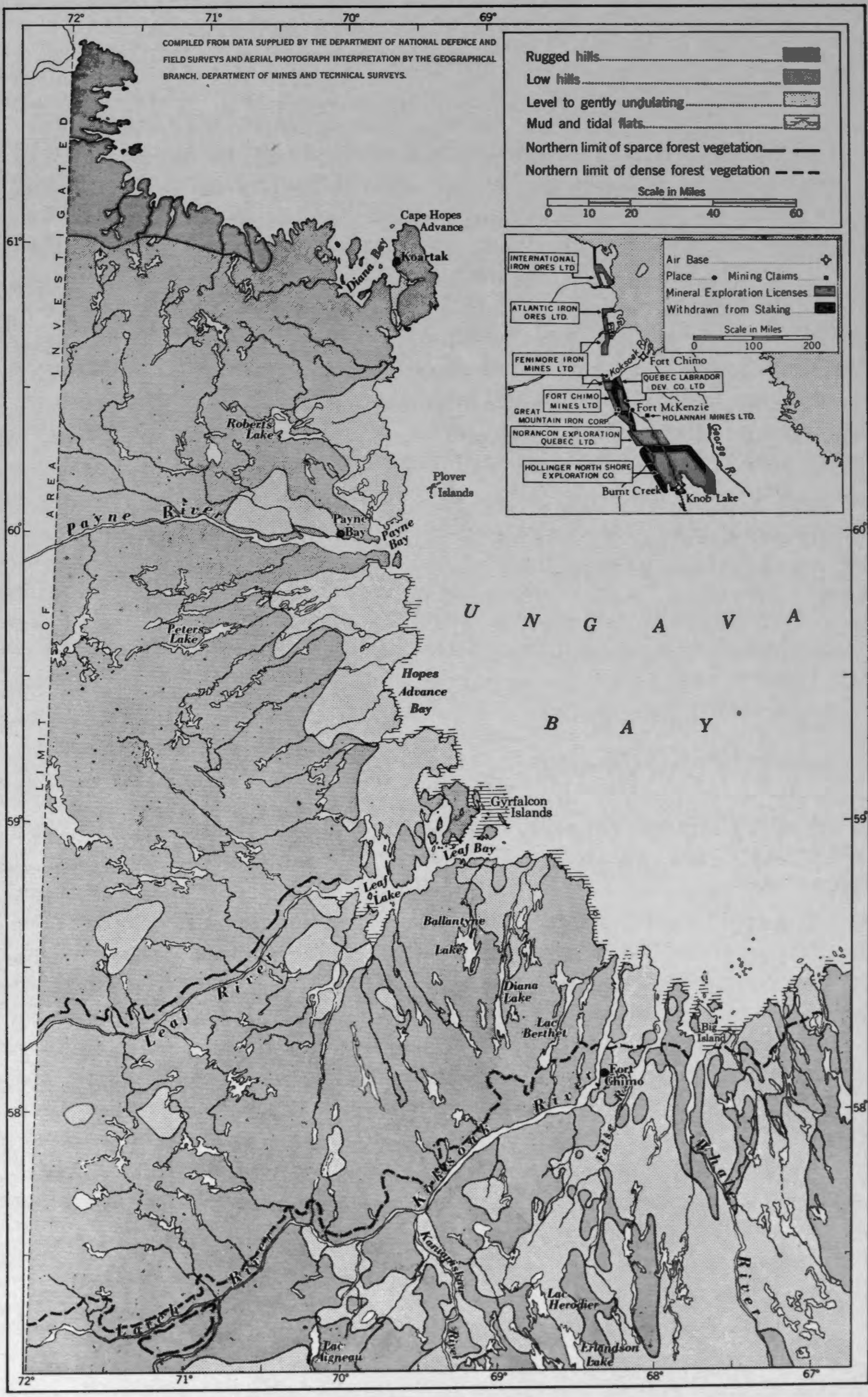

Figure 1. Relief and vegetation.
Inset: Mining properties, based on Quebec Dept. of Mines Geological Report 56, 1953.

At the turn of the century exploration in the area was begun by the Geological Survey of Canada. The traverses and reconnaissances of Low[1-3] down Leaf, Larch, and Kaniapiskau Rivers, and along the coasts of Hudson Strait and Ungava Bay, contributed much to the knowledge of the area. Flaherty[4] in 1912 traversed Leaf and Payne Rivers, and in 1948 an expedition under the leadership of Jacques Rousseau,[5-6] crossed the Ungava Peninsula via Kogaluk and Payne Rivers. The interior beyond the rivers was unknown until recently, when the aerial photography program of the Royal Canadian Air Force permitted the drawing of accurate maps, and the search for iron ore necessitated investigations inland away from the rivers, which had provided the easiest transportation routes.

STRUCTURE AND ROCK TYPE

The Ungava Bay area is a part of the Canadian Shield of Precambrian rocks (Figure 2). In Ungava, granites and gneisses of Early Precambrian or Archæan age are thought to predominate. Only jointing and faulting relieve the peneplaned surface, so that for the most part this structure gives rise to low hills, although along the Hudson Strait coast steep cliffs and entrenched rivers present more rugged relief (Figure 3).

In the area to the south and west of Ungava Bay, a north-south belt of rocks of Proterozoic (Late Precambrian) age lies at varying distances from the sea (Figure 2). These rocks consist of sediments and volcanics laid down in a geosyncline that lies unconformably on the Archæan rocks. This geosyncline has become known as the Labrador trough and extends in the area under study more or less continuously from southwest of Koksoak and Larch Rivers north to Diana Bay. The Proterozoic rocks include both a volcanic and a sedimentary group. The volcanic group lies in the more easterly position and is composed of chloritic lavas, schist, slate, and intermediate to basic intrusions. The sedimentaries consist of quartzite, sandstone, dolomitic limestone, chert, slate, iron formations, and conglomerate[7]. It is the iron formations of these rocks that are exciting interest today.

The Labrador trough is characterized throughout its length by a series of ridges and valleys parallel with the general trend (Figure 4).

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[1] Low, A. P.: Report on Explorations in the Labrador Peninsula, along the East Main, Koksoak, Hamilton, Manicuagan, and Portions of other Rivers, in 1892-93-94-95; Geol. Surv., Canada, Ann. Rept., vol. VIII, 1897, pt. L.

[2] Low, A. P.: Report on a Traverse of the Northern Part of Labrador Peninsula from Richmond Gulf to Ungava Bay; Geol. Surv., Canada, Ann. Rept., vol. IX, 1898, pt. L.

[3] Low, A. P.: Report on an Exploration of Part of the South Shore of Hudson Strait and of Ungava Bay; Geol. Surv., Canada, 1901.

[4] Flaherty, R. J.: Two Traverses across Ungava Peninsula, Labrador; Geographical Review, vol. VI August 1918, pp. 116-132.

[5] Rousseau, Jacques: A travers l'Ungava; Mémoires du Jardin Botanique de Montréal, No. 4, 1949.

[6] Gadbois, Pierre: A Traverse Across Ungava Peninsula along the Kogaluk and Payne Rivers; Dept. of Mines and Tech. Surv., Geog. Branch, 1948 (typescript, not published).

[7] Gilbert, J. E.: Northern Quebec, a New Mining Area; Quebec, Dept. of Mines, 1953.

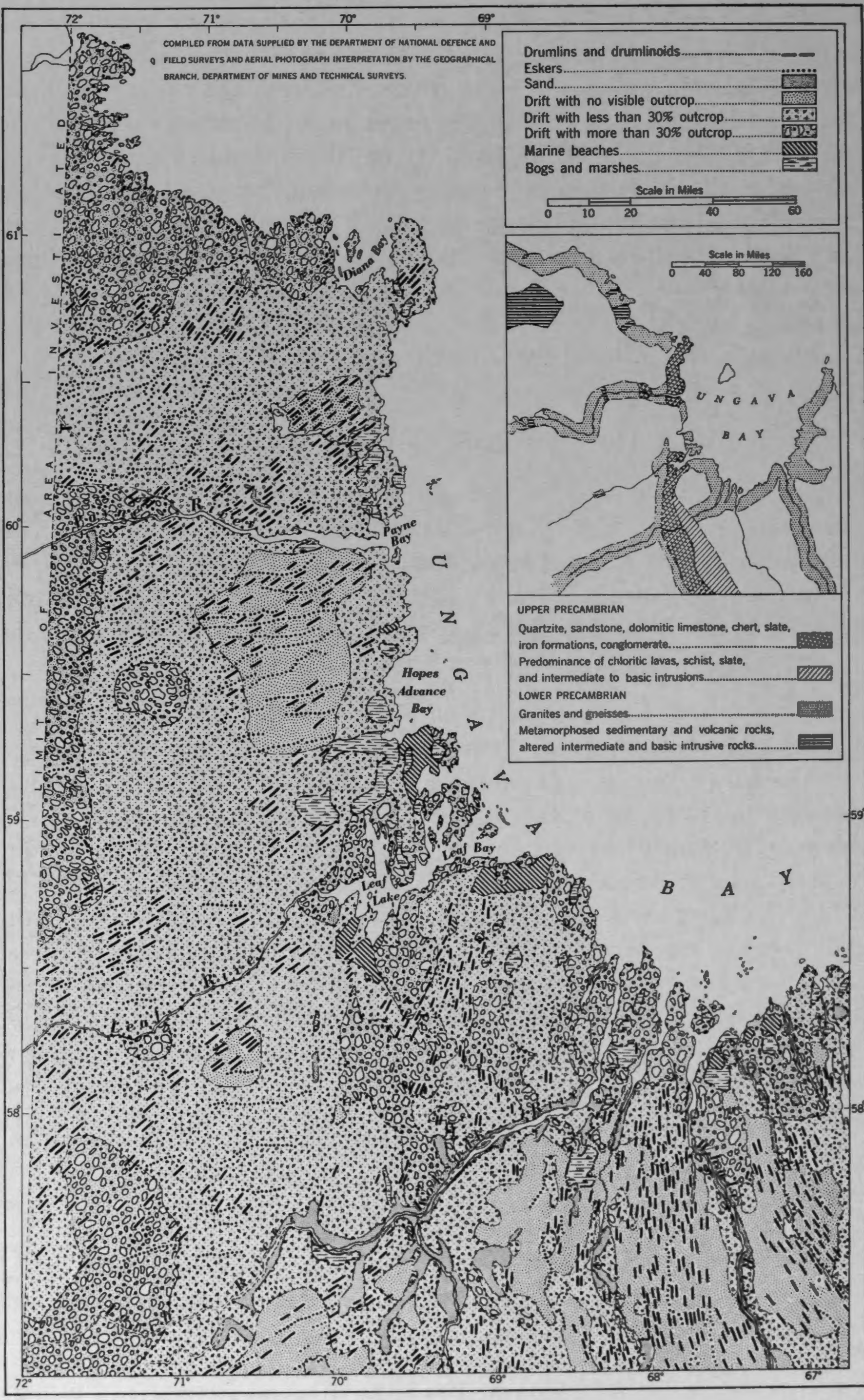
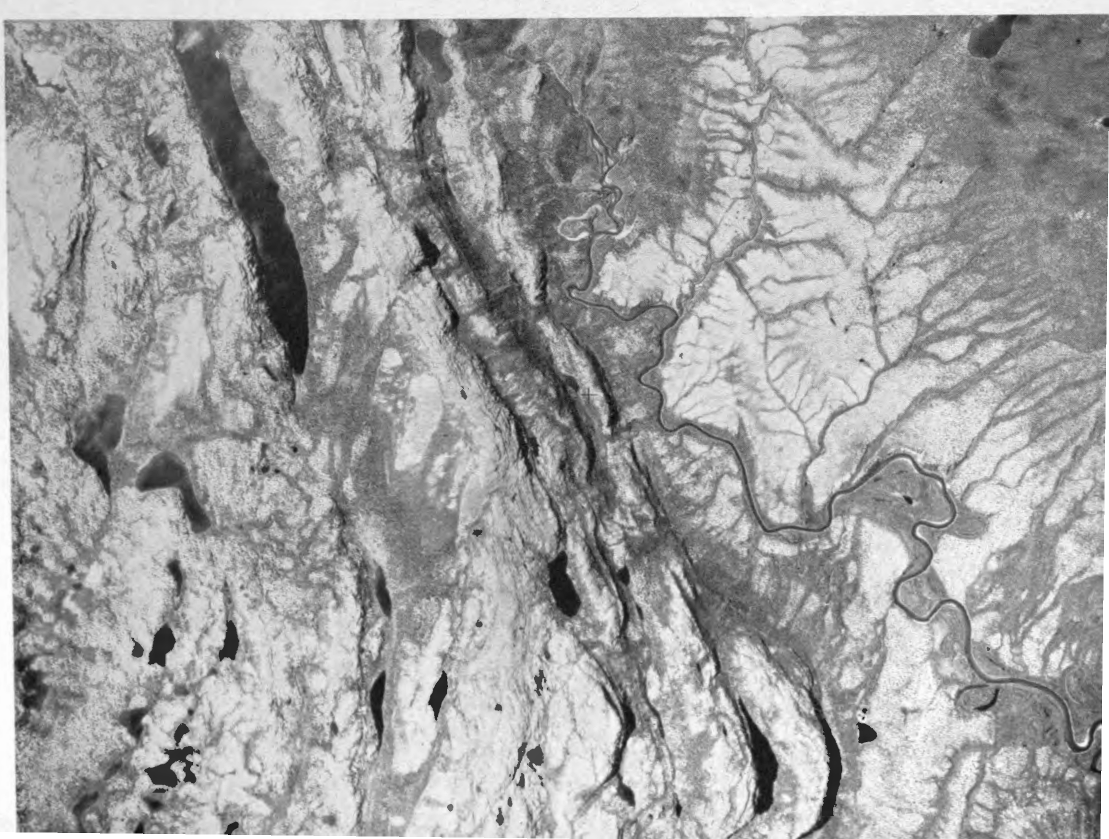


Figure 2. Surface conditions.
Inset: General geology, from Quebec Dept. of Mines Map No. 970.

Figure 3. View of the Hudson Strait coast west of Diana Bay. (RCAF photo.)

Figure 4. Great variability in relief, surface deposits and vegetation about 20 miles east of Kaniapiskau River. (RCAF photo.)



SURFACE DEPOSITS

The whole of the Ungava region has been strongly glaciated. Evidences of scouring and deposition by the Pleistocene continental glaciation are everywhere to be seen. Figure 2 shows the extent to which drift deposits have covered the pre-Pleistocene surface. In the areas of more than 30 per cent rock outcrop, the drift is confined to the valleys and

Figure 5. Rolling relief about a mile inland from Fort Chimo. Note scattered boulders with associated lichen vegetation and in the distance the light forest that characterizes the northern limit of trees.

hollows. In other areas, however, no outcrops are visible and a thick layer of drift masks the bedrock. These unconsolidated deposits consist of boulders, gravel, sand, and clay. Erratic boulders are scattered over much of the upland surface (Figure 5) and many of the boulders exposed on mud

Figure 6. Payne Bay post. Note the boulder-strewn mud-flats at low tide and the terrace on which the post is located.

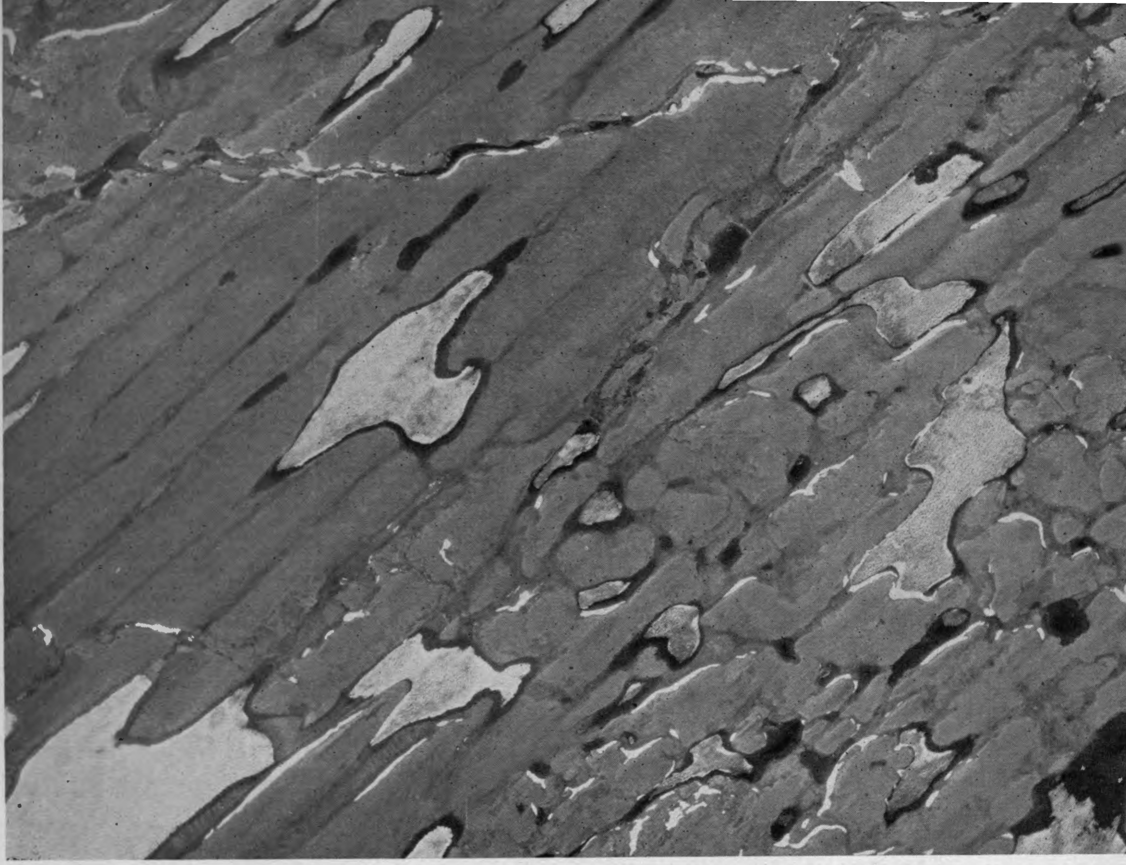


Figure 7. Drumlinoid topography south of Payne Bay. (RCAF photo.)

flats at low tide are also of glacial origin (Figure 6). Sand deposits are exposed along many of the rivers.

Numerous drumlins or drumlinoid structures are a characteristic feature of the drift-covered areas (Figure 7). They are described by Low[1] as "... steep irregular hills from fifty to one hundred and fifty feet high ... Their surfaces are largely covered with boulders and blocks, and they seem to be composed of decayed rock material only slightly displaced by the movements of ice". Eskers, many of which are over 20 miles in length, are a further indication of glacial activity. These gravel ridges are found throughout the area but are more numerous north of 59 degrees.

Permanently frozen ground probably underlies the whole of the area[2]. At Payne River the "active layer" was described by Gadbois[3] as being 16-20 inches in depth. This permanently frozen subsoil is an important factor controlling drainage, vegetation, and any construction work undertaken in the north. Water cannot percolate downwards in the soil and run-off is restricted to the shallow surface layer. Thus, poorly drained sections are to be found where the topography is level, whereas on sloping land solifluction is likely to be present. Solifluction also produces parallel

[1] Extracts from reports on the District of Ungava; Quebec, Dept. of Highways and Mines, 1929, p. 155.
[2] Jenness, J. L.: Permafrost in Canada; Arctic, vol. 2, 1949.
[3] Gadbois: op. cit., p. 11.

banding of marshes. This rippled effect, shown so clearly on air photographs, is brought about by the growth of bushes and other small shrubs on top of the ridges[1].

TOPOGRAPHY

The basis for the topography of the area is the peneplaned Precambrian surface. In places this may appear as a featureless plain, elsewhere, under the influences of faulting, jointing, glaciation, or river erosion, the terrain may consist of low or even rugged hills. The surface topography has also been altered by deposits of drift to produce a hummocky terrain. Generally, however, this area is one of low relative relief.

Rugged Hills. The most rugged section within the area is along the Hudson Strait coast (Figures 1 and 2). Here the coast is formed of steep cliffs, and headlands rise up to 1,000 feet[2] between deep bays. Terraced drift is found in coves, at the head of bays, and in valleys. Elsewhere bare rock is exposed. The rivers draining the upland surface have cut down sharply to attain sea-level, giving the topography a rugged appearance. Lakes occupy depressions and cover a large percentage of the surface.

Low Hills. The rugged hills terminate a short distance inland and are replaced by a complex of low hills of drift and rock. The surface is dotted with lakes connected by short rivers, the lack of relief and glacial deposits having disrupted any pre-existing competent drainage. The only large river on the west coast is the Payne, whereas on the southwest coast there are several—the Leaf, Koksoak, Larch, Kaniapiskau, and Whale.

The information in Figure 1 was compiled from a rapid survey of air photographs, and additional information has been obtained from a study of reports of traverses through the area. Unfortunately, these have been restricted to the main rivers and the coast, and nothing is available for the main body of the area lying away from these large rivers. The rivers are, in the main, entrenched well below the general level, so that travellers have described hills of 600 feet near the mouth of the Payne[3]; 800-1,000 feet on the upper Larch; 500-800 feet on the upper Koksoak; and 200-400 feet on the lower Koksoak. Folding and faulting have produced sharp ridges that appear in the form of rock hills (Figure 4).

Large drumlin fields are a characteristic feature of the landscape, especially to the east and west of Whale River and north and south of Payne River (Figure 7). The topography of a drumlin area varies from gently undulating where the drift is merely fluted, to hilly in places where the drumlins are over 100 feet in height. Lakes and poorly drained depressions separate the hills.

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[1] Rousseau: op. cit., p. 123.
[2] Low: op. cit., 1901, p. 171.
[3] Gadbois: op. cit., p. 29.

Long esker ridges wind their way across the surface throughout much of the area. They are most often found in conjunction with drumlins and in areas where a moderate amount of drift is present. There are several eskers within the areas of more than 30 per cent rock outcrop.

Beach lines and terraces, which are to be found along the coast and rivers, can also be attributed to the influence of Pleistocene glaciation. Since the Pleistocene, the glaciated areas of North America have been slowly rising. The extent of this rise is indicated in the Ungava area by the elevation of the terraces and beach lines that fringe the coast. The height of these terraces along streams indicates that a continual rejuvenation of the rivers has taken place (Figures 6 and 8). Gadbois[1] has noted marine terraces up to 200 feet on the banks of Payne River, and Low mentions terraces on Larch and Kaniapiskau Rivers from 30 to 250 feet in height.

Figure 8. Hudson's Bay Company post at Fort Chimo located on terrace above Koksoak River. Photo taken at low tide.

Level to Gently Undulating. The topography is level to gently undulating along the central west coast of Ungava Bay and in places throughout the southwestern part of the area studied. These areas having low relative relief are generally attributable to the concealing of the uneven rock surface by glacial or post-glacial unconsolidated materials such as drift, sand, gravel, or clay. Thus, many of the areas of drift that appear on Figure 2 are shown on Figure 1 as being level to gently undulating. Level deposits of unconsolidated material such as clay or sand are found along the rivers, indicating former river or lake expansions or deltaic deposits (Figures 4 and 9). It is on such a site that the airfield at Fort Chimo is located.

[1] Gadbois: op. cit., p. 29.

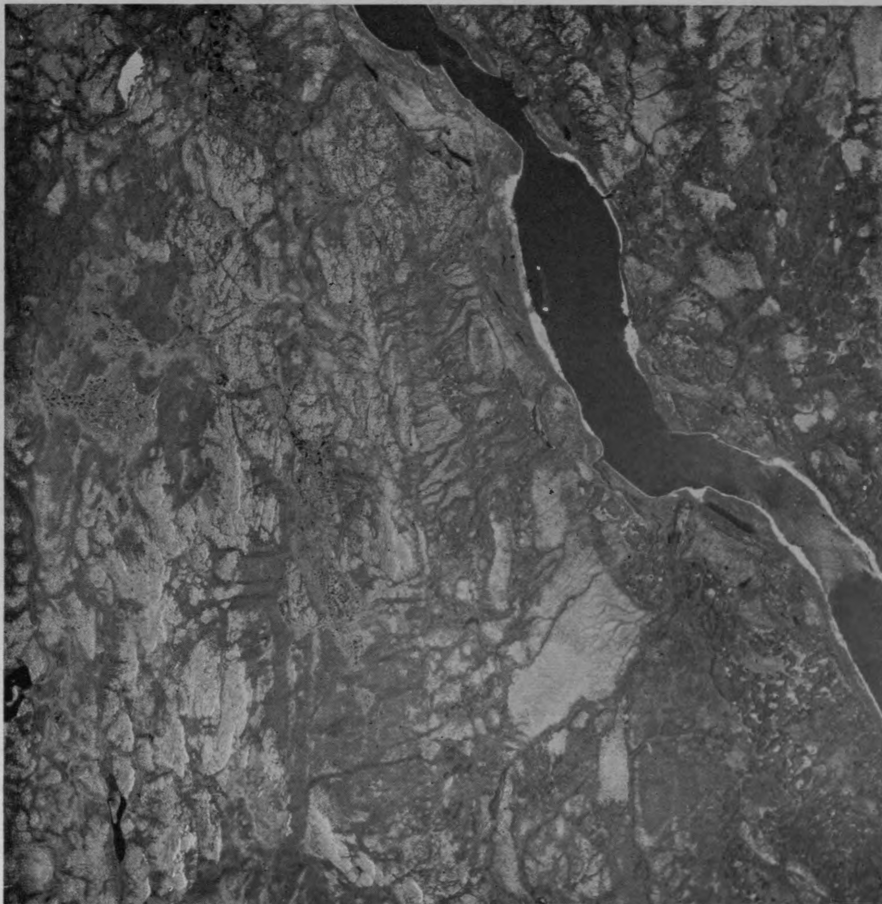

Figure 9. Mixed vegetation and surface deposits along the lower Whale River. (RCAF photo.)

COASTAL TOPOGRAPHY AND HYDROGRAPHY

Generally speaking, the coastal topography is low. The exception is the Hudson Strait coast west of Diana Bay (Figure 3) where steep cliffs and long fiords and bays are to be found, and where deep water lies offshore. Moderately high tides occur there. The mean high water at Wakeham Bay is 27½ to 30 feet at springs and 20 feet at neaps; and mean low water for the same periods is 0 to 3½ feet and 15·3 feet[1].

Cape Hopes Advance is situated on a rocky peninsula; the cape is 300 feet high and rises boldly from the sea. The meteorological station is situated on the windswept top of a hill, with higher land to the south and west.

[1] Canada, Dept. of Mines and Tech. Surv., Can. Hydrographic Serv., Chart 5452—Diana Bay, Ottawa 1953.

The west coast of Ungava Bay is generally low, although even the areas shown as level may be broken by occasional hills up to 200 feet in height. Many islands fringe the shore and the tidal range is high. At low tide extensive mud-flats strewn with boulders are exposed for some distance from the shore. Navigation is hazardous because of the treacherous coast and the great tidal ranges. At Leaf Bay the tidal currents are particularly strong, the range at Leaf Lake being estimated as 54 feet at springs and 40 feet at neaps. The Canadian Hydrographic Service Chart of Leaf Bay (1953) cautions navigators against the dangerous currents and eddies that occur in the channel between Leaf Bay and Leaf Lake. The velocity of these currents has been estimated at between 10 and 12 knots at certain stages of the tides[1].

Figuer 10. Diana Bay. Note boulder-strewn flats in foreground and high hills in distance.

Boulder-strewn mud-flats fringe the southern coast, and high tidal ranges occur, although they are not as extreme as at Leaf Bay; the high water at springs at the mouth of the Koksoak is 37 to 45 feet and at neaps 32 feet. The low water at springs is 0 to 8 feet[2]. In the estuaries of Koksoak, False, and Whale Rivers, offshore reefs provide a further hazard to navigation along the coast (Figure 8).

CLIMATE AND VEGETATION

The area to the south and west of Ungava Bay belongs to a transitional zone between the sub-arctic and arctic climates. The tree-line that marks the boundary between the arctic and sub-arctic is shown on Figure 1. There is a close link between climate and vegetation, a mean July temperature of at least 50 degrees being necessary for tree growth.

[1] Canada, Dept. of Mines and Tech. Surv., Can. Hydrographic Serv., Chart 5457—Leaf Bay and Approaches, Ottawa, 1953.

[2] Canada, Dept. of Mines and Tech. Surv., Can. Hydrographic Serv., Chart 5462—Koksoak River Mouth, Ottawa, 1952.

Cape Hopes Advance, the only station in the area from which climatic records are available[1], is situated in an exposed position at the northwest extremity of Ungava Bay. In order to obtain a picture of the change in climate that occurs with increased distance southward, the statistics for Fort McKenzie situated at 56°50′ N., 68°58′ W. have also been used.

Generally speaking, in both the arctic and sub-arctic, winters are long and cold and summers are short and cool. Cape Hopes Advance has 4 months with mean temperatures below 0° F., and only 2 months in which averages are above freezing. Fort McKenzie has similar winters but has 3 months in summer in which the mean temperature is above 32° F. Away from Hudson Strait and Ungava Bay the climate is more continental, the

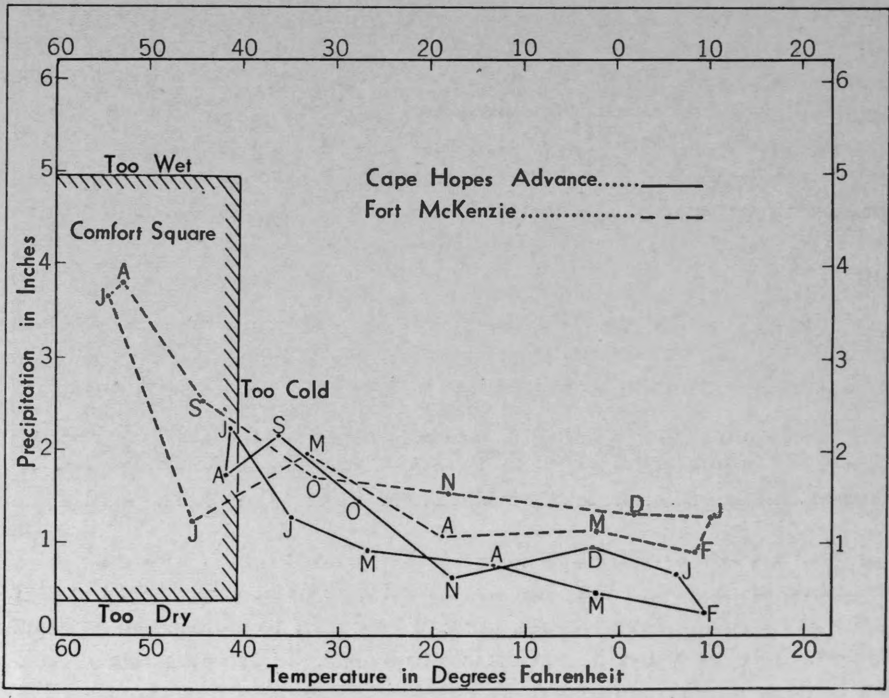

Figure 11. Climographs for Cape Hopes Advance and Fort McKenzie. (Comfort square after Griffith Taylor.)

mean annual range at Fort McKenzie being 66 degrees compared with 50 degrees at Cape Hopes Advance. Some maritime influence is evident at Cape Hopes Advance in the delay of the coldest month to February and the warmest month to August. The ameliorating influence of the sea causes the coastal stations to be several degrees warmer in December and January than inland stations. In summer, on the other hand, the average temperatures are lower close to the sea and considerably higher inland. Although summers in the sub-arctic are generally cool, an influx of warm air from

[1] Canada Dept. of Transport Meteorological Div., Climatic Summaries, Toronto, 1948, vols. I and II.

the south can cause a sudden rise in temperature. Thus, Fort McKenzie has an average July extreme maximum of 86 degrees and an average annual extreme of 87 degrees. It is interesting to note that the same extreme temperatures are experienced at Truro, N.S., although the latter has a much higher July mean temperature, and thus a much warmer summer. In the sub-arctic, on the other hand, occasional invasions of cold arctic air bring temperatures below freezing even during July. Spring and autumn are short seasons in which there is a quick changeover from the short days of winter to the long days of summer. The greatly increased insolation in early summer soon melts the snow and ice that have accumulated throughout the long winter.

Precipitation totals are low in both the arctic and sub-arctic. Somewhat higher totals are experienced with increased distance southwards, because there is a greater likelihood of cyclonic storms passing near enough to cause frontal precipitation. Thus, Fort McKenzie has 22·04 inches of precipitation a year and Cape Hopes Advance has 13·07 inches. The maximum fall comes as rain in the 4 summer months from June to September. At this time the paths of cyclonic disturbances have shifted northward, a deep low-pressure area covers continental North America, and the sub-arctic high-pressure area has moved north and covers the Arctic islands.

In winter the precipitation comes entirely in the form of snow. Totals are low but the snow remains on the ground throughout the winter, drifting in the lee of buildings and lying in hollows and other sheltered spots.

Throughout the year northwesterly winds prevail at Cape Hopes Advance. Only in July are these winds, blowing from the high-pressure centre, replaced in importance by southeast winds. The latter are strengthened at this time by the increased influence of cyclonic storms. The southeast-northwest orientation of the wind may also be due to the trend of Hudson Strait. Average wind speeds vary throughout the year from 3 to 8 miles an hour exclusive of direction. Few calm days are experienced each year, probably owing to the exposed position of the station.

Fogs are common in summer and early autumn, when air that has been heated over the land blows over the cold water of Ungava Bay and Hudson Strait. Dense fog combined with bad ice conditions can be a serious navigation hazard.

The climographs for Cape Hopes Advance and Fort McKenzie show that these stations enjoy a comfortable climate in the summer months only, and that low temperatures are the rule throughout the rest of the year.

The vegetation is in transition between the taiga and the tundra. The tree-line separates the taiga (or Northern Boreal Forest) from the tundra. On Figure 1 two lines have been shown, a line of denser forest vegetation following Larch and Koksoak Rivers, and a northern limit of

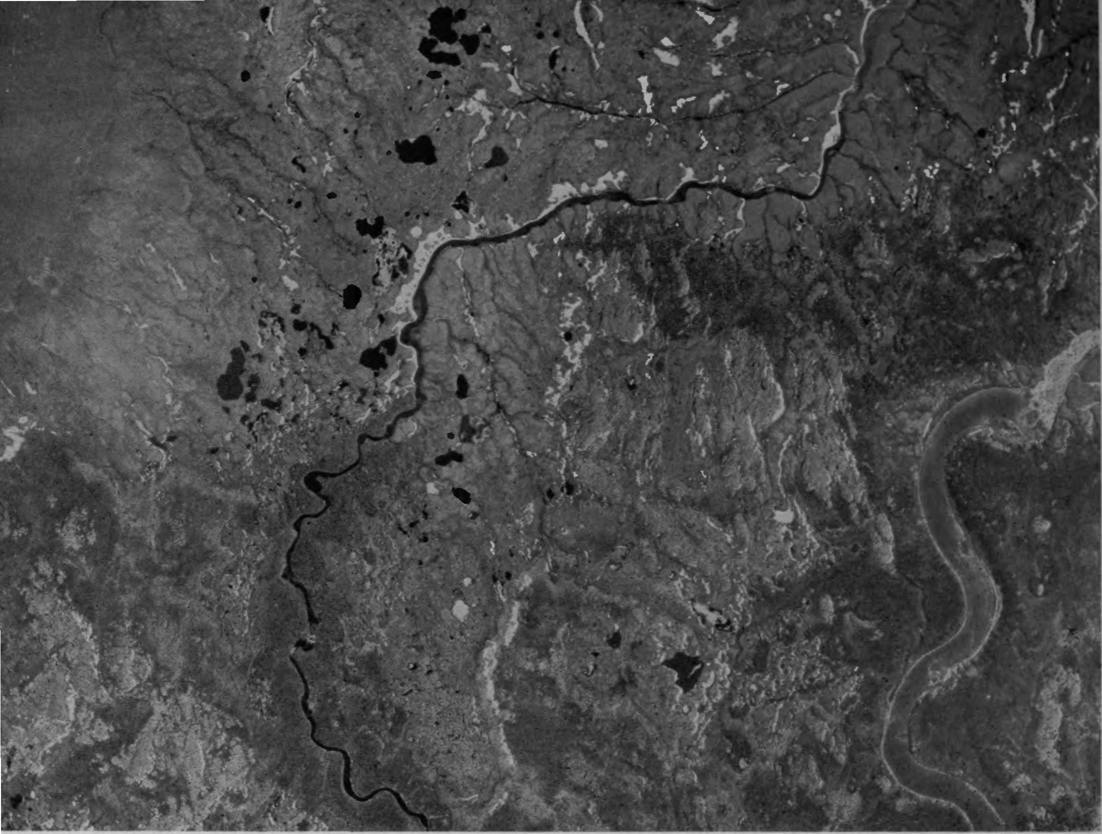

Figure 12. Mud-flats to east of the mouth of Whale River. At northern limit of denser forest vegetation the trees follow the banks of the river. (RCAF photo.)

sparse forest vegetation following Leaf River. These lines, which were drawn after scanning air photographs, agree well with the northern boundary of the taiga shown by Hustich[1]: he states that the more southerly of these two lines marks the northern limit of white spruce, the other the northern limit of black spruce and larch. Balsam fir is found along the Kaniapiskau and on Larch and Koksoak Rivers for some miles above and below the junction of the Kaniapiskau. White birch is found down Kaniapiskau and Koksoak Rivers to the limit of dense forest. Balsam poplar occurs in the same general area as the balsam fir. Thus the area of sparse vegetation is associated with black spruce and larch, and the denser vegetation to the south is due to the addition of white spruce and deciduous trees—balsam poplar and white birch.

The forest is not continuous, however, even south of the tree-line Climate is not the only factor limiting the growth of trees, as varying drainage and surface conditions also determine the type of vegetation cover. The trees are found in patches and along the banks of rivers (Figure 12). In dry areas the conifer-lichen forest *(Picea mariana-Cladonia)* occurs. A few thinly scattered and stunted trees are separated by open areas of lichens, shrubs, and mosses. In the wetter areas black spruce and sphagnum form the characteristic vegetation. The rich coniferous forest of

[1] Hustich, Ilmari: On the Forest Geography of the Labrador Peninsula. A preliminary synthesis; Acta Geographica, vol. 10, pp. 1-63 (1949).

Hustich is rare so close to the tree-line, but the section along the lower Kaniapiskau and Koksoak may be included because of the balsam fir and white spruce that occur there.

Both north and south of the tree-line there are large areas of bog caused by poor surface drainage. Sedges and rushes are to be found growing in these very wet sections.

Vegetation in the tundra consists entirely of mosses, lichens, and shrubs. Where snow cover affords protection the vegetation is abundant, but where the wind is strong the plants are stunted and the growth is weak. As in the taiga, the bogs are characterized by spongy mosses saturated with water and the dry places are marked by the growth of lichens both on soil and rocks. In locations that are both well-drained and sheltered from the wind is found the so-called arctic prairie[1], in which thrives a herbaceous vegetation of biennial plants, grass, and shrubs more than 2 feet in height. During the summer these prairies form oases where abound numerous flowers.

HUMAN OCCUPANCY

There are few permanent settlements in the area. Trading posts are in operation today at Fort Chimo and Payne River, but the many outposts that were opened around Ungava Bay in the nineteenth and early twentieth centuries have been closed, i.e., Port Burwell (1941), George River (1952), Whale River (1940), False River (ca. 1900), Fort McKenzie (1948), Leaf River (1940), Diana Bay (ca. 1940), Wakeham Bay (1940)[2]. Two of the settlements also house missions, Koartak having a Roman Catholic, and Fort Chimo both Roman Catholic and Anglican Missions. Fort Chimo was the site of a United States operated air base during World War II, but about 1951 it was abandoned by the United States and is now under the Canadian Department of Transport. It is not maintained, however, and, therefore, has limited usefulness. Koartak, Cape Hopes Advance, Fort Chimo, and Payne River have radio communication, and Fort Chimo and Cape Hopes Advance also report meteorological data. Cape Hopes Advance plays a particularly important role in the recording of ice information during the summer months.

Access to these settlements is from the sea, supplies being shipped from southeastern Canada via Hudson Strait and Ungava Bay. The chief difficulty in reaching these stations is the short season during which the sea routes are sufficiently free of ice to make navigation by ordinary vessels feasible. Thus, all these settlements, and any new ones that may develop, are dependent for their survival on the ice conditions in both Hudson Strait and Ungava Bay.

[1] Villeneuve, G. O.: Aperçu climatique du Québec; Québec, Ministère des Terres et Forêts, 1948.
[2] Dunbar, M. J.: The Ungava Bay Problem, Arctic, vol. 5. No. 1, March 1952 p. 7.

ICE CONDITIONS

Navigation of the Hudson Bay route between the Atlantic and Churchill for over 2½ centuries has resulted in many casual observations on ice conditions in these waters. It is only during the past 25 years, however, that regularly recording stations have been in operation. As there are only two such stations, one on Resolution Island and one at Cape Hopes Advance, any picture of ice conditions they provide is necessarily incomplete. The Hudson's Bay Company trading posts around Ungava Bay have been a further source of ice information. Voyages by government ice-breakers and research vessels in recent years, and flights by the Royal Canadian Air Force since World War II, have made this area better known. Reports from all these sources indicate that ice conditions in Hudson Strait and Ungava Bay are quite variable from year to year.

Hudson Strait. It is generally agreed that the strait seldom, if ever, freezes over completely, because of strong currents and high tides. In the winter months the ice cover consists of landfast ice fringing the shores, and great fields of constantly shifting pack ice in the strait itself. Ice is derived from two outside sources, in addition to that which is formed locally. Baffin Bay ice enters the strait from the east and ice from Foxe Basin enters from the west.

Baffin Bay ice enters Hudson Strait from the east and moves westward with a branch of the Labrador current that passes on either side of Resolution Island. Passing along the north side of the strait, this flow weakens in the vicinity of Big Island, and drifts southward to join the general eastward movement back to the Atlantic[1]. Heavy floes, bergs, and growlers make up this stream of ice. It is part of the pack that is carried along the coasts of Baffin Island and Labrador by the Labrador current.

Foxe Basin ice is usually in the form of floes, which are frequently dirty in appearance. These move down through Foxe Basin with the general eastward current flow that passes along the south side of Hudson Strait to the Atlantic. Some of the heavier floes originate in the Gulf of Boothia, entering Foxe Basin through Fury and Hecla Strait[2]. These are generally less discoloured than the locally formed Foxe Basin ice.

In the central part of the strait, ice from Baffin Bay and Foxe Basin mingles and is carried back and forth during the winter by strong tidal currents. Although the pack fills the strait, large leads frequently appear. Generally, in November, landfast ice begins to form in the bays and inlets, and along the shores of the strait, and slob ice forms locally in patches. Unnavigable pack ice fills the strait and persists until the following summer. There is a tendency for the heaviest conditions to occur in March, but all through the winter a belt of less compact ice may occur through the centre of the strait. Towards the end of November, Baffin Bay pack ice moves

[1] Arctic Pilot, 1947; Hydrographic Dept., Admiralty, London, p. 53.
[2] Ibid., p. 53.

down in a wide band across the entrance to Hudson Strait, sealing it off from the Atlantic. Throughout the winter the width of this band gradually increases, reaching its greatest extent in late March or April. By July the Baffin Bay pack has receded sufficiently far northward to again open the entrance to the strait, and navigation begins in the second half of that month.

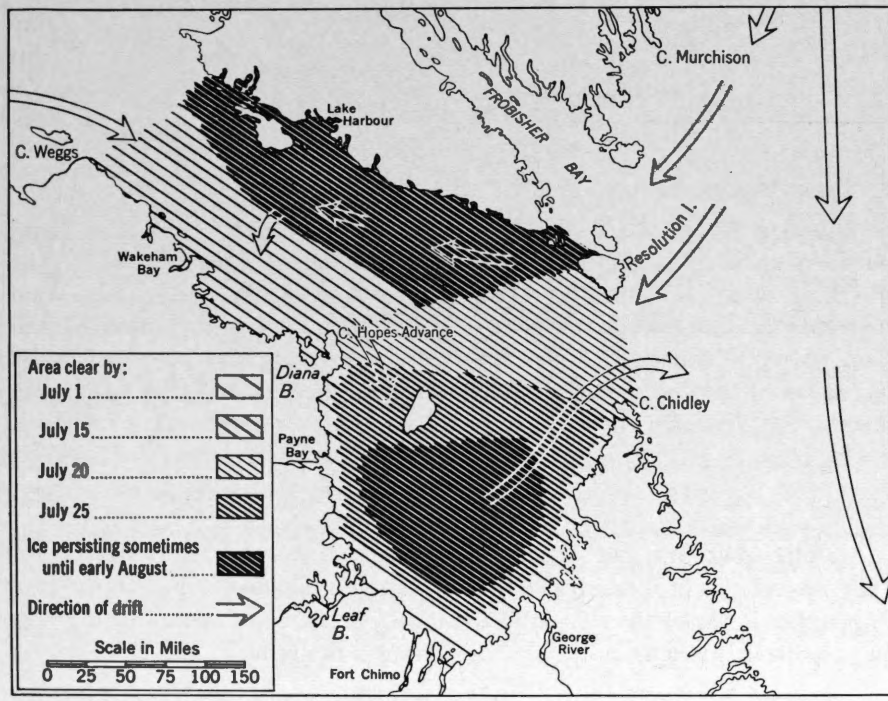

Figure 13. Break-up of ice in Hudson Strait and Ungava Bay.

Break-up of the ice in Hudson Strait begins in early summer. Clearing begins in the bays and at the mouths of rivers, and by mid-July in many areas a strip of open water lies along the coast. Clearing of the pack ice generally occurs from west to east along the south side of the strait. By July 20 sufficient clearing has usually occurred to permit navigation, but the north side of the strait and the centre of Ungava Bay remain ice-bound for some time longer. After the field ice has disappeared, icebergs and growlers remain in the strait. These are mainly from the Baffin Bay pack, as only a few small bergs are formed from the glaciers of Baffin Island. Bergs and growlers may be present all through the summer season, frequently appearing in greatest number in late August and September. The area of greatest concentration appears to be just to the west of Resolution Island.

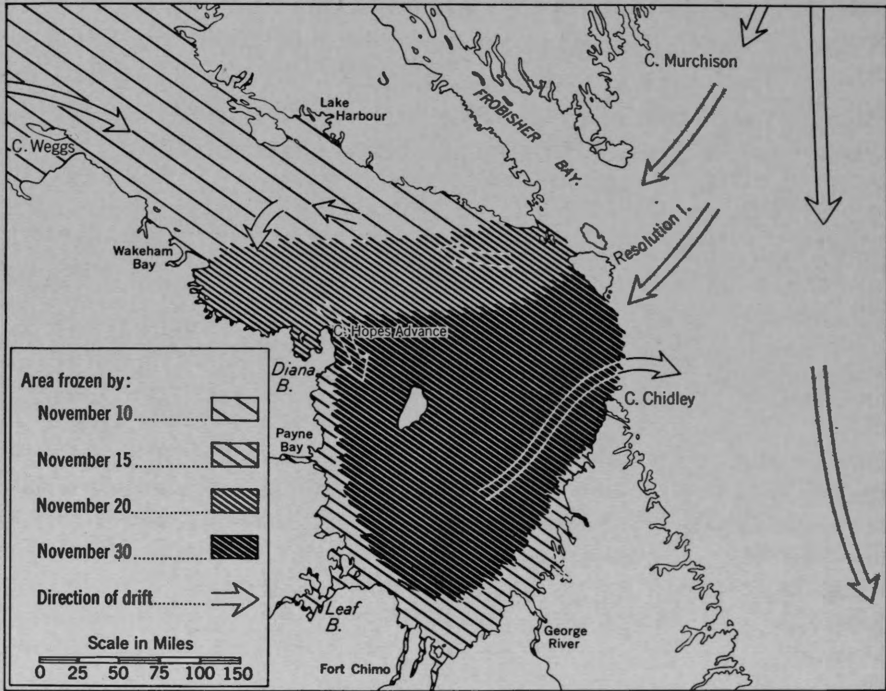

Figure 14. Freeze-up of ice in Hudson Strait and Ungava Bay.

Both freeze-up and break-up in Hudson Strait occur more or less progressively from west to east[1]. The moving down of Foxe Basin ice in November initiates the closing of the strait, and when this flow of ice stops in July clear water also first appears towards the west.

The navigation season through Hudson Strait is of approximately 3 months duration. Beginning about July 20, it ends about October 25. As mentioned earlier, conditions vary greatly from year to year, so that these dates and those given on the accompanying maps represent average conditions only. At present the insurance period for ships navigating the Hudson Bay route lasts from July 24 until October 11. With the payment of an extra premium, coverage may be extended until October 15.

Ungava Bay. During the winter season Ungava Bay is generally completely ice-bound, with landfast ice fringing the coasts and pack ice filling the centre.

Freeze-up begins at the southern end of the bay with the appearance of landfast ice around the shores, where the water is relatively shallow. This occurs towards the middle of November. About the end of November or early December pack ice moves in from Hudson Strait and completely

[1] Sailing Directions for Northern Canada; Hydrographic Office, U.S. Navy Department, Washington, 1951, p. 227.

fills the bay, which then remains ice-bound until early the following summer. Strong tidal action in the southern end of Ungava Bay generally delays the freeze-up in Payne, Leaf, and other small bays until well into December.

Break-up also begins in the southern end of the bay in the river mouths and inlets. By mid-June Koksoak, Whale, George, and Leaf Rivers are generally free of ice and patches of open water begin to form off their mouths. Ungava Bay is sometimes almost clear of ice by the end of July, but generally large fields persist in the central part until early August. By late July navigation is possible in the open water around the sides of the bay and the various trading posts can be reached. For Payne Bay, Leaf Bay, and the small bays and inlets at the head of Ungava Bay, the mean break-up date is June 15[1], but navigation is usually hindered for some time by the presence of pieces of ice that move back and forth with the tides. The navigation season, therefore, differs somewhat from the duration of time between the actual dates of break-up and freeze-up, as the following quotation indicates: "there is no close relationship between the break-up and freeze-up dates and the opening and closing of navigation. For instance, Payne Bay breaks up the 15th of June but it is seldom that vessels can enter this port before the first week in July. Similarly, at Leaf River, due to tidal conditions, freeze-up may be delayed until the end of December. Even so, all shipping should be out of the locality by mid-October"[2]. The Hudson's Bay Company has provided the following average break-up and freeze-up dates[3]:

Place	Average break-up	Average freeze-up
Diana Bay	June 20	December 10
Payne Bay	June 15	December 5
Leaf Bay	June 10	January 1
Fort Chimo	June 6	October 30

In summary, ice conditions in Hudson Strait and Ungava Bay vary from year to year so far as the dates of freeze-up and clearing of the ice are concerned. However, as a general rule the navigation season is of about 3 months duration, extending from July 20 to October 25, although the period covered by minimum insurance rates is somewhat shorter. Reports on ice conditions in Hudson Strait are broadcast daily from Resolution Island and Cape Hopes Advance, and during the navigation season a government ice-breaker patrols the area. Thus, the commercial vessels navigating the strait need experience little risk or delay in connection with ice. Numerous cargo vessels, mainly engaged in carrying wheat from Churchill, pass through Hudson Strait during the summer, but at present shipping in Ungava Bay is confined chiefly to Hudson's Bay Company supply vessels and government ice-breakers and research vessels.

[1] Correspondence from Hudson's Bay Company, dated November 18, 1953
[2] Loc. cit.
[3] Loc. cit.

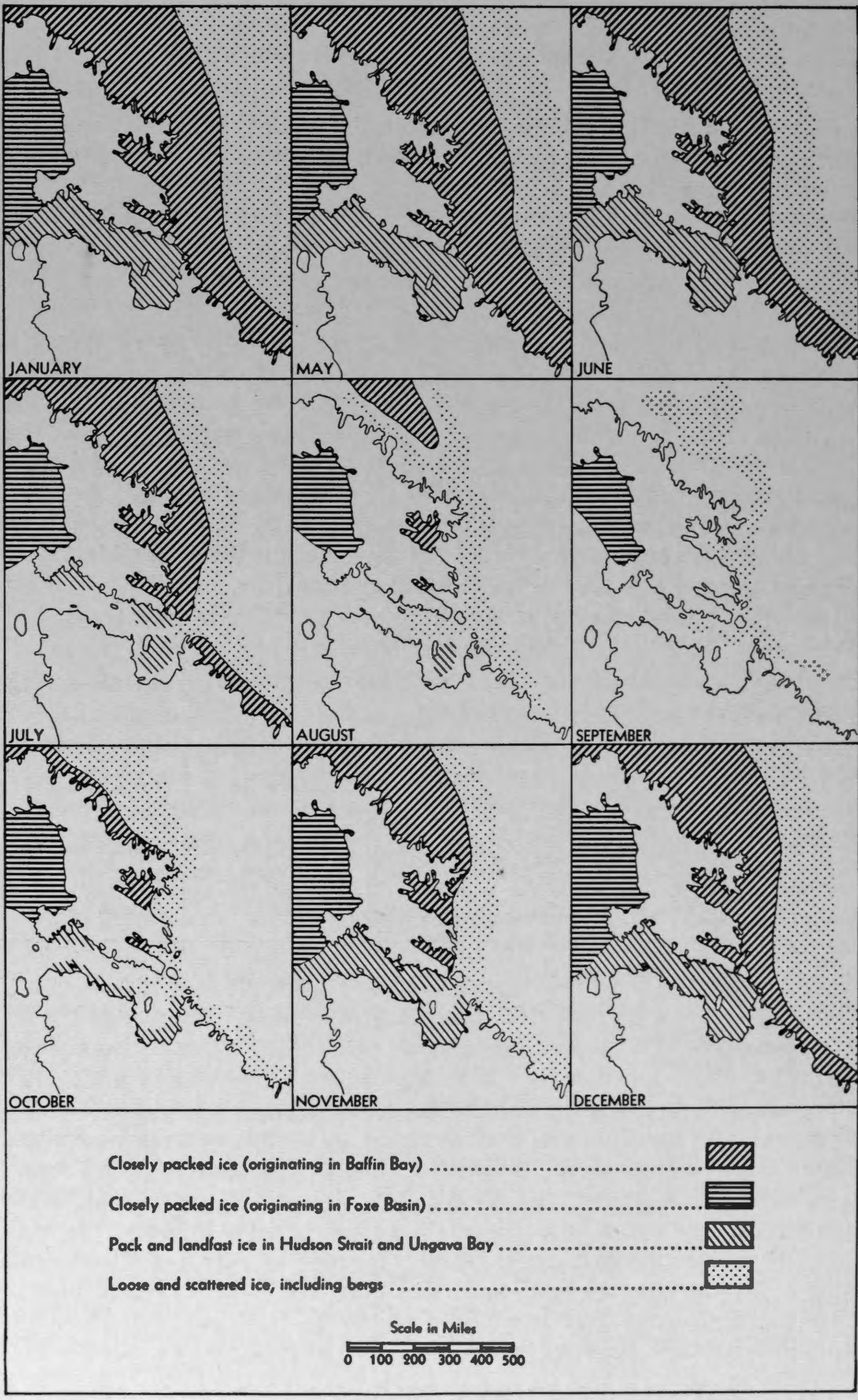

Figure 15. Distribution of ice in Hudson Strait, Ungava Bay and approaches, from May until January. (Adapted from *Atlas der Eisverhältnisse des Nordatlantischen Ozeans und Übersichtskarten der Eisverhältnisse des Nord- und Südpolargebietes.*)

RÉSUMÉ

La topographie de la région située au sud et à l'ouest de la baie d'Ungava est très variée. Près de la côte inhospitalière du détroit d'Hudson, les collines sont abruptes et escarpées tandis qu'à l'intérieur elles sont plutôt basses et alternent avec des vallées et des plateaux à surface unie. La glaciation a désorganisé l'écoulement normal des eaux et y a laissé des dépôts superficiels de toutes sortes. Le permafrost, qui se retrouve à peu près partout, influence directement le drainage et la végétation. La région jouit d'un climat confortable quelques mois par année seulement.

Le brouillard, les conditions de la glace, la présence de haut-fonds le long de la côte et l'amplitude des marées rendent la navigation difficile et risquée dans le détroit d'Hudson et la baie d'Ungava, limitant la saison de navigation à une période de trois mois, soit du 20 juillet au 25 octobre approximativement.

La forêt boréale s'arrête dans son extension nordique à la rivière Larch, tandis que la rivière aux Feuilles, un peu au nord de la précédente, marque la limite d'une zone transitoire de végétation du type taïga; au nord de cette rivière c'est le domaine de la toundra.

Le peuplement est disséminé le long de la côte dans quelques postes où l'on retrouve trois centres d'activité: la mission, le poste de traite et le poste de météorologie. L'exploitation de nouveaux gisements miniers donnera naissance à d'autres centres de peuplement qui resteront soumis aux facteurs physiques régionaux.

Les conditions de la glace dans le détroit d'Hudson et la baie d'Ungava varient d'une année à l'autre. La glace se forme sur place et provient aussi, en partie, du bassin Foxe et de la baie Baffin. La débâcle procède de l'ouest à l'est dans le détroit d'Hudson et les premiers espaces d'eau libre apparaissent le long de la rive sud. Vers la fin de juillet, la navigation reprend son cours près du littoral de la baie d'Ungava. De grands champs de glace persistent au centre de la baie jusqu'en août. La congélation débute à la fin de novembre. En règle générale, la saison de navigation dans le détroit d'Hudson et la baie d'Ungava commence vers le 20 juillet et se termine le 25 octobre.

RURAL SETTLEMENT AND LAND USE IN THE NEW GLASGOW REGION

Norman L. Nicholson[1]

The New Glasgow region of Nova Scotia extends inland from the north shore of the province to a line running southeast from Brûlé Point, on Northumberland Strait, to West River station, on Salmon River, thence following approximately the watershed between those rivers that flow directly into the Atlantic Ocean and those that flow into Northumberland Strait, to Malignant Cove on the strait. On the north it includes all the islands bordering the coast, the largest of which is Pictou Island. The region thus defined is shown on Figure 1 and covers an area of about 770 square miles.

1 Dr. Nicholson was the leader of a Geographical Branch field party to the New Glasgow region in 1951. This paper presents part of the results of the party's work, which was undertaken in collaboration with the Nova Scotia Research Council and initiated by Dr. D. F. Putnam, Professor of Geography at the University of Toronto, while temporarily on the staff of the Geographical Branch in 1950.

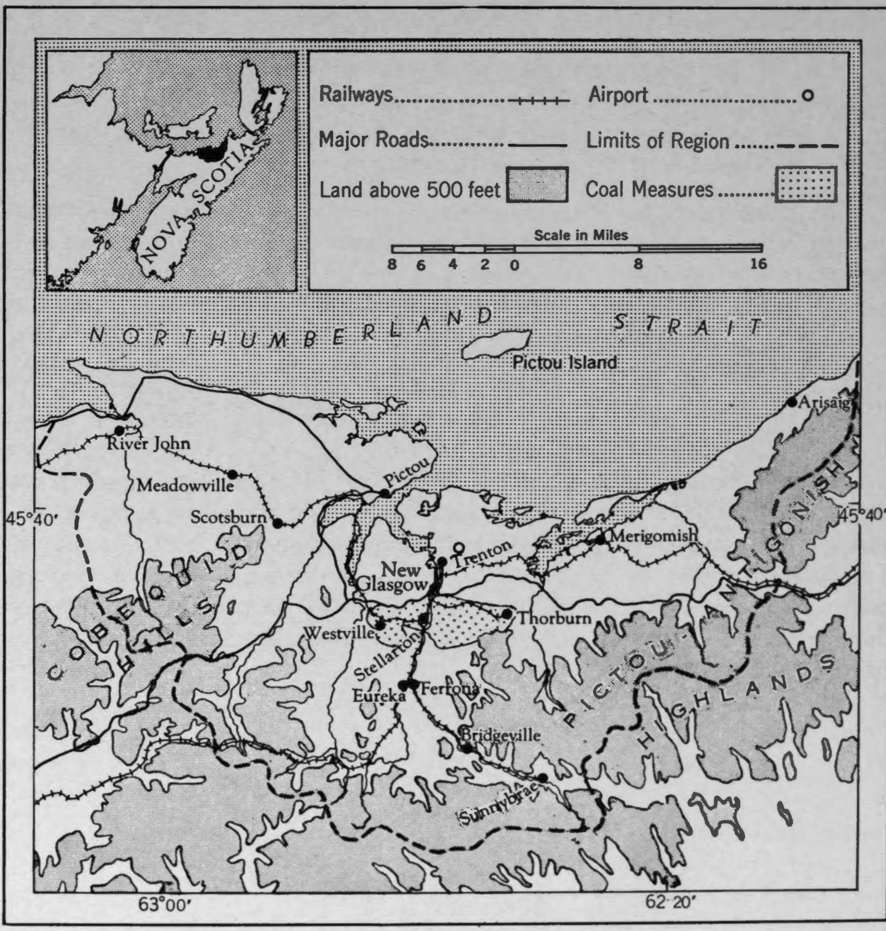

Figure 1. Location map.

THE PHYSICAL SETTING

RELIEF

The southern and eastern limits of the region lie in hill country. These uplands form the most striking topographical feature of the region although their average elevation is 800 feet and nowhere do they reach heights of 1,000 feet. They are broken by the valleys of West, Middle, and East Rivers for a distance of about 20 miles, the western section forming part of the Cobequid Mountains and the eastern part, the Pictou-Antigonish Highlands, the principal spur of which runs in well-developed ridges northeast and terminates in Cape George. These uplands are the eroded remnants of an ancient mountain system[1] fundamentally made up of igneous and metamorphic rocks of Ordovician age, and Silurian limestones, slates, and sandstones.

But most of the region under consideration extends over part of the Cumberland-Pictou plain, which makes up the lowlands of northern Nova Scotia, extending eastwards from the New Brunswick-Nova Scotia boundary to Cape George. Lying between Northumberland Strait on the north and the Cobequid Mountains and Pictou-Antigonish Highlands on the south, it has a width of 10 to 15 miles at the western edge of the region and becomes narrower in going eastward until it disappears completely at Malignant Cove. Immediately south of the town of New Glasgow, in the gap between the east end of the Cobequids and the west end of the Pictou-Antigonish Highlands, the lowland blends almost imperceptibly with the higher and more irregular hill country, but southeast of New Glasgow the lowlands meet the highlands at a steep scarp, several hundred feet high, which "extends continuously from Piedmont station northeastward to Malignant Cove, where it reaches the shore and finds still further continuation in a long, straight sea-cliff that reaches 10 miles to Cape George"[2].

In most places the flatness of the plain is quite evident, the average elevation being between sea-level and 300 feet, but in other places the surface undulates unevenly in long, flattish ridges and smooth drumlinoid hills. These undulations have been shown by Bell[3] to have a general dependence on the underlying rocks. In the New Glasgow region some of the elevations are underlain by more resistant rock than others and as they rise well above the general level of the plain they are known locally as mountains. The ridge to the east of New Glasgow, called Fraser Mountain, rises to 480 feet, and owes its existence to thick boulder-conglomerate of Pennsylvanian age, as does Green Hill, which rises to over 625 feet, some 5 miles west of New Glasgow. McGregor Mountain, 4 miles south of New Glasgow, has a maximum elevation of 560 feet, and is due to the presence of a resistant capping bed of basic volcanic rock and of underlying hard sandstones of Lower Carboniferous age[4]. Just as McGregor Mountain is

[1] Goldthwait, J. W.: Physiography of Nova Scotia; Geol. Surv., Canada, Mem. 140, 1924.
[2] Goldthwait: op. cit., p. 55.
[3] Bell, W. A.: The Pictou Coalfield, Nova Scotia; Geol. Surv., Canada, Mem. 225, 1940.
[4] Ibid, pp. 4-5.

part of the lowland, although it is situated near the border of the Pictou-Antigonish Highlands, so Fitzpatrick Mountain, Campbell Hill, and Rogers Hill, which rise to heights of over 900, 800, and 875 feet respectively, lie within the plain, just north of the Cobequids, about 13 miles west-northwest of New Glasgow.

The rocks whose rapid decay has caused the development of the plain are sedimentary formations, laid down during the Carboniferous and Permian periods[1]. The most important area of Upper Carboniferous rocks constitutes the Pictou coalfield. This area was disturbed some time after the Appalachian orogeny, which is represented by an extensive and rather complicated system of faults. "In form it is roughly an isosceles triangle, with apex at Thorburn, with north, south, and east sides determined by faults and with a western base of early Pennsylvanian sediments, barren of coal"[2]. The area thus comprises a down-dropped area or graben, about 10 miles in length and 2 to 3 miles from north to south. New Glasgow itself is situated midway along the north boundary of the coalfield and the other towns of its "*umland*", except Pictou, are situated within it.

CLIMATE AND DRAINAGE

In general, the climate of the New Glasgow region may be described as Humid Continental (D). More specifically, the region lies in the Dfb subdivision of Köppen's major climatic realm, the subdivision which is often referred to as Humid Continental, short-summer phase. This is the type of climate that is characteristic of all of the most densely populated parts of Canada east of the Rocky Mountains, with the exception of the extreme southwest of southwestern Ontario.

TEMPERATURE[3]

In the New Glasgow region, the mean annual temperature varies between about 40° and 43°F. Due to the variations in relief, the lowland coastal area is distinctly milder than the upland interior, particularly in winter, and the mean January temperature is between 15° and 20°F. The July mean is about 66°F. (*See* Figure 2).

The region thus experiences slightly colder winters and slightly warmer summers than the southern and eastern parts of Nova Scotia and the resulting mean annual range of 45-50°F. is, therefore, relatively high for the province.

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[1] Goldthwait: op. cit., p. 53.

[2] Bell: op. cit., p. 53.

[3] This, and the sections that follow, are based on statistics in Climatic Summaries for Selected Meteorological Stations in the Dominion of Canada, Canada, Dept. of Transport, 1948. *See also:* Putnam, D. F.: The Climate of the Maritime Provinces; Can. Geog. Jour., vol. 21, 1940, p. 135, and Cann, D. B., and Wicklund, R. E.: Soil Survey of Pictou County, Nova Scotia; Canada, Dept. of Agriculture, 1951, pp. 13-15.

The mean daily range of temperature is about 20°F. but is lower along the coast than in the interior, Pictou's 30-year average being 16°F. The length of the growing season is about 180 days, extending from the last week in April to the end of October, but the frost free period is shorter, being about 110 days. This is one of the principal climatic limitations to agriculture.

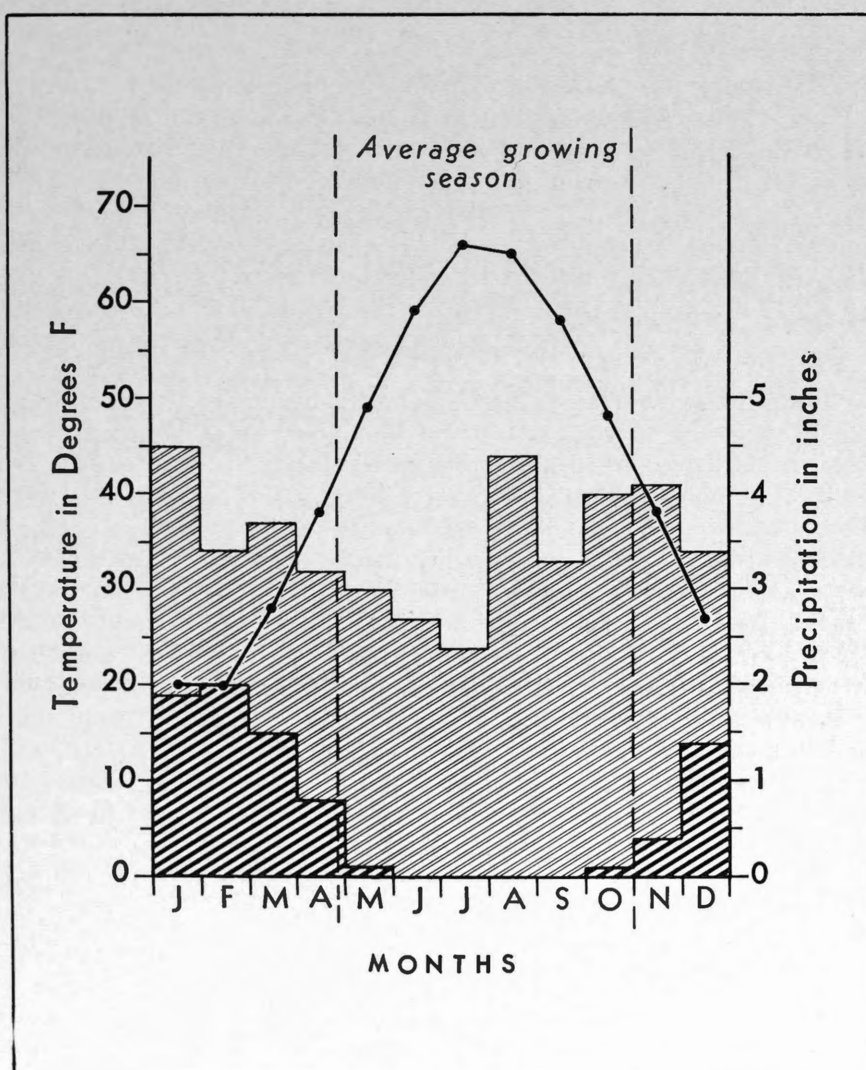

Figure 2. Climograph for Pictou, Nova Scotia. The heavily shaded area indicates precipitation that falls as snow, reduced to its equivalent in inches of rain.

PRECIPITATION

The mean annual precipitation for the region amounts to 40 to 45 inches, the higher amount being experienced in the upland south, particularly in winter. There is a slight maximum throughout the region during the cooler months, due to the proximity to the tracks of winter depressions. Almost half the precipitation falls as snow, the average for Pictou being over 80 inches a year, and heavy rain from thunderstorms is not uncommon during July and August.

The average precipitation during the growing season is about 15 inches, which is adequate for plant growth under prevailing temperature conditions, and may at times be excessive. Precipitation at the town of Pictou averages 9·4 inches in the months of June, July, and August combined, which is above the amount considered necessary for successful agriculture. The average number of precipitation days is about 120 a year and summer droughts are few, being of the order of ten in 50 years.

DRAINAGE

In the main, the river systems form typical dendritic patterns although some of the minor stream courses were determined by the deposits left on the retreat of the ice, which also disorganized the pre-glacial stream pattern and has, consequently, resulted in several boggy and swampy areas such as those north of Pictou, around Meadowville, and west of New Glasgow (Sutherland bog). All of the large streams are graded and near the coast they meander "in graceful curves, which, by a shifting process characteristic of mature rivers, lead them to trim their banks from place to place, and thus to increase the width of their flood plains"[1]. The existence of these flood plains has been very significant in the development of the regions' agricultural occupance, which is discussed below. The main river systems are River John, Toney River, Caribou River, Sutherland, French, and Barney Rivers and the West, Middle, and East Rivers of Pictou. The estuaries of the latter three are now drowned to a considerable depth and form Pictou Harbour.

SOILS

The whole region has been glaciated, and apart from some areas of exposed bedrock it is overlain by Pleistocene deposits to a mean depth of 10 to 15 feet, although depths of 86 feet have been measured in some places[2]. Most of the drift is unstratified and was deposited as ground moraine although there are some drumlins in the region[3]. Consequently, the soils have either developed from till or water-deposited materials. The former are the most widespread and a wide variety of different soil types

[1] Goldthwait: op. cit., p. 55.

[2] Poole, Henry S.: Report on the Pictou Coal Field, Nova Scotia; Geol. Surv., Canada, Ann. Rept., vol. XIV, 1901, pt. M, p. 30.

[3] For a map showing these features on a scale of 1 mile to 1 inch *See* Hogg, W. A.: Pleistocene Geology of Pictou County, Nova Scotia; Nova Scotia Research Foundation, Halifax, 1953.

are distinguishable among them, depending upon the parent materials. In the New Glasgow region, the central upland axis is mainly composed of resistant felsites, syenites, diorites, schists, granites, quartzites, and slates and the soils of the Cobequids and Pictou-Antigonish Highlands are, therefore, usually intrazonal, stony, and shallow. Indeed, the bedrock often protrudes through them. In many areas, the topography alone is such as to preclude agriculture.

In the lowlands, the most widespread rocks are Permian sandstones and shales although there is a considerable area of rocks of the Carboniferous system that stretches in an arc, 4 or 5 miles wide, around the flanks of the Pictou-Antigonish Highlands. From these, the most mature zonal soils of the region have been developed.

The soils derived from water deposited materials include some of the poorest for raising crops, particularly those derived from the eskers, kames, and kame terraces, yet, in addition, some of the best, such as the azonal Stewiacke and Cumberland Associations. The Stewiacke Association occurs around Plainfield, and the Cumberland Association is found in the "intervales" or flood plains of the larger rivers, notably River John, West, Middle, and East Rivers, McLennan Brook, Sutherland River, French River, and Barney River.

The stratified drift is evident as eskers, kames, and kame terraces of gravel and occasional patches of water laid silt and clay. The most outstanding gravel deposits stretch almost continuously for 10 miles from Scotsburn to Lower Mount Thom along the eastern flanks of Rogers Hill, Fitzpatrick Mountain, and the Cobequids. But the gravels of the eskers and kames are widely distributed throughout the region. They bear good forest cover under natural conditions and thus to the early settlers were indistinguishable from good soils. As a result they were often cleared and attempts made to cultivate them. Today such cleared areas are devoted to poor pasture or completely abandoned. It is only on such soils that soil erosion is apparent, mainly sheet erosion with occasional gullies.

Thus, the soils of the region, like the geology and topography, show wide variety and from an agricultural point of view range from good to submarginal.

SETTLEMENT

BEFORE 1763

Long before the Europeans arrived, the New Glasgow region provided the means of subsistence for the Micmac Indians who inhabited it. Most of the Indian settlements were along the coast, usually at the mouths of the larger rivers. Merigomish Island appears to have been their headquarters in this part of Nova Scotia but the present towns of Pictou and New Glasgow were both probably established on or near sites of Indian villages. In such locations food was abundant. Wild fowl were numerous and the sea and the rivers provided cod, salmon, trout, and lobster. Very little effort was needed to harvest the clams and oysters from the shallow waters near the shore and inland the forests supported game animals of many kinds that provided those who hunted them with food and furs, some of which were even traded with the European fishermen who ventured to this area.

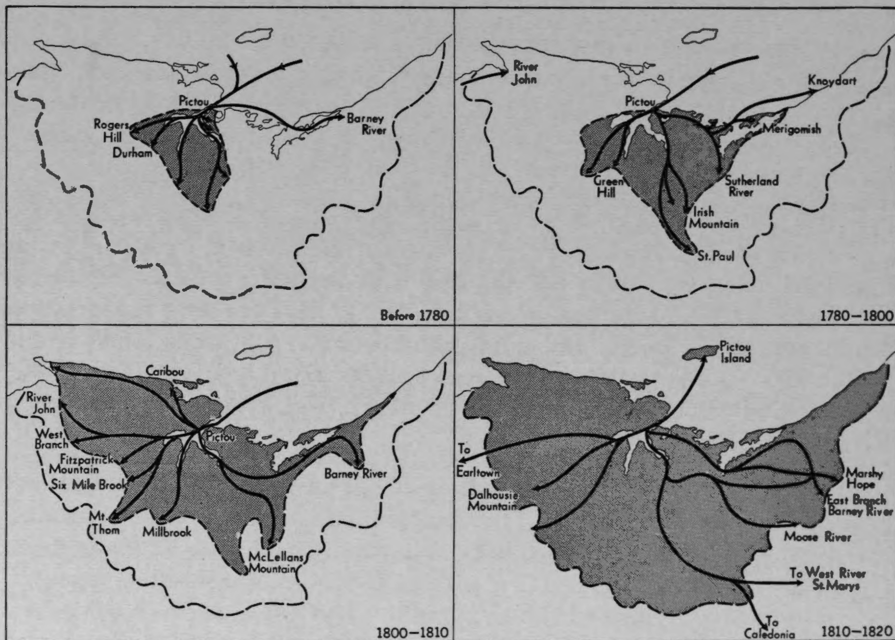

Figure 3. The spread of settlement in the New Glasgow region. The main routes of penetration are shown and the effectively occupied areas at each stage are shaded.

In time, the French arrived as the governing power, but during the 150 years of their control they did not colonize the New Glasgow region very extensively, and confined their attention mainly to a few coastal and insular outposts. They formed a relatively large settlement at Tatamagouche mainly because it lay on the direct route connecting the large Acadian centre at Truro and the French settlements on Prince Edward Island. It is for this historical reason that Tatamagouche and vicinity are outside the New Glasgow region proper. The largest French settlement within the New Glasgow region was on the Big Island of Merigomish but they also had a small settlement at the mouth of French River, and evidence of their presence has also been found at Caribou and at one or two other scattered locations along the coast.

1763-1780

Settlement in the modern sense did not occur until after the Treaty of Paris, 1763. In October 1765, a district embracing the larger part of the present Pictou county and part of Northumberland county was granted to a group of individuals. Of these early grants, the locations of two of them are particularly important as they influenced the early pattern of settlement. One, known as the Irish Grant, included the shores of Pictou Harbour and extended inland for about 20 miles, embracing the whole of the lower reaches of East and Middle Rivers, and the east side of West River to about a mile above Durham. It also embraced "one other piece" bounded by a line running north from Brown Point to the "seashore", and including Pictou Island. This, thus included "nearly all the most desirable portions of the harbour"[1] including the area on which the town of Pictou was later established.

The second significant grant was made to the Philadelphia Company[2]. It covered the area between Point Brûlé and the Irish Grant and extended inland from the shore. It is noteworthy that on Pictou Harbour, the Philadelphia Company's grant was confined to that part of the shore south and west of Brown's Point.

In May 1767, the company dispatched the Brig *Hope* from Philadelphia with the first settlers, made up of several families from Maryland and Pennsylvania. At least one of these families included a negro slave and it is probable that a few other negroes also arrived in the region during the early years of modern settlement[3]. One of the new arrivals, John Rogers took up land on what is now Rogers Hill partly because it was on the trail to Truro, which it was thought would become the road to Halifax[4]. The trail was blazed by people from Truro when they set out to welcome the new arrivals from the *Hope*. One or two of these people remained with the newcomers and became part of the pioneer community there. By 1770 the population numbered 120. But the most noted event in the settlement of the area occurred in 1773 when the *Hector* arrived at Pictou with a group of people from the highlands of Scotland, brought out by the agent of the Philadelphia Company. When the *Hector* arrived, the limited shore of the company's land was all occupied, and her passengers were taken back 2 or 3 miles. Faced with the difficulties of clearing the land as well as the lack of access to the sea and its resources, they refused to settle on the company's land. Some went to Truro, others to even more distant parts of Nova Scotia, and still others squatted at Brown's Point during the first winter.

In the meantime, no effort had been made to settle the Irish Grant and it, consequently, reverted to the Crown. Some of the *Hector's* passengers, therefore, moved to these lands. However, difficulties were thrown in the way of their getting grants, presumably by the agents of the Philadelphia

[1] Patterson, Rev. George: A History of the County of Pictou, Nova Scotia; Dawson Bros., Montreal, 1877, p. 52.

[2] The reason given for seeking land in Nova Scotia was that the good agricultural areas in the southern American Colonies were overpopulated! *See* Patterson, op. cit., pp. 47-48.

[3] Illustrated Historical Atlas of Pictou County, Nova Scotia; J. H. Meacham and Co., Philadelphia, 1879, p. 8.

[4] Patterson: op. cit., p. 61.

Company. Nevertheless, they spread out about the mouths and lower reaches of East, Middle, and West Rivers, and in 1783, 10 years after their arrival, title to the lands they occupied was issued.

In 1776, these small settlements were reinforced by some fifteen families from Prince Edward Island. They had left Dumfriesshire, Scotland, for the island in 1774, but a plague of mice there produced a severe famine and ultimately forced their migration across the strait. Also in 1776 or 1777, the first settlement was made at the mouth of Barney River.

Thus by 1780, the population of the region was about 250[1]. The settlement pattern so far had been principally one of consolidation about Pictou Harbour with inroads up the valleys of West, Middle, and East Rivers and two "outposts" at Rogers Hill and Barney River (*See* Figure 4).

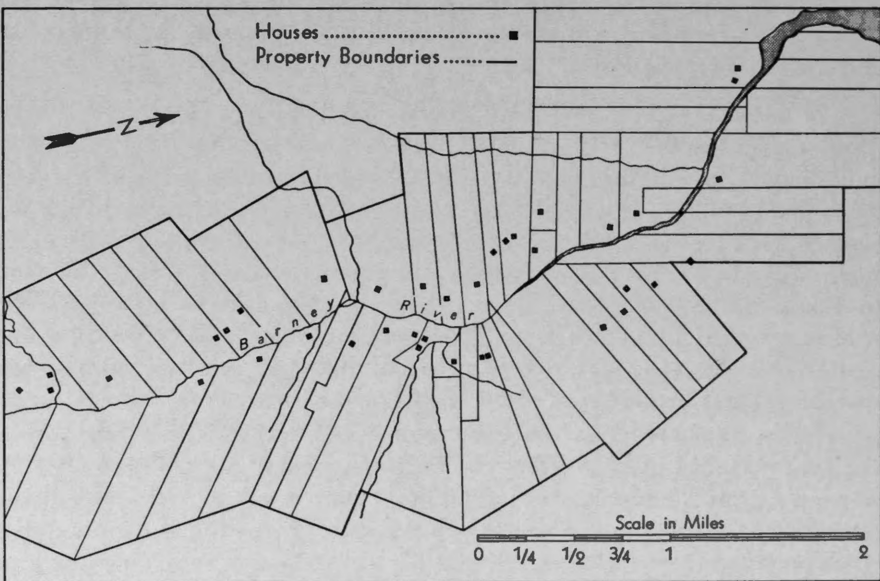

Figure 4. The pattern of settlement along lower Barney River. (After *Illustrated Historical Atlas of Pictou County.*)

1780-1800

The next accession of settlers, and the largest yet received, was at the peace of 1783. The group was largely composed of disbanded soldiers from Halifax but included a few families who had emigrated from Britain. Together they settled on the large tract of land set apart for them along the coast from Frasers Point to Merigomish, except for smaller grants previously made at Barney River, and the grant made to John Wentworth in 1765. In 1784, a second group of disbanded soldiers arrived who took up 3,400 acres of land extending along both sides of upper East River, around

[1] Ibid., p. 110.

what is now Springville and St. Paul. The land in the valleys, called locally "intervale land"[1], was in demand by this time and it was for this reason that so many settlers were attracted inland[2]. Some of them went to West Branch, and later in the same year, another group of Highlanders arrived who settled along East River near the present New Glasgow and Churchville. In 1785, the "Wentworth grant" was settled, in order to prevent its surrender to the Crown. This area extended inland for 7 to 10 miles from Merigomish Harbour and included the lower part of Sutherland River, which was named after one of the pioneer communities of this time.

On the western side of the region, the area about the mouth of River John was settled by a group of Protestants who were originally from Germany. They had taken up land in Nova Scotia near Tatamagouche in the area granted to Des Barres. But he was unwilling to sell his land, preferring to keep his settlers as tenants, so they obtained land in their own right, to the east of Des Barres grant, from the Philadelphia Company. Further immigration from the Highlands of Scotland saw Knoydart and Irish Mountain settled (1787) and the beginning of the Lowland Scots settlements at McLelland Brook and Green Hill (1788-89).

Thus by the end of the century, settlement had spread out from the harbour. The easiest mode of access was by water and thus the spread was up the main river valleys and along the coast. Land taken up in either of these locations had the additional advantage of being relatively more fertile or favourably placed with regard to the food resources of the sea. These movements of population largely consolidated the areas taken up between the main settlement "front" and the "outposts" of the previous period and were thus almost exclusively confined to the area to the east of Pictou Harbour. At the same time, new "outposts" became established at Knoydart on the east and River John on the west. The eastward movement is a peculiarity of the early settlement pattern of the region. It appears explicable only in the light of the land grants that were made, for the largest areas of good agricultural land are all to the west of Pictou Harbour. This land, however, was held by the Philadelphia Company. The area to the east of the harbour was held mainly by the Crown, having reverted by escheat, and was granted on liberal terms to newcomers, or by Wentworth who, in order to prevent process of escheat against him, offered equally liberal terms to new settlers.

The comparatively large increases in population resulted in the demand for community centres and saw, in turn, the beginning of nucleated settlements. In 1787 the first two meeting houses (churches) in the region were built—one at Loch Broom, near the shore, and one near what is now New Glasgow. It will be recalled that the site of the present town of Pictou was included in the "Irish Grant" of 1765, but that this was escheated in 1770. The area was regranted in 1776 but changed hands again in the 1780s

[1] This may be a corruption of the word "interval"—meaning the intervals between the hills. Cann and Wicklund use the word interval in the "intervale" sense.
[2] Patterson: op. cit., p. 121.

when plans were made for a town. The first buildings were erected around 1789 or 1790 and thus, 35 years after the arrival of the first of the modern immigrants, the town of Pictou began to take shape. A further response to the growing development of the region occurred in 1792 when Pictou District was set apart within the County of Sydney. Until this time it had been part of the District of Colchester.

1800-1810

The new century saw a fuller utilization of the resources of the New Glasgow region. The spread of settlement had led to the fuller use of the agricultural resources and had turned greater attention to the forest resources. The first cargo of squared timber had been exported in 1774, and the timber trade increased from that time. Then in 1798, the existence

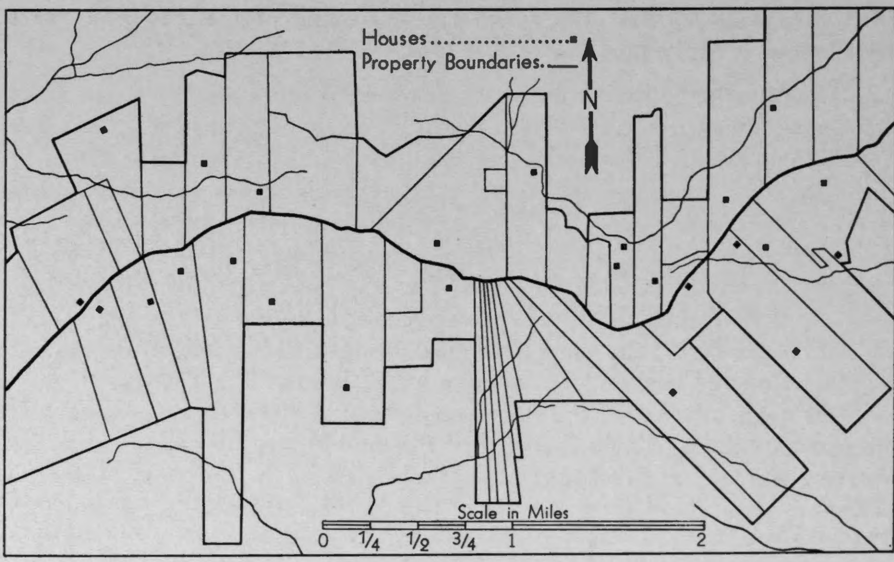

Figure 5. The pattern of settlement along the road crossing Mount Thom. (After *Illustrated Historical Atlas of Pictou County.*)

of a great resource under the ground became known when coal was discovered. On top of all this the human resources were increased by further immigration. Between 1801 and 1805 two or three vessels of settlers, mainly Highland Scots, arrived each year. Many of them, recognizing in the Cobequid Mountains and Pictou-Antigonish Highlands, a visible environment similar to the one they had left on the other side of the ocean, made for the hilltops and pioneer communities were established at Mount Thom and McLellan's Mountain in 1801-02 and Fitzpatrick Mountain in

1803[1] (*See* Figure 5). There was a significant movement upstream from the mouth of Barney River in 1807, but as most of the major valleys were occupied by that time, additional settlement near Pictou Harbour could only take place on the higher land between them, as the establishment of Mill Brook (1801), Four and Six Mile Brooks (1803), and Gairloch (1805) indicates.

But the main movement of population during this period was to the northwest of Pictou Harbour. The first settlement of the "back-shore" between Toney River and Cape John occurred in 1803 and land was taken up around Caribou and West Branch River John in 1805, thus linking the "outpost" at River John with the core of the region.

Such advances warranted further development, political and otherwise. In 1807 the district was divided into the three townships of Pictou, Egerton, and Maxwelton, and in 1810 the first roads fit for carriages were begun, beginning with the road to Halifax. The road building was handicapped because the routes had to cross over high ground so as to avoid being impassable in winter.

1810-1820

During the war of 1812, a number of negroes, who had been slaves in Virginia and had escaped to the British Fleet, settled in the region, and with the end of the war, the last of the great movements of population began. But as the shores and intervales had already been largely taken up, the only means of access to the remaining unoccupied areas was by land. This migration by land routes was the dominant characteristic of the settlement process during the period and it resulted in population movement to the fringes of the New Glasgow region. Nevertheless, certain characteristics of the earlier periods were still apparent. Among the newcomers, Scots continued to predominate. Irish were in second place, a good proportion of them coming from Newfoundland where they had lived for a few years, and the English, a poor third[2]. Some of the Highland Scottish emigrants continued to move to the Nova Scotian Highlands and Dalhousie Mountain settlement was established in 1815 "under the idea that the soil was of very superior quality"[3]. The colonization of Pictou Island took place by sea in 1817. However, the main movement was further into the interior. In the west it was toward Earltown and New Annan. In the east it extended to Kenzieville, Marshy Hope, Piedmont valley, and still further up Barney River and its tributaries, and southeastward settlement reached Blue Mountain and Moose River. Indeed, the region was becoming fully occupied and population pressure was forcing newcomers

[1] These higher sites are less liable to late spring and early autumn frosts, which may also have affected their occupation, as was the case in New Brunswick. *See* Ganong, W. F.: A Monograph of the Origins of Settlements in the Province of New Brunswick; Trans. Roy. Soc., Canada, sec. II, 1904, p. 13.

[2] Martell, J. S.: Immigration to and Emigration from Nova Scotia 1815-1838; The Public Archives of Nova Scotia, Halifax, 1942, p. 8. *See also* Hobson, Peggie M.: Population and Settlement in Nova Scotia; Scottish Geog. Mag., vol. 70, 1954, pp. 49-63.

[3] Patterson: op. cit., p. 275.

over the Atlantic Ocean divide, and thus out of the New Glasgow region proper to St. Mary's and Caledonia and such relatively distant places as Glenelg.

Urban development[1] was characterized by the beginning in 1810-11 of New Glasgow, which was ultimately to become the regional nucleus.

AFTER 1820

After 1820, there was little new rural settlement in the region. By 1827, it was the general opinion that all the land capable of cultivation that would give economic returns had been taken up for agriculture[2] and though cultivation was being attempted on some small areas of submarginal cropland, such land was utilized principally for its forest products. After this date, too, land was supposed to be sold, not granted.[3]

However, this period saw a fuller utilization of the occupied farm land. In the early years, lumbering was a much more profitable enterprise than raising crops and agriculture had been primarily concerned with the growing of food for immediate needs. But after 1820, as methods of transportation improved, and mining and manufacturing developed, urban markets began to appear. These economic developments in the New Glasgow region began to take definite form in 1827 when the General Mining Association began mining coal near what is now Stellarton. In that year, 100 English miners landed at Pictou, to be followed by 33 more in 1828, and supplemented by 157 Scots in 1829[4]. It is likely that these activities also attracted people from other parts of Nova Scotia, including negroes, who had landed at Halifax in not inconsiderable numbers after the war of 1812.

By the 1830s the region had largely emerged from the pioneering stage and was assuming the general aspects that are present in it today. In 1836, Pictou was erected into a separate county and by the 1840s, immigration on a large scale was over.

The next significant stage in the development of the region came with the building of the railways. The first major line, from Halifax through Truro to Pictou Landing (on the east side of the harbour, opposite Pictou town) was completed in 1867, and the last from Ferrona to Sunnybrae in the 1890s. These assisted in the dispersal of the rural population within the region and their number continued to increase until the 1880s. But after that time the region began to feel the impact of Confederation and Canadian national growth[5]. It had to meet keener competition from more favoured and more distant agricultural areas, and this, together with better adjustment of local land use to land capacity and the development of more

[1] For a general account of this urban development *See* Nicholson, N. L.: The New Glasgow Region of Nova Scotia; Scottish Geog. Mag., vol. 69, 1953, pp. 79-86.
[2] Martell: op. cit., p. 23.
[3] Ibid., p. 7.
[4] Ibid., pp. 60-64.
[5] For a discussion of these changes *See:* Gentilcore, R. L.: Land Use and the Dairy Industry in Antigonish County, N.S.; The Canadian Geographer, No. 2, 1952, pp. 43-50.

efficient methods of farming, caused the rural population to decline. Thus, today the number of people living outside the towns and villages is approximately the same as the total population of the region in 1830 (Figure 6).

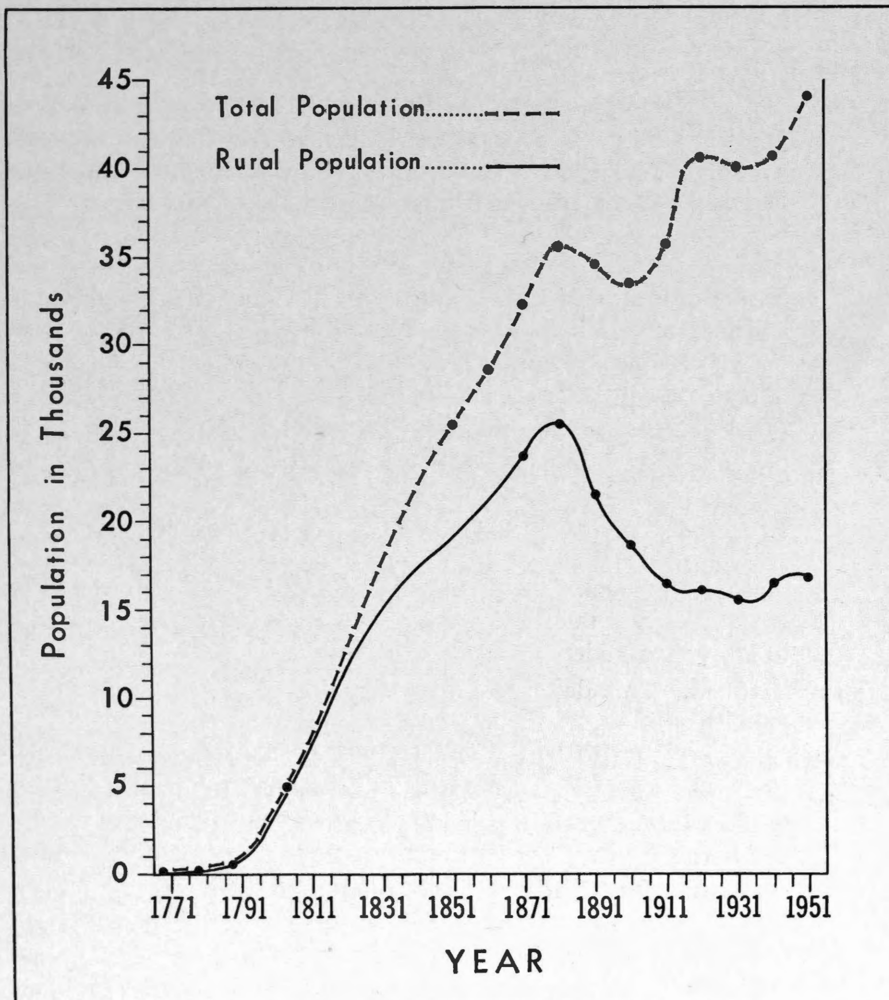

Figure 6. The population of Pictou county, Nova Scotia, 1767-1951.

THE RURAL LANDSCAPE

Travel through the New Glasgow area shows up the obvious facts in the present rural landscape of the region. The level areas along the coast and major river valleys are dominantly arable; the slopes bordering them are dominantly grasslands and forest and woodland occupies most of the remote interior and the upland fringes of the region.

But the inter-relationship of these landscapes and their less obvious features required a more detailed examination. To this end all the farmland in the region was visited and the use to which each field[1] was put was recorded on air photographs on scales of 1″=2,640′ and 1″=3,240′, and according to the following scheme[2]:

Hayland

H=hay. This letter was applied to cultivated haylands as well as areas of wild grass; it was also applied to abandoned farmlands, where no small growth had begun to appear. In some cases, the hay was not cut, particularly on isolated abandoned farms.

Pasture Land

P=pasture, was applied to fields that were obviously used for pasture, and in some cases to fields that would serve as pasture but were not observably used as such at the time.

Ps=pasture, small growth. These letters were applied to fields where small growth was beginning to appear, but not so thick as to preclude use for grazing. In some cases, the observed use was for grazing and in other cases such use was assumed.

Cropland

g=grain. This denoted crops such as oats and wheat. At the time of the year that the survey was started, it was not always possible to individually identify these.

I=intertilled. This denoted garden or field crops such as potatoes, peas, turnips, and other vegetables.

C=cultivated. Early in the season, it was not always possible to determine what crops would be grown or had been sown in land that was ploughed or was being ploughed. Such land was merely designated by C.

O=orchards.

Forest and Woodland

Much of the forest and woodland was delimited directly from an examination of the air photographs. Traverses through some areas were made, however, and any other sections that appeared unusual on the photographs were visited. The fringes of the farmed lands were all visited and classified thus:

Sc=scrub. Applied to small growth such as alders, willows, hawthorn, hazel, etc., which will not become merchantable, yet was so thick that it precluded any type of agricultural use including pasture.

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[1] This is fundamentally the approach of Dr. Dudley Stamp, Professor of Geography in the London School of Economics; for the principal results of his research *See* Stamp, L. D. (Ed.): The Land of Britain, The Report of the Land Utilization Survey of Britain; London, Geographical Publications Ltd., in nine volumes.

[2] For other approaches to the problem of land classification by the Geographical Branch *See* Reed, Lloyd G.: Land Classification as part of a Geographical Survey of the Avalon Peninsula of Newfoundland; Geographical Bulletin No. 5, 1954, pp. 58-78.

Forest and Woodland—Continued

Sg = Applied to coniferous or deciduous small growth that may become merchantable, and was so thick that any agricultural use was precluded. "Small" referred to tree growth (a) 1′ to 5′ in height, either dense or scattered and (b) 5′ to 10′ in height but always scattered.

When the field survey had been completed, maps were then prepared from the aerial photographs and the geographical aspects of several of the elements of the rural landscape were examined in greater detail.

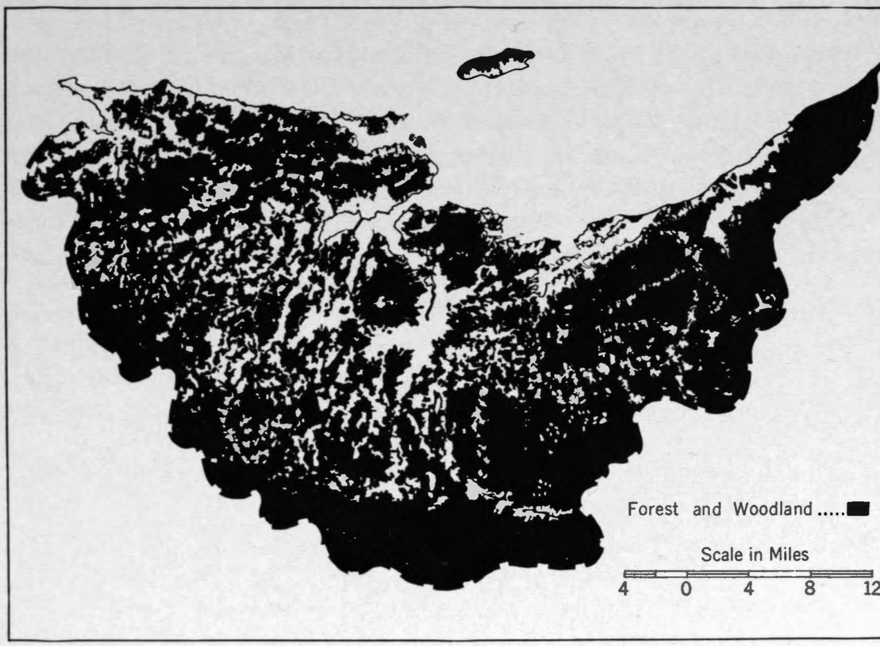

Figure 7. The distribution of forest and woodland.

FOREST AND WOODLAND

DISTRIBUTION

One of the striking features of the region is its forested-wooded appearance. The area shown on Figure 7 covers some 600 square miles, about 78 per cent of the total area. Early accounts of the region lead to the conclusion that within historic times it was completely forested, in places heavily so, with the possible exception of some of the coastal areas covered with recent marine deposits. Deforestation was at first consequent upon the clearance of land for subsistence agriculture. Later clearance occurred as agriculture became established on a commercial basis, as trade in raw timber developed, and as the rise of the early iron and steel industry created a demand for charcoal. Today, the least severely culled areas are found on the landward rim, particularly on the higher parts of the Cobequid Hills and Antigonish Highlands. Here the slopes are often quite steep, usually at least 5-10 per cent; the bedrock is exposed in many places and where there is a covering of till it is coarse textured and porous. Both stoniness and topography are thus deterrents to agricultural use due to the excessive amount of labour required to clear the land.

Within the lowlands, there are three large areas of forest and woodland that are noteworthy. Two are near the centre of the region, in the Abercrombie and Boat Harbour peninsulas, and the other runs in a broad zone, 2 to 3 miles wide, westward from Pictou. In these areas the soils present many difficulties from an agricultural point of view. The Hansford Association, found in the Boat Harbour peninsula, has low natural fertility and, being developed from a coarse-textured, gritty till derived from sandstones, tends to be droughty due to its open nature. The remaining extensive lowland forests are found on the Queens Association, a heavy textured group of soils whose fertility is likewise not very high, and where the major obstacle to successful cultivation is the poor drainage and the high cost of artificially overcoming this.

COMPOSITION

The extremely varied topography, soils and bedrock of the region is reflected in the diverse nature of the woodlands. In general, they show a broad-leaved nature[1] although the characteristic dominant is red spruce.

The chief zone of forests is the upland fringe of the region. Mainly hardwood stands of yellow birch, hard maple, and beech are found on the Cobequid Mountains, particularly on the higher parts, and on the felsites and syenites of the Antigonish Highlands[2]. Mixed-wood associations, however, make up the largest part of the forest cover, particularly on the intermediate and lower slopes of the highlands where they are mainly composed of yellow birch, red spruce, maples, beech, hemlock, white pine, and some fir.

The forest and woodland of the coastal plain is similar in composition but it is all second growth and frequently much less mature. The poorly drained depressions usually support a mixture of black spruce, tamarack, poplar, and alder and the sandy outwash deposits are covered with pines and wire birch.

The forests and woodlands are primarily utilized through operations that are usually carried on by small crews using portable mills. During the survey, the location of abandoned and active sawmill sites was plotted whenever observed, but the map of their distribution is not reproduced here as it merely shows the widespread nature of such sites, particularly on the uplands of the western half of the region.

[1] Halliday, W. E. D.: A Forest Classification for Canada; King's Printer, Ottawa, 1937, p. 38.
[2] Fernow, B. E.: Forest Conditions of Nova Scotia; King's Printer, Ottawa, 1912, p. 67.

CROPLAND

DISTRIBUTION

The most notable feature of Figure 8 is the fact that there are no large continuous areas of cultivated land. It is clear that the Cobequids and Pictou-Antigonish Highlands are almost devoid of cultivation and that elsewhere in the region the cultivated land is all in small parcels. This patchy pattern shows both the impress of the sequence of settlement as well as the physical characteristics of the land. Almost all the "bottom-lands" of the river valleys are cultivated, a use based on the alluvial sands and gravels.

Away from the major river valleys, the cultivated areas coincide only in part with the more fertile and easily worked soils. Such soils are the medium-textured, sandy or sandy clay loams derived from sandstones. They extend from the northwest corner of the region, along the north shore to Pictou; southward up the West River Valley to the vicinity of Salt Springs. They reappear again along the west coast from Merigomish to the northeast corner of the region in a belt about 4 miles wide. Yet some of these soils are hardly cultivated at all. The best example of this is the area between Caribou Harbour and Toney River. The non-agricultural use of much of this area undoubtedly stems from the fact that the original forest cover was particularly luxuriant, that the area was opened up for settlement relatively late in the history of the region, and that it remained relatively inaccessible to the major centres of population.

By contrast, the adjacent soils of the Nappan Association, which extends westward into the Cape John peninsula, are used much more for crops, despite their lower rating for such purposes[1]. Even areas of only fair crop land, such as the rolling to undulating area between the Cobequids and the Pictou-Antigonish Highlands, are sometimes used much more intensively than the better crop lands. Such variations are also common on the same soil association. The Queens Association of the Abercrombie peninsula and east of East River is almost completely devoid of cultivation, and west of Pictou Harbour it supports scattered areas of crop land.

Thus the greatest concentrations of cultivated land are not necessarily found on the best crop land soils but only where the original settlements and good soils coincided, as with the areas about the lower reaches of West River and Sawmill Brook and the area around Merigomish Harbour.

CROPS

The chief crops, other than cultivated hay, are oats, barley, and potatoes, in that order. More than half the oat average is in the north-western third of the region. Potatoes, on the other hand, are concentrated in the northeast of the region, particularly along the coast from Sutherland

[1] *See* Cann and Wicklund: op. cit., pp. 56-57.

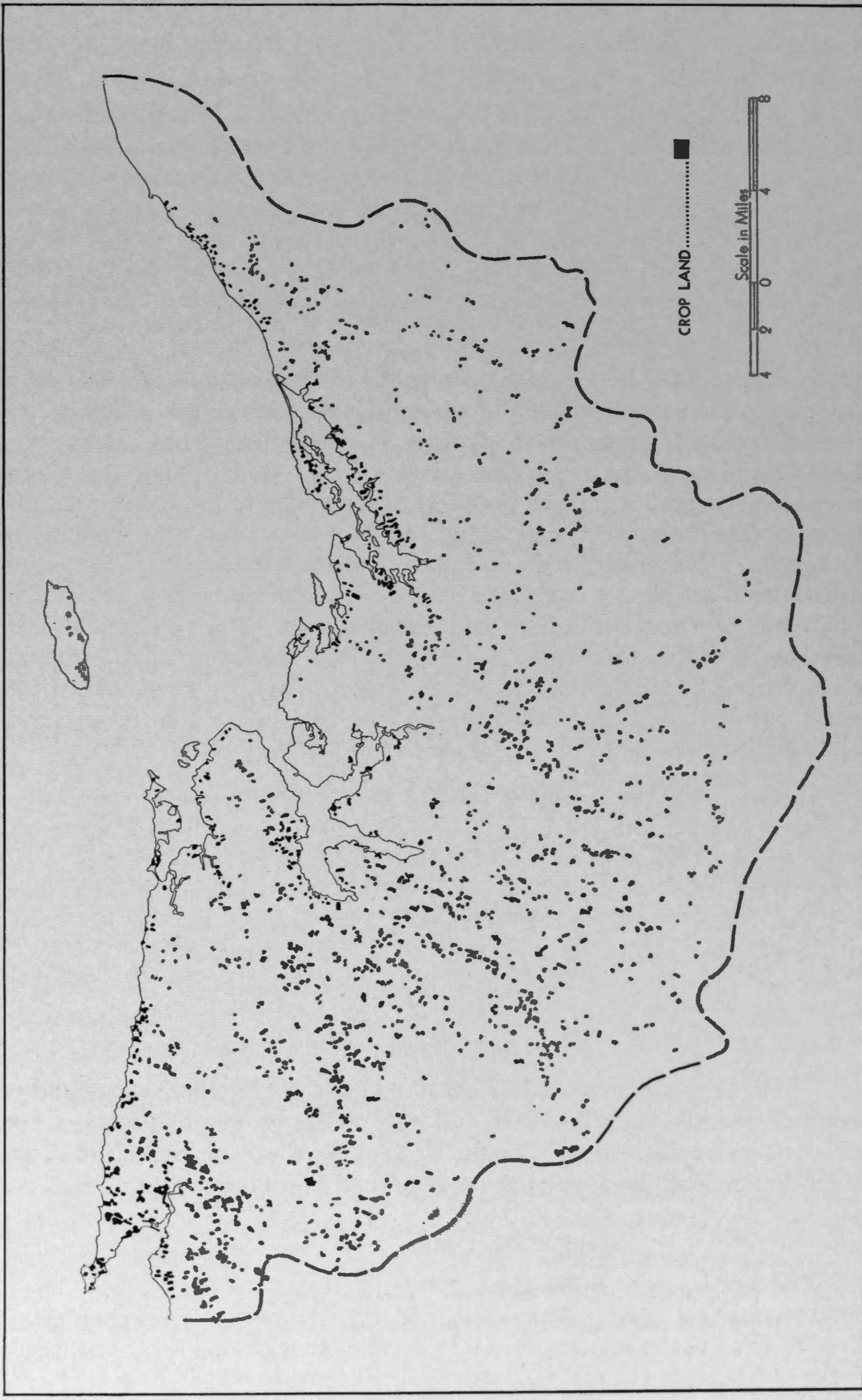

Figure 8. The distribution of crop land.

River eastwards, including Big Island and the lower part of Barney River Valley, where the Merigomish soil association seems to be particularly suited to this type of utilization.

Peas, corn, brussels sprouts, and pumpkin are grown in amounts that are significant to the region itself. In the case of peas and corn the region is the major single source of its own requirements, pea production having been stimulated by the establishment of a canning factory at Pictou.

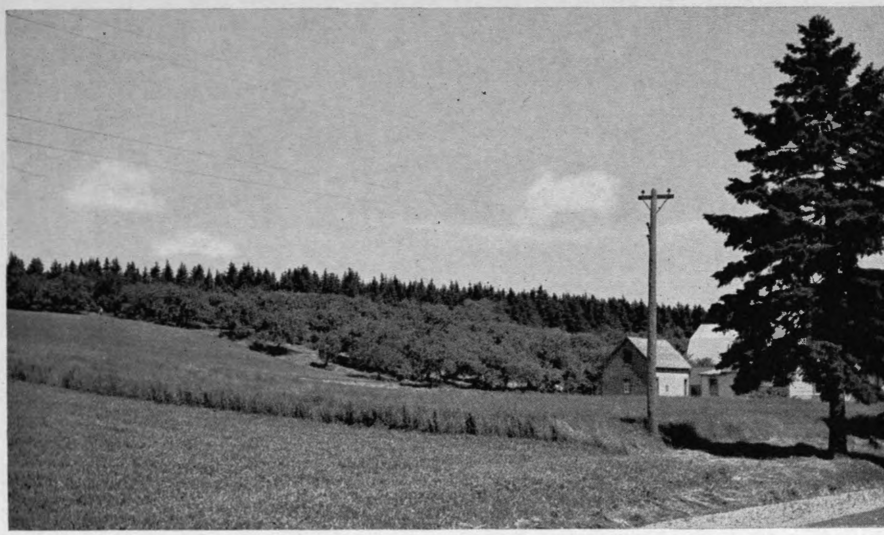

Figure 9. Orchard on the west side of West River near Durham.

Orchards are a notable feature on the slopes of the lower reaches of the major river valleys, particularly of West River. Apples are by far the leading fruit, followed by plums and, to a much lesser extent, pears and cherries[1].

PASTURE LAND

DISTRIBUTION

After forest and woodland, most of the land in the region is devoted to pasture, which occupies some 11 per cent of the total area. It has a wide distribution throughout the coastal plain, with the exception of the Abercrombie and Roaring Bull peninsulas but most striking are the extensive pasture areas in the east of the region, more particularly on the broad, moderate, seaward facing slopes of the Pictou-Antigonish Highlands (Figure 10).

The large areas in pasture in the east are mainly on soils of the Merigomish and Woodbourne Associations. In this area some of the farmers

[1] *See* Heighton, V. A.: The Market for Fresh Fruits and Vegetables in the New Glasgow Area of Pictou County; Nova Scotia Dept. of Agriculture and Marketing, Halifax, 1951.

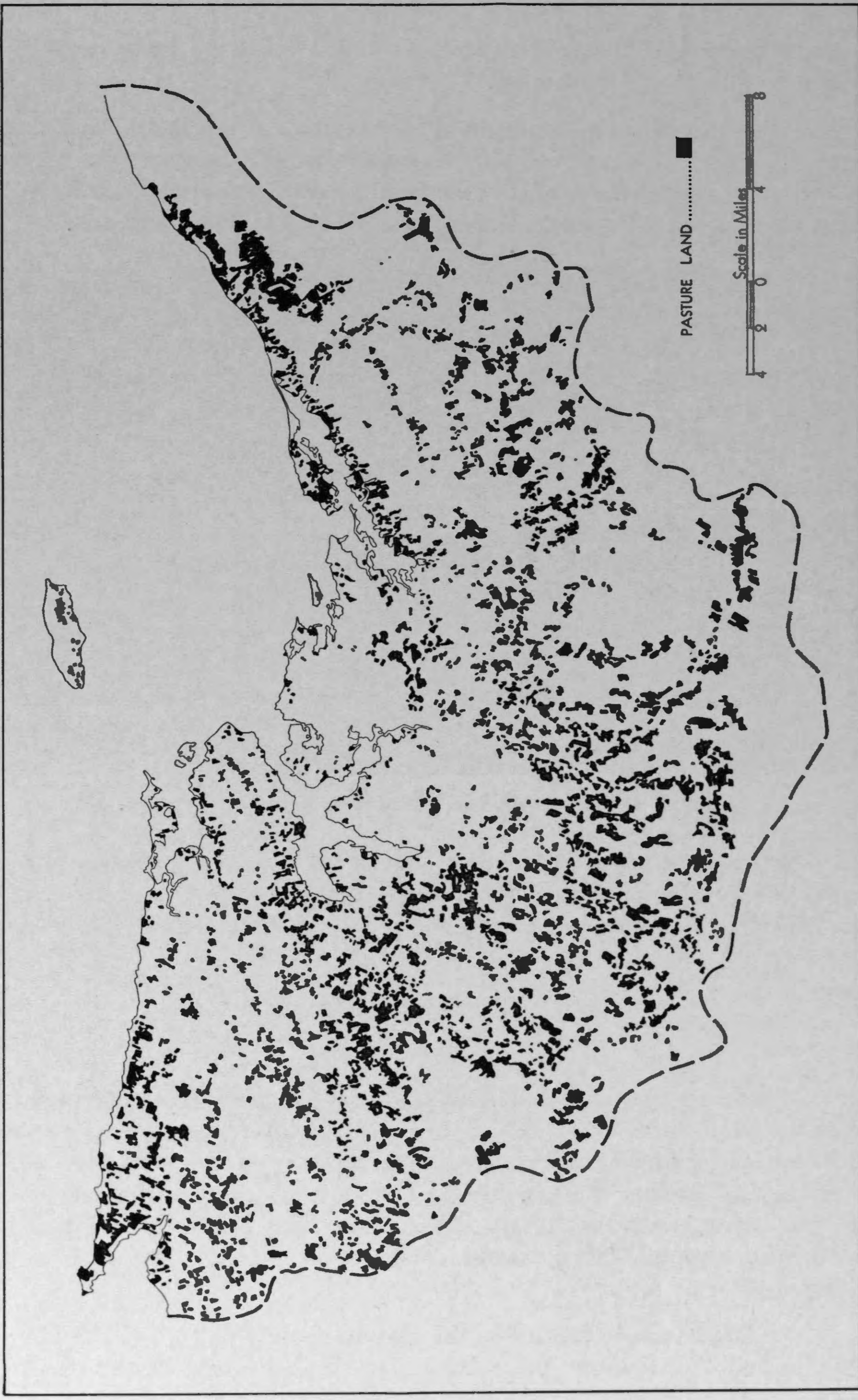

Figure 10. The distribution of pasture land.

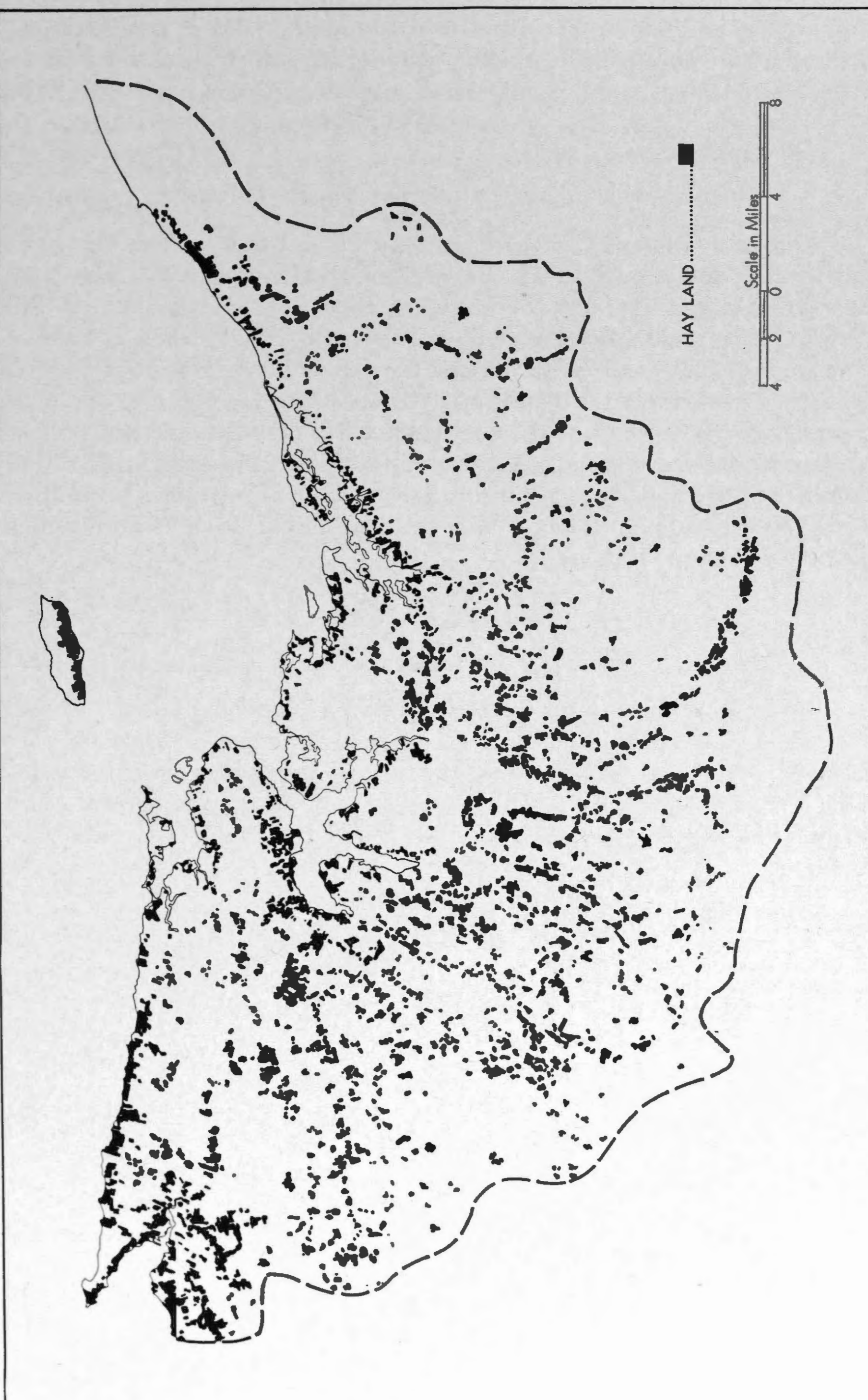

Figure 11. The distribution of hay land.

derive part of their income from fishing and the land is not, therefore, utilized as intensively as it might otherwise be. Where the soil is of the Woodbourne Association, rapid run-off would cause erosion on the steeper slopes and hence such areas are limited to pasture. The same is true of the Nappan Association.

ANIMALS

The main animals raised are dairy cattle and sheep. The former are particularly dominant in three areas—the Cape John peninsula, the Scotsburn-West River area, and the Merigomish-Big Island coastal area. This distribution is undoubtedly related to the presence of creameries at Tatamagouche, Scotsburn, and Stellarton and the demand from the urban dwelling industrial workers of the towns at the nucleus of the region. Sheep are concentrated in the area to the northeast of Big Island on the slopes of the highlands and Barney River Valley. They are also present in significant numbers in the Cape John peninsula and on some of the hillier lands in the south of the region. They are noticeably absent from the immediate vicinity of Pictou Harbour.

HAY LAND

DISTRIBUTION

About 7 per cent of the land of the region is devoted to hay. This is the third major use to which the land is put in the region and in some parts forms a continuous and extensive feature of the landscape (Figure 11). This is particularly true of the coastal fringes on the edge of the region and on the middle slopes of the major valleys and the hills within the coastal plain.

Figure 12. Cutting hay on Mount Thom.

There is thus a reasonably close relationship between the pattern of hay land distribution and that of the pasture land, and hay land is concentrated in the same areas as animal raising. It is particularly noticeable that the hay lands occupy the most level land and follow the shore in marine locations, whereas the grazing lands are on the upland side of the hay lands. This pattern is especially noticeable in the Cape John peninsula.

THE FARMSTEADS

In order to try to measure objectively the relative success made of the use of the agricultural land, the farmsteads were rated on the basis of size and condition. The farm dwelling was assessed separately according to these two factors, a number denoting its size and a letter its condition, being indicated on the aerial photographs according to the following scales:

Size: 5 and over—mansion
- 4 —over 2 storys, with 8-10 rooms
- 3 —2 storys or over, 6-8 rooms
- 2 —1½ storys or 2 storys, 5-6 rooms
- 1 —1 or 1½ storys, 4-5 rooms

Condition: A—excellent; B—good; C—fair; D—poor; x—dilapidated; o—shack (no assessment of size was made in these cases)

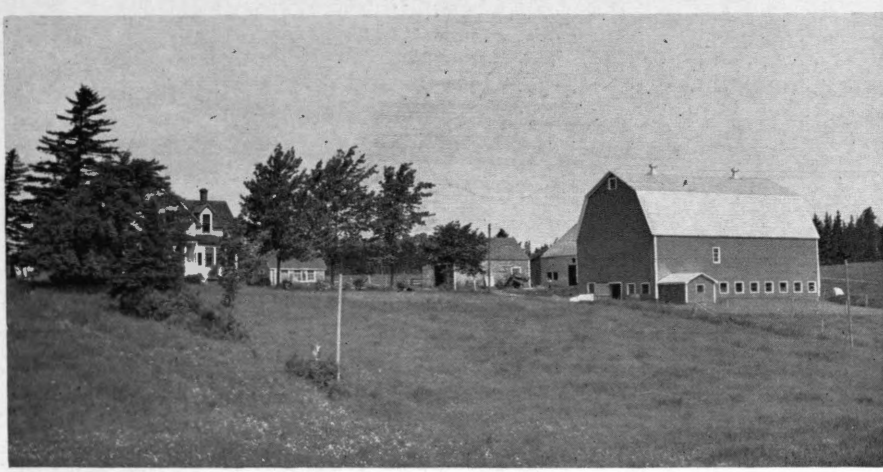

Figure 13. A 2B5 farmstead.

In assessing the over-all condition, attention was paid to the condition of the basement and foundation, construction, roof, window frames, verandahs, paintwork, walks, and grounds. The barn and other outbuildings directly connected with agricultural operations were considered together, and a number allocated to the combined condition and size according to a scale running from X (barn hardly larger than an outbuilding) to 6 (very large barns and numerous outbuildings or large-scale dairy farms). Thus, a complete farmstead classification might appear as 3C4—3 denotes the size of the house, C the condition of the house, and 4 the size and condition of the barn.

Later, in the office, the assessments of houses and barns and outbuildings were combined and rearranged into three broad groups—above average, average, and below average.

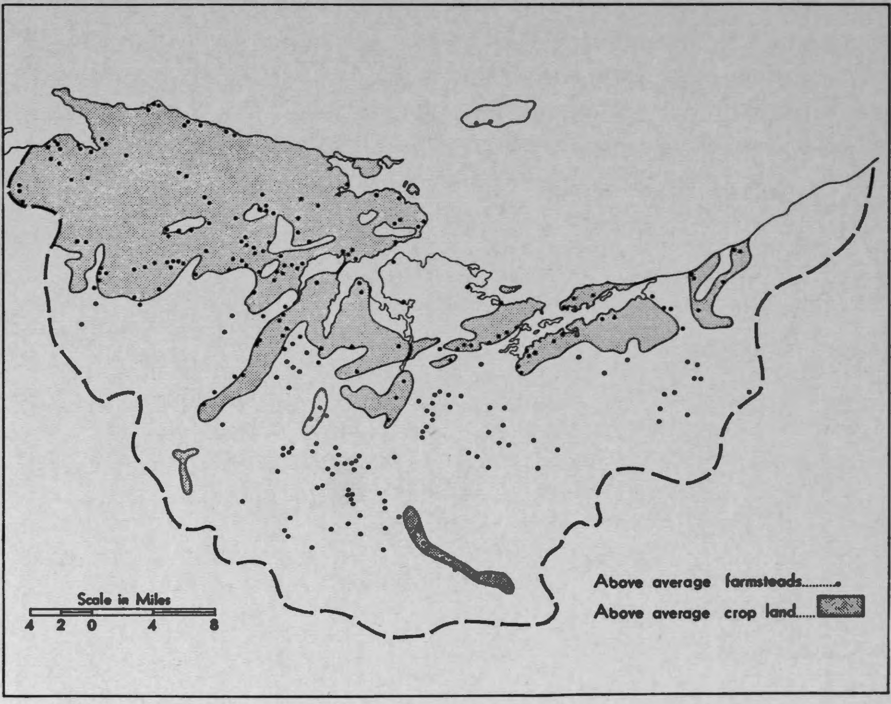

Figure 14.

Figure 14 shows the location of above average farmsteads in relation to above average crop land and indicates a reasonably positive correlation between the two.

In addition, in the field, the location of abandoned farmsteads were plotted. Although the resulting map (Figure 15) indicates only those abandoned buildings that were visible at the time the survey was made, it bears some analysis. It is necessary to remember that empty farm buildings do not always indicate farm abandonment as the farm land that the empty buildings originally served may have been taken over by a neighbouring farmer in the process of farm enlargement. This was generally the case where..empty or ruined buildings were observed on the good agricultural soils. On the other hand, there were more empty farmsteads on the poor agricultural soils and the land around them was usually used for pasture or had reverted to scrub woodlands.

However, the two factors of soil quality and farm enlargement were not sufficient alone to explain the distribution of abandoned farmsteads. The concentration of such farmsteads on the northern flanks of the Cobequid Mountains, for example, occurs on the soils of the Westbrook Association,

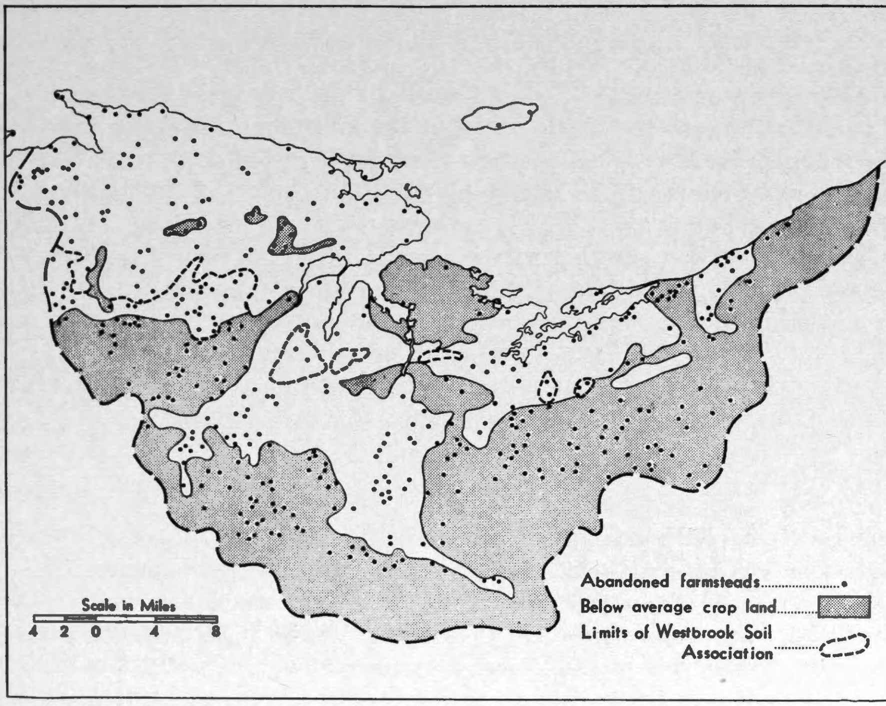

Figure 15.

which is, generally, average crop land. But in this particular area the topography is rougher than in the other parts of the region where this soil association is found. Not only is it, therefore, difficult to cultivate, but erosion, which in places is severe, has limited its continued intensive use and abandonment has taken place.

Thus, Figure 15 indicated not only a general movement from the lands due to the farm enlargement that results from increased use of machinery, but also a finer adjustment of land use to soil type and topography.

CONCLUSION

There is little doubt that these processes will continue to produce changes in the pattern of the rural geography of the region. That some of the early settlement was geographically maladjusted was as much due to the then unknown diversity of the physical characteristics of the region as to the European traditions of the settlers, and readjustment is still taking place.

The traditions of the people, however, remain a dominant factor in the types of crops grown. As these change, so the better agricultural lands are likely to be used more intensively and for a wider variety of crops, particularly small fruits and vegetables.

From the work carried out during 1950-51 it is also possible to draw some conclusions on the field-by-field survey technique as it applies to one small part of Canada. For the wealth of information that it can produce and for an intimate knowledge of a small area it is probably unsurpassed. But not only is the process of carrying out the survey a lengthy one but the mapping and interpreting of the results is even more lengthy. In the survey reported upon, 78 man-field days were required to record the observed data, quite apart from interviews. Unless as much field assistance is available as was afforded to the Land Utilization Survey of Britain, detailed studies would be best confined to small areas faced with special problems or conditions. For mapping land use on a scale of 1:1M, as recommended by the Land Use Commission of the International Geographical Union or for a more rapid preparation of a Land Use Map of Canada, quasi-reconnaissance survey methods will have to be used.

RÉSUMÉ

La région de New Glasgow fait partie de la plaine Cumberland-Pictou qui s'étend entre le détroit de Northumberland, les monts Cobequid et les hautes-terres d'Antigonish. Cette région jouit d'un climat continental humide (courte saison estivale), d'où la brièveté de la période sans gelée, l'une des principales restrictions climatiques au développement agricole. Les sols varient beaucoup d'une ferme à l'autre; ils s'échelonnent à partir de ceux de bonne qualité jusqu'à ceux en dessous de la moyenne.

Le peuplement commença en 1767 avec l'arrivée de plusieurs familles de colons des états du Maryland et de la Pennsylvanie et se poursuivit par une immigration à peu près exclusive de colons venant d'Écosse. L'étendue colonisée s'étendit des rivages du port de Pictou pour couvrir progressivement toute la région aux environs de 1820.

Les limites présentes des terres à foin, des pâturages, des zones forestières et des fermes sont indiquées et illustrées par des cartes d'environ 16 milles au pouce. D'après ces cartes on remarque d'une façon assez évidente que l'ajustement du peuplement au milieu physique continue de progresser.

L'enquête sur le terrain qui a servi de fondement à cet article démontre que ce serait une perte de temps, voire impossible, que de procéder au relevé de chaque champ et de chaque ferme, sauf pour de petites régions à problèmes bien définis.

THE HINTERLANDS OF SAINT JOHN

Marion H. Matheson[1]

In the National Ports Survey, 1931-32, the author, Sir Alexander Gibb, speaking of the Canadian transportation system, remarked: "The principal ports are not, as in many countries, founded on the service of a great exporting or consuming area in their immediate neighbourhood . . . They exist primarily as the connection between land and sea in the long route that the exports of Canada must take to reach their markets . . ."[2].

The seaports of Canada still function as transfer points at the ends of the east-west routes across the country, collecting exports and distributing imports throughout the whole populated area. The hinterland of Saint John is probably fairly typical of the hinterland of all our national ports.

The term "hinterland", as used by geographers, has been defined in various ways. In speaking of seaports, however, it is used to describe those areas from which a port draws its exports and to which it sends its imports. These areas do not usually coincide, and so it is also usual to speak of the "export hinterland" or the "import hinterland" as well as the "hinterlands" for various types of commodities. Together, all these areas comprise the hinterland of the port, the area throughout which the influence of the port extends.

Within the hinterland of a port, certain areas may contribute and receive a greater volume of goods than others, or the influence of a second port may be important. To determine the first, statistics on the volume of each shipment between the port and its hinterland would be required. To determine the second, it would be necessary to define exactly the hinterlands of all competing ports. In the following discussion, no attempt has been made to define the zones within the hinterland except on the basis of the number of shipments and variety of goods carried, nor has the competitive influence of other ports been considered in detail because the limits of their hinterlands are not known.

There are several general characteristics of the hinterland of Saint John that may be taken as typical of those of the major ports of Canada. In an east-west direction, the hinterland extends from the Atlantic to the Pacific, with a core extending from the Maritime Provinces to the Rocky Mountains. One reason for this is geographical; the great producing and consuming areas of Canada lie in the interior of the country, at some distance from the seaboard. The breadth of the hinterland, however, is typical of those served by liners[3] whose cargoes of light-weight but high-cost commodities can be economically transported considerable distances

[1] Marion H. Matheson, B.A., M.A., British Columbia, was leader of a Geographical Branch field survey party to southern New Brunswick in 1953. This report is a Branch contribution to the International Geographical Union's Commission on Industrial Ports.
[2] Gibb, A.: National Ports Survey, 1931-32; Ottawa, 1932, p. 9.
[3] A liner is a dry cargo carrier on a regularly scheduled service. It may or may not carry passengers.

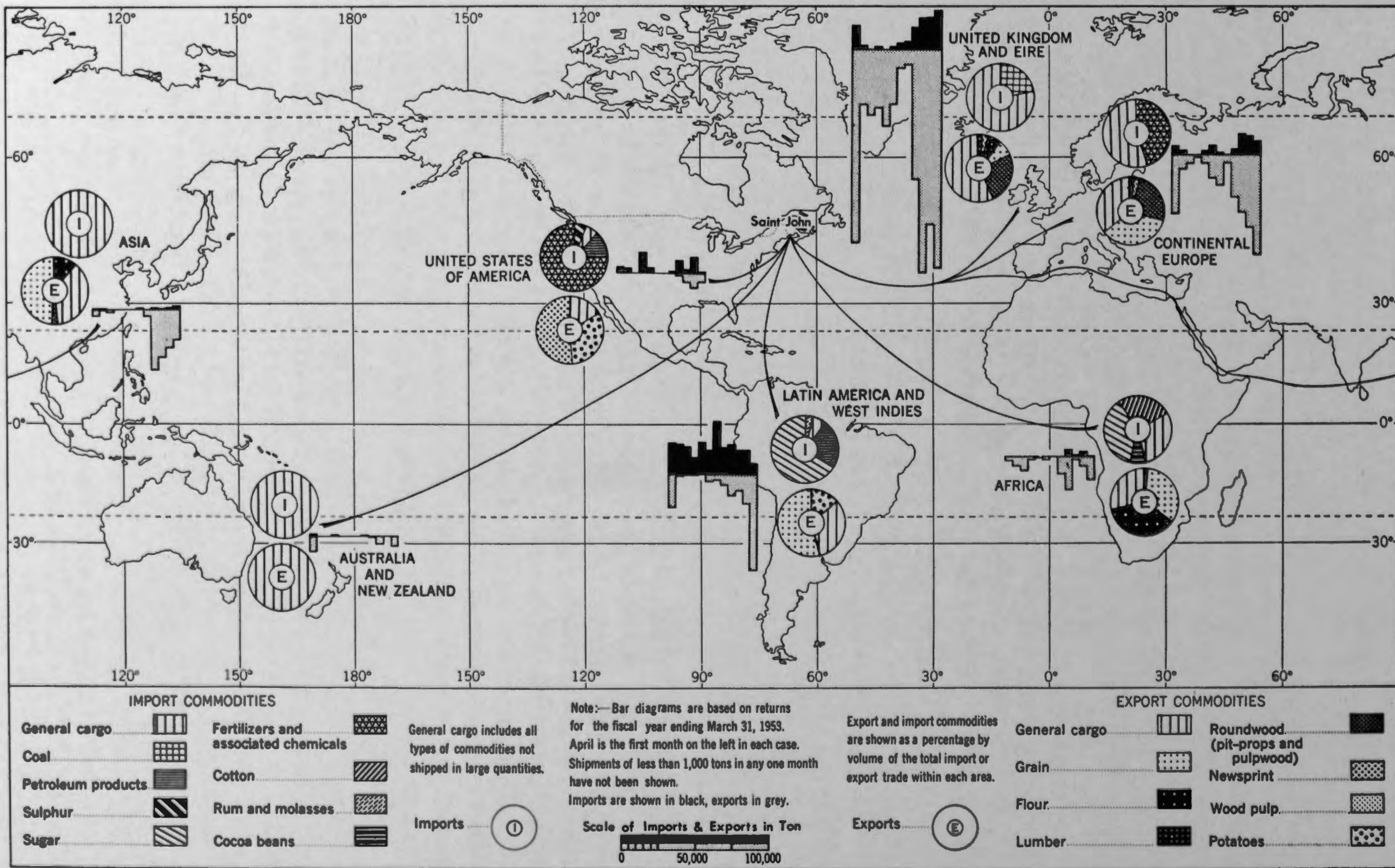

Figure 1. Trade between Saint John and seven areas of the world, 1952-53.

overland. Morgan has defined these as "liner" hinterlands[1], and they are found in other countries as well as in Canada. On the periphery of the main hinterland of Saint John there are isolated areas either exporting or importing through the port, possibly an indication that competition of other ports is particularly strong. In a north-south direction the hinterland is limited to the well-populated areas of Canada.

WORLD TRADE

The United Kingdom and Eire are the best customers of the port of Saint John (Figure 1), the total volume of goods moving between them and the port amounting to nearly 1,000,000 tons in 1952-53[2]. The next greatest customers were in Latin America (including the West Indies) and continental Europe, respectively, although each supported trade of less than 400,000 tons in volume. Below these, in volume of trade, came the continent of Asia, with slightly over 150,000 tons, Africa, with slightly less than 100,000, the United States of America, with about 70,000, and Australia and New Zealand, whose combined volume amounted to 30,000 tons. The United Kingdom and Eire, therefore, account for nearly 50 per cent of the foreign trade of Saint John. Trade with the United States of America may seem unusually low, but Saint John lies away from the main Canadian-United States trade routes.

The total volume of trade in the period under review amounted to 2,071,393 tons, of which 1,570,833 were export and 500,560 were import cargoes. The only areas from which Saint John imported more than was exported were the United States of America and Latin America. The busy season for Saint John occurs when the St. Lawrence ports are ice-bound, usually from December to April, inclusive. From May to November 1952, Saint John exported 360,084 tons and imported 210,481 tons, or about 25 and 40 per cent of the annual exports and imports, respectively.

The principal exports of Saint John are grain, lumber, pit-props, pulpwood, logs, newsprint, flour, potatoes, and general cargo[3]. The main import cargoes are raw sugar, petroleum products, fertilizers, and general cargo, including such products as wool and tea. The importance of these commodities in the trade with each area varies considerably (Figure 1), depending on geographic and other factors in the countries concerned.

The proportion of the export and import trade with each area in relation to the total trade of the port is as follows:

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[1] Morgan, F. W.: Seaport Hinterlands; Indian Geographical Society Silver Jubilee Souvenir, and N. Subrahmanyam Memorial Volume, Madras, 1952, p. 33.

[2] Data for the following sections are based on the period April 1, 1952, to March 31, 1953. The Customs and Excise Division of the Department of National Revenue, from which much of the material was obtained, keeps its records on the basis of the fiscal year. Furthermore, use of the fiscal year as a base permitted the study of a full winter season rather than parts of two seasons, which would be the case if the calendar year were the base.

[3] "General" cargo is composed of small quantities of any commodities, including those normally carried in bulk; much general cargo, but not necessarily all, is composed of manufactured articles.

TABLE I

Trade of Saint John with Seven Areas of the World

Area	Volume of exports from Saint John (per cent)	Volume of imports to Saint John (per cent)
United Kingdom and Eire	55·2	24·7
Continental Europe	18·3	12·0
Latin America	9·6	46·7
Asia	8·7	2·7
Africa	5·3	2·9
Australia and New Zealand	1·5	1·3
United States of America	1·4	9·7
	100·0	100·0

Much of the so-called Latin American trade is with British Guiana and the British West Indies, that of Asia with India, Pakistan, and Ceylon, and that of Africa with the Union of South Africa. It will thus be seen that the Commonwealth countries as a whole are extremely important in the world trading activities of the port of Saint John.

EXPORT HINTERLANDS

The export hinterland of Saint John comprises those parts of Canada from which goods are drawn for export. There are two main types of export commodities: bulk goods, usually primary products, and a variety of goods, mainly manufactured, which are classed as general cargo. The areas from which the two types are drawn overlap, but there are certain parts of the hinterland in which the export of one or the other predominates. There is further differentiation within these general areas according to the type of bulk or general cargoes being considered.

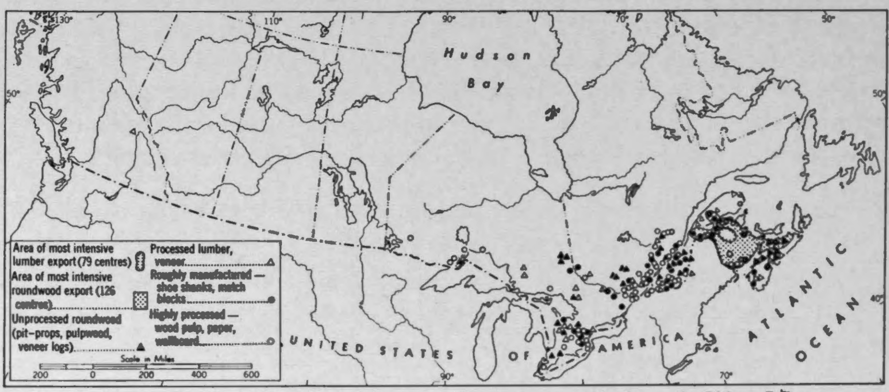

Figure 2. Points of origin of forest products exported through Saint John.

FOREST PRODUCTS

The port of Saint John first became prominent as a centre for the export of forest products, and these still comprise an important part of its export trade. Today, however, the forest products hinterland extends far beyond the boundaries of New Brunswick (Figure 2), and is continuous from Nova Scotia almost to the eastern boundary of Manitoba. Within this hinterland, highly processed, more expensive goods are moved the greatest distance to Saint John for export.

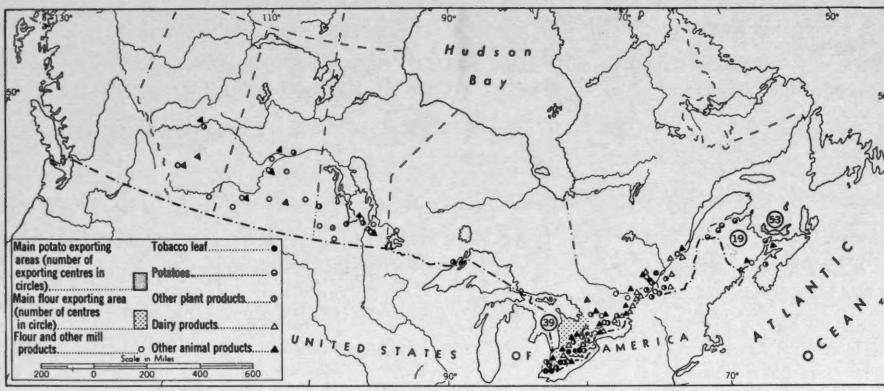

Figure 3. Points of origin of agricultural products exported through Saint John.

Roundwood, being the least expensive type exported, originates in the areas most accessible to the port (Figure 2). Spruce pit-props and pulpwood are produced for export throughout the populated areas of New Brunswick and eastern Quebec almost to the St. Lawrence River, but much of the Nova Scotia output is probably exported via Halifax. Aspen logs and hardwood veneer logs are shipped greater distances, from the northern parts of New Brunswick, Ontario, and Quebec, and from southern Ontario, respectively.

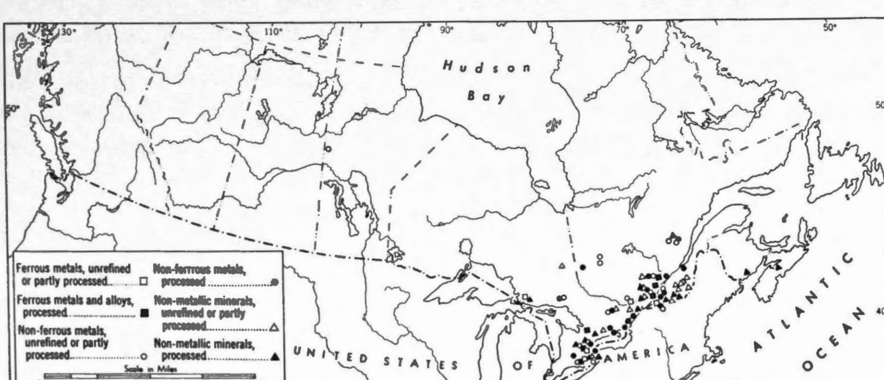

Figure 4. Points of origin of mining and metallurgical products exported through Saint John.

Lumber is a slightly more costly product and can be carried longer distances. For this reason, it is exported from Nova Scotia, Quebec and Ontario. Hardwood or special sizes of lumber may be carried farther, even from British Columbia.

Most of the output of simple wood manufactures such as match blocks and shoe shanks comes from areas farther west than the main centres of roundwood and lumber exports.

Highly processed forest products such as wood pulp, pulpboard, and paper are produced only where forest, power, and labour resources occur in close contiguity. Such products, therefore, originate in limited areas, but their nature enables them to be carried long distances to the seaboard. Goods of this type are exported from a few points in New Brunswick, including, during the winter, the Bay of Chaleur, but most exports of this type originate in Ontario and Quebec.

The Maritime Provinces are the main source of low-cost, high-volume exports. The volume of such goods fluctuates widely from year to year, whereas the smaller volume of higher priced commodities from central Canada is comparatively constant.

AGRICULTURAL PRODUCTS

Saint John developed as a modern winter port for the export of grain, and it was with this development that the great expansion of its hinterland took place. The agricultural products hinterland today falls into three distinct parts, each well defined areally, and each with its own characteristics (Figure 3).

In the Maritime Provinces, the export hinterland is defined by the potato-growing areas of New Brunswick, and by Prince Edward Island. Saint John, being an accessible port, possessing the necessary storage facilities for handling the crop, and busy with shipping during the season when potato shipments occur, has become an important exporting point. Other agricultural products from the Maritimes are of minor importance.

The hinterland in central Canada, lying in the St. Lawrence-Great Lakes basin, exports the greatest variety of goods. Flour is exported from most of the larger cities and from many smaller centres in southern Ontario, where milling has long been important. Dairy products and tobacco leaf are exported from those areas in both Ontario and Quebec that have become noted as centres of production (Figure 3). Other agricultural products exported from this area include seeds, vegetables, fruit, beef, and leather. No potatoes are exported.

A much smaller variety of goods is exported from the Prairie Provinces but, because of the quantities of grain involved, it is probable that this area produces the greatest volume of exports. The exact origins of grain exported through Saint John cannot be determined, because the shipments pass through so many hands. Grain usually moves eastward to the lakehead from the vicinity of the Alberta-Saskatchewan border. The extent of the hinterland in the Prairie Provinces is defined by the larger centres in all three provinces. Small quantities of seeds, leather, and other animal products are exported.

The export hinterland for agricultural products reflects the general pattern of agriculture in Canada east of the Rocky Mountains. In particular it illustrates one of the great problems besetting both the Canadian agricultural and transportation industries—the necessity of shipping bulky, low-cost products for great distances to export points.

MINING AND METALLURGICAL PRODUCTS

Few mining products are exported from Saint John in completely raw form, so that the export hinterland is determined by considerations of power and labour resources as well as by the situation of mineral resources. The core of this hinterland, therefore, is situated along the Quebec city-Windsor axis and extends into the Canadian Shield (Figure 4)[1].

There are a few exporting centres outside the main hinterland such as Flin Flon (Figure 4), Arvida, and the Maritimes; the products exported from each are zinc spelter, aluminium, and limestone and gypsum, respectively.

The hinterland in central Canada again reflects the general pattern of the mining and metallurgical industries; the primary producing areas such as Sudbury or the Eastern Townships, and the secondary producers in districts accessible to the former. Because the greater part of Saint John's world trade is with the United Kingdom and continental Europe, however, the chief exports of the port are not the ferrous metals but aluminium and asbestos. Both are produced in areas accessible to Saint John. The most important parts of this hinterland, therefore, are those that lie in the valleys of the lower St. Lawrence and its tributaries.

FISH AND OTHER PRIMARY PRODUCTS

Because of its greater distance from the North Atlantic fishing grounds, Saint John is not in itself a great fishing port in the sense that Halifax is. Some fish canning and processing is carried on at Saint John, but the port functions mainly as a collecting and exporting centre for the Bay of Fundy and Northumberland Strait fisheries (Figure 5). The principal species caught in these waters is herring, which in the dried and smoked or canned forms is particularly desired in tropical countries. These products play an important part in maintaining the year round export trade of the port of Saint John.

[1] The explanation of the terms used in Figure 4 is as follows: 1, unrefined—mineral products exported in the form in which they left the mine; 2, partly processed—minerals that have been transformed into ingot, matte, or spelter form for further metallurgical processing; 3, processed—minerals that have been refined suitably for manufacture into consumer goods (sheets, strips, etc.).

The core of the fish products hinterland is the lower Bay of Fundy, the site of one of the great sardine fisheries[1] of the world. Most of the catch is processed where landed, but small quantities are sent to Saint John for processing. By-products such as oil and meal are also exported from this area. The Northumberland Strait fishery is not so highly developed. Herring and alewives (a similar species) from this area are usually exported in dried, salted, or smoked form. Small quantities of dried salt cod and canned lobster from other fishing grounds are also exported.

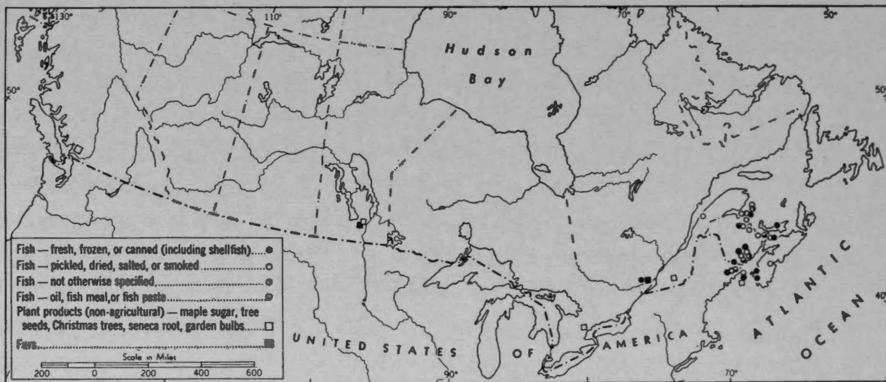

Figure 5. Points of origin of fish and other primary products exported through Saint John.

A few miscellaneous primary products, including furs, tree seeds, and garden bulbs, are exported through Saint John. Their very high value in proportion to their weight makes long-distance rail shipment economically feasible.

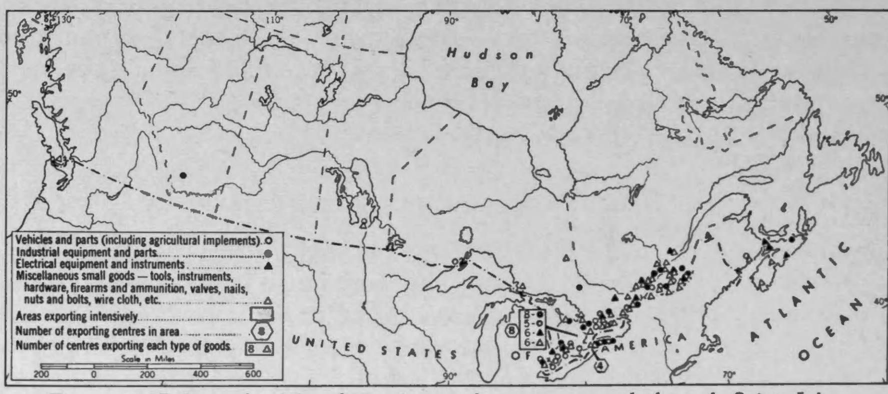

Figure 6. Points of origin of metal manufactures exported through Saint John.

METAL MANUFACTURES

Metal manufactures are fairly typical of the manufactured goods that comprise the greater part of general cargo. Two factors determine the extent of the hinterlands for such cargo; firstly, they are chiefly produced

[1] The sardines produced in this area are immature herring.

in the densely populated areas of central Canada, where the manufacturing industries are concentrated, and secondly, their small bulk and high value make possible their export from comparatively distant ports.

Metal manufactures are typical in that the majority of exporting points are located along the Quebec-Windsor axis (Figure 6). Vehicles and agricultural implements are mainly exported from that part of southwest Ontario centring on Windsor, and heavy industrial equipment from the Toronto-Hamilton area and the Niagara peninsula.

Two types of metal goods exports do not follow this tendency. Specialized types of equipment are sometimes exported from the districts where they are used, as, for example, mining equipment from Kirkland Lake and New Glasgow, or shoe-making machinery from Frankford, Ontario. Small electrical goods and small metal-wares are produced in many communities across the country, and may be exported from any area. This type of export predominates in the Maritime Provinces.

CHEMICALS AND CHEMICAL PRODUCTS

The raw materials for the industries making goods of this type are almost all themselves the products of large industries. For this reason, exports of the types under consideration are more than usually limited to the Quebec-Windsor area (Figure 7). In this category are rubber, plastics, chemicals, and cellulose goods, which are manufactured from raw materials produced at Sarnia, Shawinigan Falls, and points in the St. Lawrence Valley. Glass, china, paints, inks, and other consumer goods are usually produced in areas where a large local population has provided a market.

Figure 7. Points of origin of chemicals and chemical products exported through Saint John.

A few goods of this class, such as pharmaceuticals or aluminium paste, are exported from areas outside the main hinterland. In Saint John itself, the fertilizer plants, which import raw materials cheaply by sea, export some processed and packaged products in the same way.

MISCELLANEOUS MANUFACTURED GOODS

This category includes a great variety of goods, including such things as textiles, clothing, footwear, foods, and beverages. Most are produced in the manufacturing belt from Quebec to Windsor (Figure 8).

In general, hydro-electric power sources in such areas as the Ottawa Valley, the edge of the Canadian Shield, or the Eastern Townships have favoured the development of textile plants. Plants producing clothing have also become established in their vicinity. Manufacturers of footwear, on the other hand, tend to be located in areas where supplies of leather are obtainable.

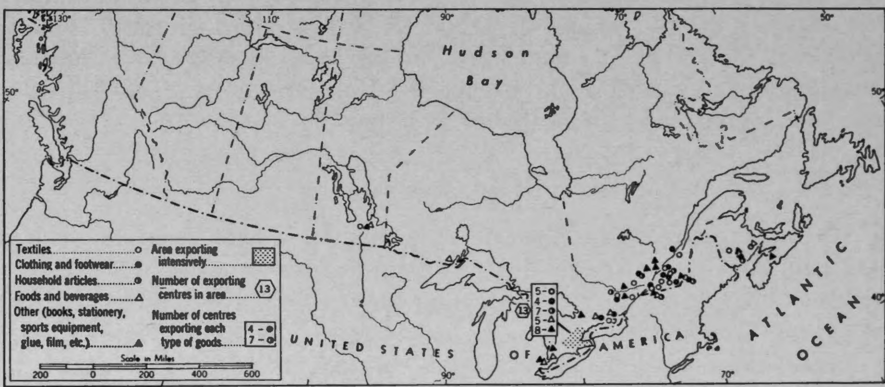

Figure 8. Points of origin of miscellaneous manufactured goods exported through Saint John.

Many of the goods included in this category, however, are produced where a large population provides both labour and markets. Central southern Ontario exports a greater variety of such goods than does any other area in Canada (Figure 8).

Proximity to the seaboard is the factor that has encouraged manufacturers of textiles and other goods to establish themselves in the Maritime Provinces. Saint John exports the products of those located in New Brunswick and, because of coastal shipping connections, those in western Nova Scotia also.

THE EXPORT HINTERLAND

The combined export hinterland extends as far west as the Rocky Mountains and falls into the same three divisions as do some of the commodity hinterlands (Figure 22). In the west, the Prairie Provinces export bulk agricultural products, but few manufactured goods. In central Canada, there is a broad area from which bulk quantities of forest and mineral products are exported. Within this central area is a core exporting in quantity both bulk agricultural products (tobacco and flour) and numerous manufactured goods. In the Maritime Provinces there is a fairly broad hinterland exporting large quantities of bulk forest products. Here, too, there is a core area, centred on Saint John and the lower Bay of Fundy, but it is more notable for the variety than for the quantity of goods it exports.

The most notable feature of the export hinterland of Saint John, and one that characterizes all the national ports of Canada, is that the area from which the greatest quantity of bulk cargoes is derived lies at its farthest extremity, in contrast with the conditions prevailing in the hinterlands of, for example, European and Australian ports.

IMPORT HINTERLANDS

General cargo, largely manufactured goods, forms an important part of the import commodities entering Saint John. These products are in demand both in the densely populated areas and in those more sparsely populated areas where local manufacturing is not well developed. The import hinterlands of Saint John, therefore, exhibit the same general patterns as the export hinterlands, but are somewhat broader in extent.

TEXTILES

Some of the most widely distributed imports through Saint John are probably textiles (Figure 9). These may travel anywhere from Newfoundland to Vancouver Island, and to many communities in each province. Large centres import finished goods for wholesale distribution, and raw materials for their own textile industries. Many small centres import finished goods directly for retail sale and other "mill towns" import raw materials.

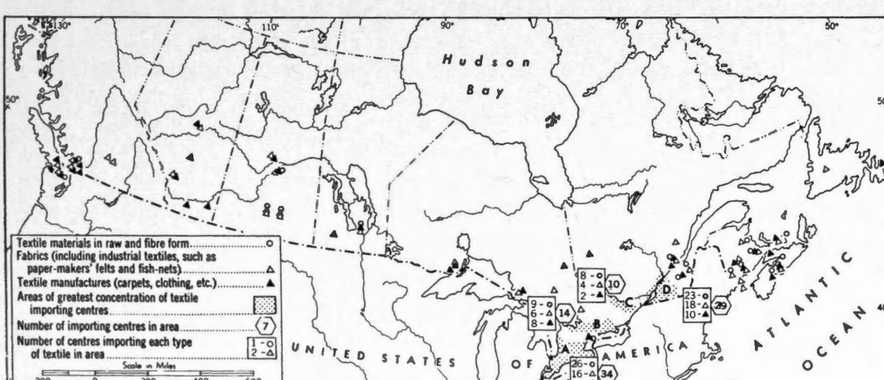

Figure 9. Destinations of textiles imported through Saint John.

From Manitoba westward, a variety of fabrics and other goods for retail sale is imported by the eight largest cities. Some small centres import directly, chiefly carpets and fabrics. There are few imports of raw materials, because the western provinces have few textile mills.

Imports by the outlying communities of Ontario and Quebec resemble those of the smaller western centres.

The core of the textile-importing hinterland, comprising 74 per cent of all such importing centres in the country, is located in the St. Lawrence-Great Lakes lowland. Textiles are imported into this area for consumer purposes and nearly 70 per cent of the centres import raw materials for the Canadian textile industry as well. Importing centres are concentrated in four zones within the area, of which Zone A imports most intensively. Over 68 per cent of its centres import consumer goods and 75 per cent import raw materials. Zone B does not have such a large population or textile industry, and imports less intensively. In zones C and D, 80 per cent or more of the centres import raw materials. Zone D has a large population and imports consumer textiles nearly as intensively as does southwestern Ontario.

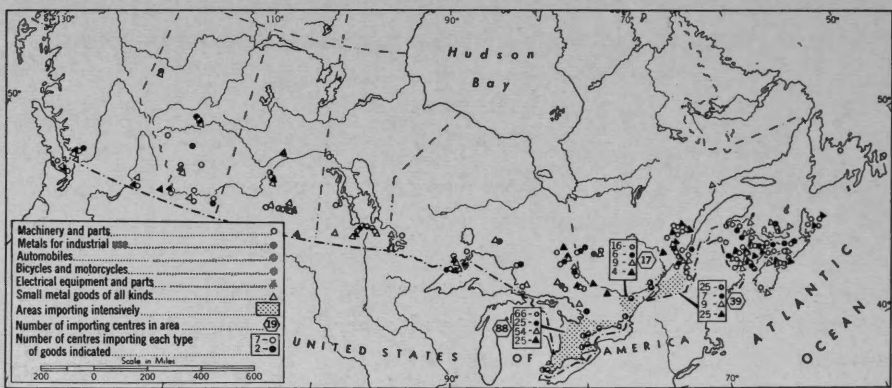

Figure 10. Destinations of manufactured metal goods imported through Saint John.

The larger cities of the Atlantic provinces import consumer textiles for distribution to other centres; the smaller mill towns may import raw materials directly. In addition to the usual types of textiles, this area imports fishnets, sacking, and raw materials for making nets and ropes.

The breadth and intensity of the textile hinterland reflects the importance of the United Kingdom and Europe, all textile exporters, in the trading of the port of Saint John.

MANUFACTURED METAL GOODS

The contrast between import and export hinterlands is well demonstrated in the case of manufactured metal goods (cf. Figures 6 and 10). Whereas exports come from a small area of the Maritimes, the Quebec-Windsor manufacturing area, and from scattered points in the west, imports go to Newfoundland, broader areas in the Maritimes and central Canada, and to many communities in western Canada. Even within the Quebec-Windsor area, more communities import such goods than export them.

Machinery and machine parts are imported by towns all across the country, particularly by industrial and mining areas. Mining machinery is imported into Cape Breton Island, Sudbury, and the Quebec-Ontario gold fields, flour-milling machinery into western Canada, and paper-making machinery into New Brunswick, but the manufacturing belt is by far the greatest importing area. Automobiles are imported by a few large centres for further distribution.

Partly processed metals for industrial use are also widely imported, principally, again, by mining and manufacturing areas. Perhaps because of the competition of Canadian goods, electrical equipment and small metal goods are imported by fewer centres than are machinery and industrial metals.

As in the case of textiles, the breadth of this hinterland probably reflects the prominent position of the United Kingdom and continental Europe in the manufacturing of machinery and metal goods.

GLASS, CERAMIC PRODUCTS, AND PARTLY PROCESSED MINERALS

The hinterland for these products is similar in its general pattern to that of metal goods (Figure 11). Most of the ceramic goods imported (including china, earthenware, and vitrified ware) are in the form of consumer goods. Some of the glass, which is imported in sheet form, is intended for industrial use, as are all the partly processed minerals.

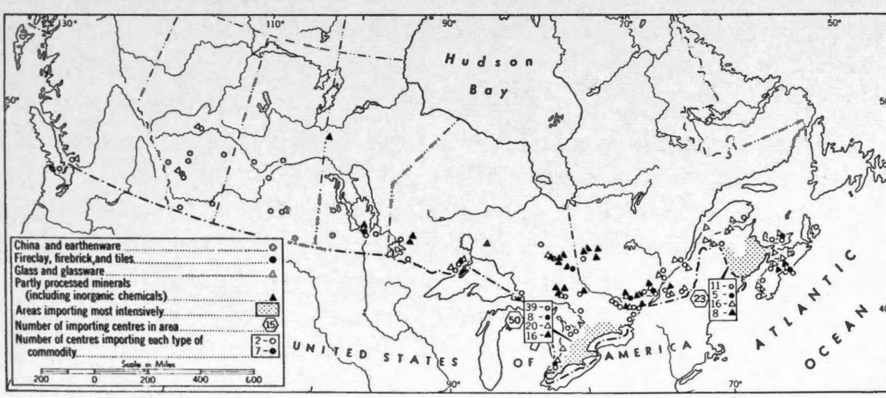

Figure 11. Destinations of glass, earthenware, and partly processed minerals imported through Saint John.

Ceramics are distributed to centres all across Canada, including many small communities that import directly. Glass is one of the principal manufactured imports of Saint John[1], and is distributed from Halifax to Vancouver. Both Oshawa and Windsor import glass for use in automobiles, and glass is imported by many other places in the manufacturing belt. In the Maritime Provinces, it is the most widely distributed of any commodity in this category.

[1] Hadskis, H. A.: Saint John, the Loyalist Port; Foreign Trade, vol. 14, 1954, p. 23.

Firebrick and fireclay are used entirely by industrial plants that are chiefly concentrated in eastern Canada. In view of this, and because of their low value in relation to their bulk, they are not distributed in western Canada. Partly processed minerals are imported by mining and manufacturing areas.

Figure 12. Destinations of mineral products imported through Saint John.

The number of centres in Quebec that import such commodities is fairly limited, perhaps because of the position of Montreal as a distributing point for the area and perhaps, in the case of industrial commodities, because of the competition of locally produced goods.

MINERAL PRODUCTS

The import trade in mineral products contrasts with the export trade in that its volume is low, many of the products are highly processed, and the bulk products remain in or near Saint John itself. Foreign imports of fuel oil and gasoline are much smaller in volume than domestic imports, and are destined only for Saint John, as are imports of European anthracite coal. These products make up the great bulk of the mineral imports. The lighter goods travel farther inland. Petroleum greases and waxes go as far as Vancouver (Figure 12), coal-tar and pitch to Maritime points, and cutch, a preservative derived from coal-tar, as far west as Owen Sound.

Highly processed mineral products go to industrial and population centres. Abrasives are imported by many communities for use in mining, milling, and general manufacturing; asbestos goods by the large wholesaling centres. Granite and marble are imported for architectural purposes, and their high value, in spite of their weight, accounts for their fairly broad distribution. Plastic goods and imitation gem stones are often imported directly to smaller communities, but are usually sent to the large cities that function as regional distribution points.

MISCELLANEOUS CONSUMER GOODS

This category includes a great variety of goods, none of which is imported in great quantities. Many such goods are sent only to the larger cities, where they are distributed to local consumers (Figure 13). These include such items as textile labels, typewriter ribbons, plastic goods, and

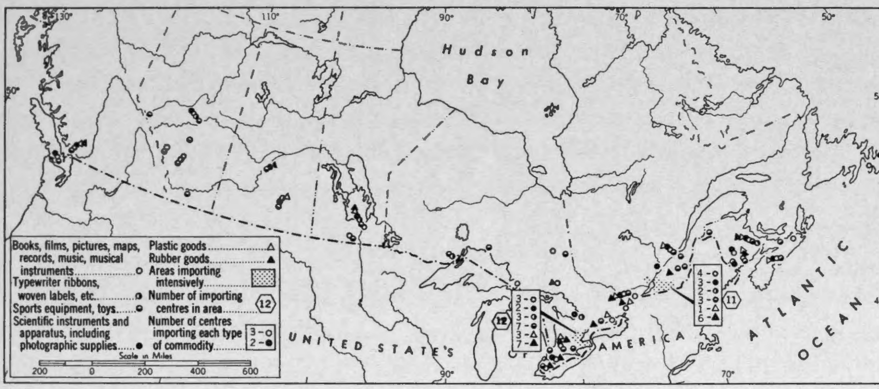

Figure 13. Destinations of miscellaneous consumer goods imported through Saint John.

rubber goods. Rubber belting and other industrial rubber goods, however, may be imported directly by manufacturing and mining firms. Books and other printed matter, phonograph records, and scientific apparatus and instruments are also imported to distributing points, but may be imported directly all across Canada. Sports equipment, in particular, is often so imported. The importance of wholesale importers in the handling of consumer goods may be judged from the fact that Winnipeg, Toronto, Montreal, and Moncton are the only centres in Canada importing all the types of commodities included in this class.

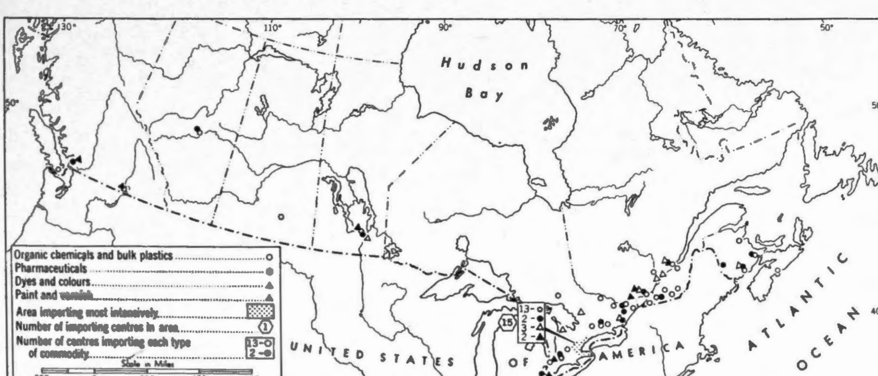

Figure 14. Destinations of chemicals and chemical products imported through Saint John.

CHEMICALS AND CHEMICAL PRODUCTS

The greatest volume of goods in this class is destined for industrial consumers. As might be expected, the core of this hinterland lies along the Quebec-Windsor axis (Figure 14).

Pharmaceuticals, paint, and varnish are usually considered consumer goods and, as such, are imported by large cities. They are, in some cases, also used as raw materials for further processing or in the finishing of goods, and are then imported directly by industrial firms. Aniline dyes, organic chemicals, and bulk plastics are raw materials of heavy industry and are imported directly by industrial consumers from British Columbia to the Maritimes. Reflecting the pattern of industry in Canada, most of the importers are located in central Canada.

PLANTS AND SEEDS

The distribution of imported bulbs and garden seeds is typical of that for any type of light-weight, high-cost product. In the distribution of imported plants, however, speed is a very important factor. For this reason, plants may be imported through Saint John for express shipment to Vancouver because this route is quicker than shipment via Panama, but are not imported widely in the Maritimes if shipment via Halifax is more direct (Figure 15).

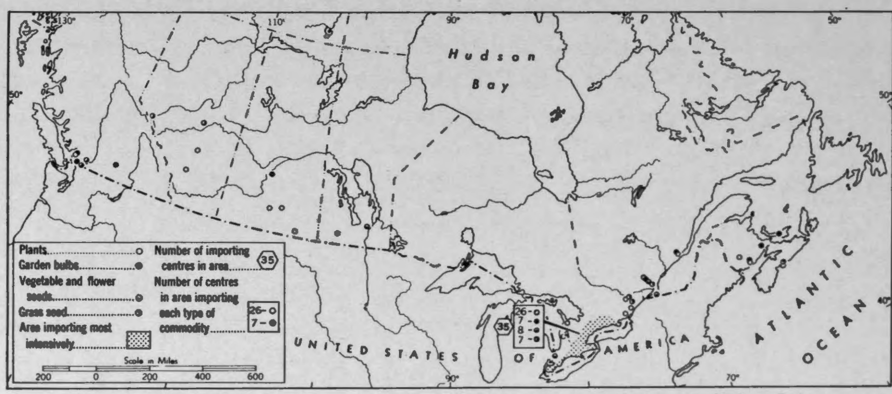

Figure 15. Destinations of plants and seeds imported through Saint John.

Most of the shipments to British Columbia are of flower bulbs. Vancouver imports rose stock and other plants, and the dairying area of Fraser Valley imports grass seed. The Prairie Provinces import shrubs, grass seed to the fringes of the grain-growing area, and vegetable seeds to points near Winnipeg. In Ontario, where most of the importing centres are located, Essex county and the Niagara peninsula import mainly plants; flower and vegetable seeds are imported by the heavily populated areas, and grass seed by the dairying areas of the province. Nearly all Quebec imports go first to Montreal. Although plants are not distributed locally far from Saint John, bulbs and seeds move to more distant parts of the Maritime Provinces.

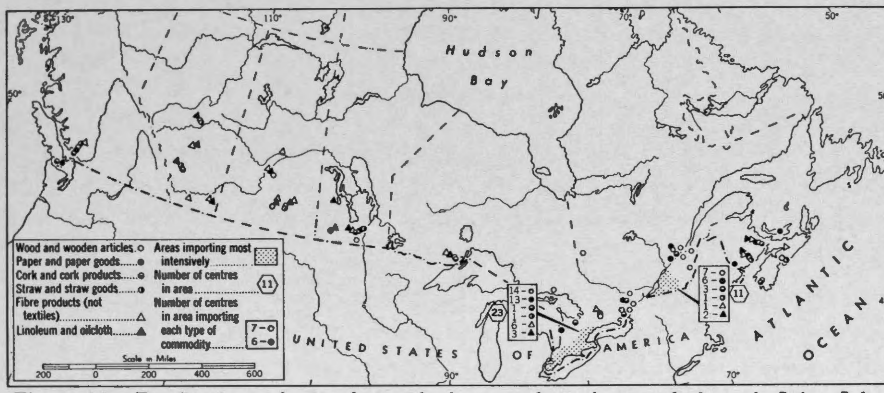

Figure 16. Destinations of manufactured plant products imported through Saint John.

MANUFACTURED PLANT PRODUCTS

The pattern of this hinterland repeats that of others: minor importing areas in the Maritime Provinces and western Canada, with the main hinterland in the St. Lawrence-Great Lakes area (Figure 16). Within the latter there are two zones of concentration—in southwestern Ontario and in the Montreal-Eastern Townships area.

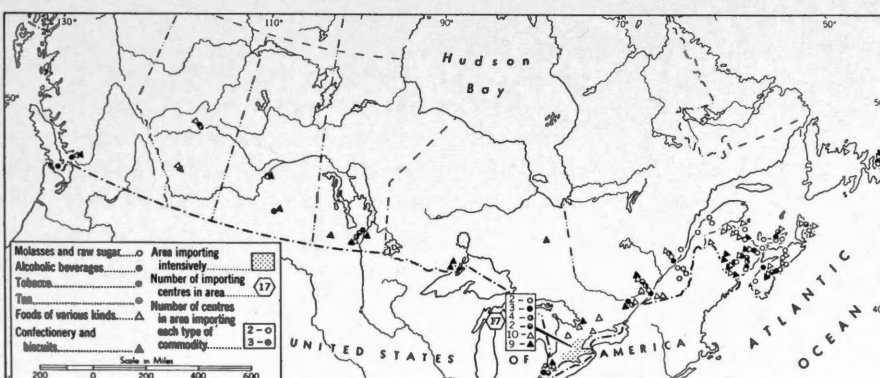

Figure 17. Destinations of food and associated products imported through Saint John.

One of the most important groups in this category includes wood and wooden articles. In general, lumber (from British Columbia) remains in the Maritimes, few items of furniture and other heavy goods go west of Ontario, but household articles are distributed from coast to coast. Paper and paper goods are usually imported by the larger population centres, but that for industrial use goes to milling towns in the Maritimes and central Canada. Straw and its products are mainly in the form of hats, handbags, and shoes, or materials for making them, and go to wholesaling and manufacturing centres. Some straw remains in Saint John for brush-making. Cork products, fibre products, and linoleum are shipped to many communities across the country, with a tendency to move to large centres in eastern Canada, but directly to smaller centres in western Canada.

FOODS AND ASSOCIATED PRODUCTS

This hinterland again illustrates two features of the import hinterlands. Throughout the country, most goods move to wholesale and distributing points, and bulk commodities tend to remain near the eastern seaboard (Figure 17).

Alcoholic beverages, imported by the provincial authorities, go only to the capitals or large cities in each province. Canned foods, biscuits, and confectionery may go directly to small centres, but most tropical products and specialty items go to wholesale and packaging establishments in the large cities. Most of the tea imported by Saint John firms, as well as by those in Montreal and Toronto, comes directly from India, so that any destined for western Canada might be attracted to the port of Vancouver. Tobacco imports, usually cigars, go mainly to the St. Lawrence-Great Lakes lowland.

The refinery at Saint John imports raw sugar, which is the largest single foreign import commodity. In conjunction with this trade, molasses is imported in barrels for many points in the Maritimes and eastern Quebec, where it is put in containers for the retail trade. As a bulk product, very little molasses goes west of Montreal, but some, already in cans, goes to Saint John's, Newfoundland.

Toronto and Montreal dominate the import trade in foods, importing the greatest variety and volume next to Saint John itself. The Maritime Provinces and eastern Quebec, on the other hand, import directly through Saint John to a much greater extent than do communities in central Canada.

MANUFACTURED ANIMAL PRODUCTS

This hinterland (Figure 18) illustrates the same principles as does that of the previous group. Consumer goods, such as leather articles and footwear, are almost the only types of commodities that are imported by the western provinces. Many points in central Canada import consumer goods as well as dressed leather, glue, fur and feathers, bone charcoal, and bristles, for use in manufacturing. Apart from imports of dressed leather by manufacturing towns of the Eastern Townships, however, most goods of this class imported into Quebec province go to Montreal. In the Maritimes, the larger communities import both consumer goods and raw materials.

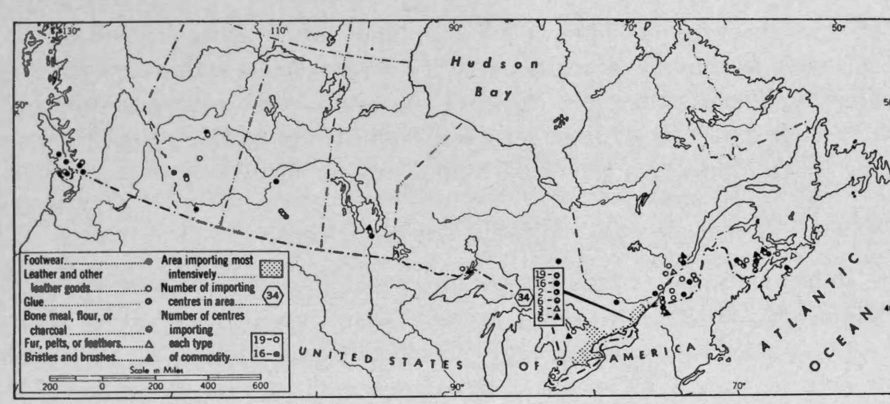

Figure 18. Destinations of manufactured animal products imported through Saint John.

THE IMPORT HINTERLAND

The import hinterland of Saint John exhibits the same general pattern as the export hinterland (Figure 22), but there is considerable contrast in regard to the movements of commodities within it.

Three areas again emerge as divisions of the general hinterland. In the west, commodities of many kinds are imported into an area extending from east of Winnipeg to the Alberta-British Columbia border, and into the populated areas of southwestern British Columbia, but no bulk commodities are imported. In central Canada, the hinterland extends from Quebec city to the lakehead, but the core of the area is the Quebec-Windsor axis. Both consumer goods and industrial raw materials are imported, but shipments of bulk goods are less important. The import hinterland in the Maritime Provinces extends into eastern Quebec. All types of goods are imported, with food products being the most widely distributed. In this latter area, bulk imports of coal, petroleum, raw sugar, molasses, and tea comprise the greater part of the import trade. Newfoundland imports only general cargo goods.

The movement of goods, therefore, in contrast with that in the export hinterland, is more typical of similar movements in European and other port hinterlands. The heavy cheap goods do not move far from the port, whereas the lighter more expensive goods can be moved for great distances inland.

COASTAL TRADE HINTERLAND

The coastal trade of Saint John is extremely small in relation to its foreign trade. Nevertheless, Saint John is an important source of supply for the immediate coastal area, which in turn helps to provide local products of considerable importance to the foreign trade of the port.

The city of Saint John acts as the distribution and collection centre for a considerable area, but this activity may have no connection whatsoever with the port, because many of the goods involved are transported both ways by land. The coastal trade hinterland of the port comprises that area within which goods are transported by water.

AREA SUPPLIED BY SAINT JOHN

The area supplied by Saint John may be considered as a parallel to the export hinterland. It includes western Nova Scotia, from Yarmouth to Digby (Figure 19), to which area considerable quantities of general cargo are shipped. Small quantities of petroleum products were also supplied to this area during the year 1952-53. The eastern end of the Bay of Fundy obtains supplies of petroleum products that are brought to the port of Saint John in large tankers and distributed from there in smaller vessels.

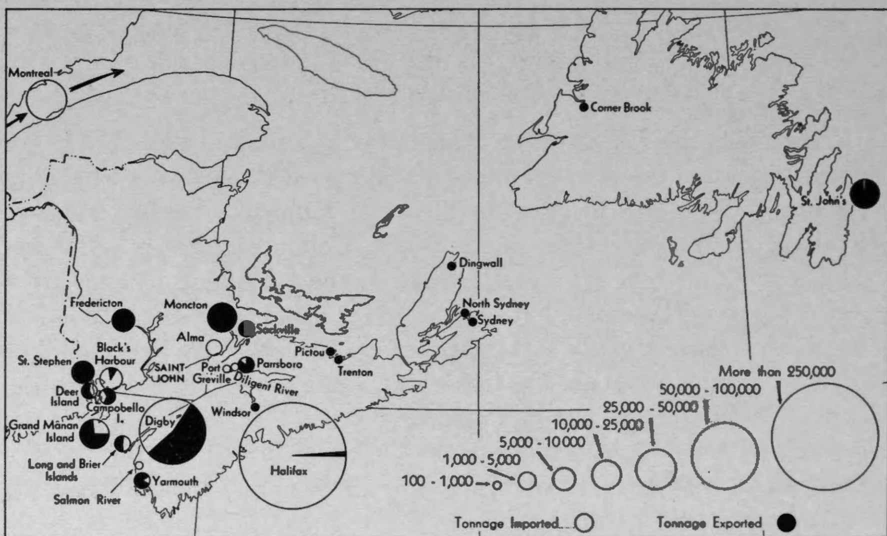

Figure 19. The local trade of Saint John.

The western end of the Bay of Fundy is supplied with both petroleum products and general cargo. This latter includes such things as salt for the fish-processing plants, general supplies, lumber, and small quantities of coal. The lower Saint John valley is supplied with petroleum products, when the river is not ice-bound, by coastal tankers small enough to navigate the river. Some supplies are also sent to Newfoundland during the winter. The supplying of northeastern Nova Scotia with petroleum products was an unusual feature of the year's trade, and is probably to be considered as what Morgan terms "freak traffic"[1].

[1] Morgan, F. W.: Pre-War Hinterlands of the German Baltic Ports; Geography, vol. 34, 1949, p. 205.

AREA SUPPLYING SAINT JOHN

Coastal cargo movements reverse the order of foreign movements in that incoming cargoes have a much greater volume than outgoing. The reason for this is that large shipments of gasoline and other petroleum products come from Halifax all year and from Montreal in summer (Figure 19). No other commodities come by water directly from these ports. Western Nova Scotia supplies Saint John with general cargo (some of it, such as cotton duck, for export) and small quantities of fish products. Lumber from Alma, on the north shore of the Bay of Fundy, is the main supply obtained from the eastern end of the Bay of Fundy. This lumber is usually loaded to ocean-going ships by lighter. Pulp logs for the Saint John mill and lumber for foreign export are also brought down Saint John River, but no statistics on the volume of this traffic are available. The western end of the Bay of Fundy ships canned and fresh fish, fish meal, and fish oil to Saint John. It is the main supplier of a product that attracts to the port shipping that otherwise might not call there.

COASTAL TRAFFIC

The coastal traffic of Saint John is composed of four main types of sailings: regularly scheduled sailings handling freight and sometimes

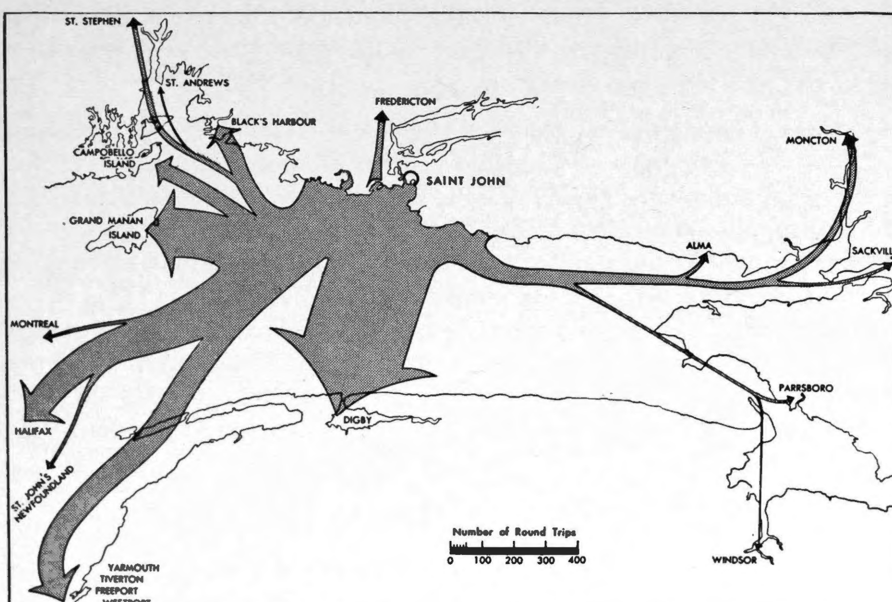

Figure 20. Regular coastal traffic of Saint John, 1952-53.

passengers, irregular but frequent sailings of company vessels for transporting company produce, movements of both ocean-going and coastal tankers, and the unscheduled movements of small independent coastal freighters. Although these last follow no specific routes, the availability of cargoes attracts them to the routes established by the other types of vessels. The unusual shipments of petroleum products to northeastern Nova Scotia (actually made on a single voyage) and the casual movements of fishing vessels in ballast have been omitted from consideration.

The greatest coastal traffic is that which plies between Digby and Saint John (Figure 20). This is made up of a daily service for both freight and passengers, supplemented by a few tankers trips in winter. Traffic between Saint John and Freeport, Tiverton, and Yarmouth consists of a weekly freight service and some coastal freighter movements. A freight and passenger service links Saint John, Grand Manan, and Campobello Islands, and there is, in addition, a freight service to the last-named. Sailings of coastal tankers, coastal freighters, and company vessels comprise the rest of the traffic to these and to other points in the western part of the Bay of Fundy. Sailings to the eastern end of the Bay of Fundy are made most frequently by tankers. There are no scheduled services, coastal freighters rarely make voyages, and there is one company vessel operating in the area. Ocean-going freighters ply between Saint John, Halifax, and St. John's in the winter, some including calls at New York in their schedules. Cargo carried from Saint John to Halifax on these voyages is usually in transit to Newfoundland. Considering the volume of cargo moved, comparatively few sailings are made between Saint John and Halifax and Montreal because of the large size of the vessels employed. Vessels on these runs make the return voyage in ballast.

Coastal imports of petroleum products from Halifax and Montreal are vital to the community at large and provide the port with bunker oil for ocean-going shipping. These ports, however, do not depend on Saint John for any supplies in return. Digby and Saint John, on the other hand, are of great mutual importance, and Saint John has an important function in relation to the immediate area of southwestern Nova Scotia. There is less mutual interdependence with the eastern end of the Bay of Fundy, although the volume of traffic involved is not unimportant. The western end of the Bay of Fundy, however, is dependent upon Saint John for a very large proportion of its supplies, and provides in return an important export commodity—fish.

INTERCOASTAL TRADE HINTERLAND

The movement of goods between the east and west coasts of North America via the Panama Canal is not a recent development, but in Canada, at least, it has not been of great volume. The Canadian service is being expanded in conjunction with the production of aluminium in British Columbia. In view of the connections that the port of Saint John already has with both British Columbia and Latin America, it seems possible that the volume of intercoastal trade through Saint John may increase.

EXPORTS

Goods that move westward through the Panama Canal are considered to be exports of Saint John and have, in effect, two hinterlands, that in eastern Canada where they are collected, and that in western Canada where they are distributed (Figure 21). During the period under review, most of the commodities came from Toronto, the St. Lawrence Valley, and Saint John. They included a variety of fairly expensive consumer goods, food products, and some heavier goods such as wrapping paper, nails, calcium carbide, and other commodities. Most of the heavier goods did not move beyond Vancouver upon arrival. Those originating in Saint John, however, and some of the lighter, more expensive goods originating in central Canada were shipped to points as far inland as Edmonton.

IMPORTS

Goods moving from the west coast via the Panama Canal to Saint John are considered imports and also have two "hinterlands", one for the collection of goods in western Canada, the other for their distribution in eastern Canada (Figure 21).

All the intercoastal imports during 1952-53 originated in Vancouver or on Vancouver Island. These goods included canned foods (such as salmon, fruit, and vegetables), lumber, and large timbers. The lighter goods came from Vancouver, but some of the timbers and lumber came from Vancouver Island.

Figure 21. Areas of intercoastal trade through Saint John, 1952-53.

The movement of these goods in the distribution hinterland is an excellent example of the ability of high-value goods to bear the costs of a long rail haul. British Columbia canned goods and other high-value commodities are distributed through Saint John within the Maritime Provinces only, because they can be delivered by rail to central Canada at competitive prices. Lumber and timber from British Columbia imported through Saint

John, on the other hand, go principally to central Canada because, as a result of their size and special quality, they are in demand in that area, and it is cheaper to ship them by the intercoastal route than by rail.

Whether imports or exports, heavy, cheap goods appear able to withstand the cost of a rail haul at one end only of their journey. Lighter, more expensive goods can bear the costs of rail transportation at both ends of the journey.

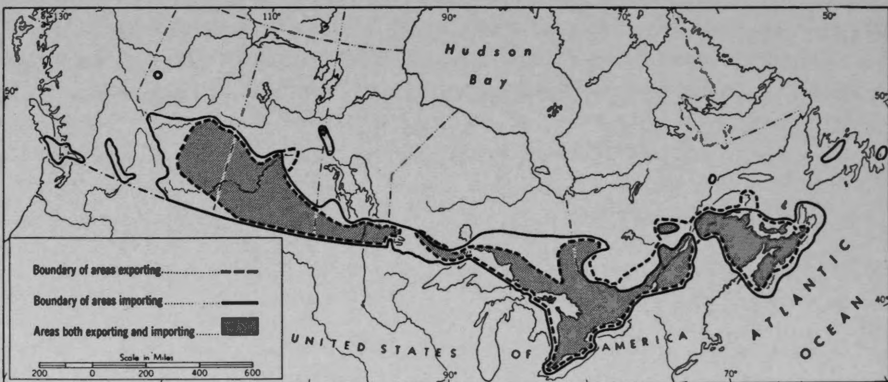

Figure 22. The hinterland of Saint John.

Several Saint John manufacturers and food processers already take advantage of their seaboard position to ship their products to the interior of British Columbia and even to Alberta. There may exist in the Saint John area possibilities for further expansion of such trade in competition with central Canadian manufacturers, who must ship their goods by rail.

THE CANADIAN HINTERLAND OF SAINT JOHN

The export hinterland of Saint John has three distinct divisions—Western Canada, Central Canada, and the Maritime Provinces (Figure 22). The import hinterland likewise exhibits this threefold division, although there is no distinct break between the western and central sections. The central section of both has as its core the area from Quebec city to Windsor, and the maritime section has southern New Brunswick and western Nova Scotia.

The western part of the hinterland supplies Saint John with grain, the most important export commodity of the port. In turn, Saint John provides an outlet for this product on the eastern seaboard during the winter months. Other agricultural products are exported from this area, but, because there is not much manufacturing in the Prairie Provinces, little general cargo is exported. This class forms the major part of the goods imported by western Canada through Saint John. The demand for industrial materials is low, but such goods would in any event be transported via the Great Lakes or Vancouver. Saint John depends on the western hinterland, however, for its staple winter export, wheat, and the availability of this bulk cargo attracts shipping to the port during the summer months. The core of the western hinterland extends only to the western boundary of Alberta.

Although the central Canadian section does not supply Saint John with its major export (grain) or receive its major import (raw sugar) it is, nevertheless, a most important part of the hinterland. Bulk cargoes are included in both the exports and imports of the area, but the real value of the central area lies in its ability to produce and consume general cargo commodities. These goods form the mainstay of liner traffic in the port, and their handling brings greater wages to port workers than does the handling of bulk cargoes. Although Saint John has little significance to the area in summer, it is a major exporting and importing point when the St. Lawrence River is ice-bound.

The Maritime section of the hinterland supplies Saint John with two important bulk commodities, potatoes and forest products, and locally produced goods. The former attract tramp shipping throughout the year, whereas the latter, including such products as canned fish, help Saint John to maintain scheduled services with tropical areas. The Maritime area is the mainstay of the import trade in bulk commodities, attracting year-round scheduled services and tramp shipping. The volume of general cargo imports consumed in the Maritimes is small in comparison with that destined for central Canada, but the area enables the port to maintain a small import trade in these goods during the summer months. Saint John functions as a major importing and exporting point for the Maritime Provinces, as well as sharing with Halifax the task of supplying Moncton, an important wholesaling centre.

Geographical factors have produced the "bridge" areas that divide the various parts of the hinterland of Saint John. These factors, however, have also given each part of the hinterland a distinctive character, so that each is important to Saint John for different reasons. There is scarcely a part of the populated area of Canada that is not dependent, to some extent, upon Saint John. The port is not unique in this respect. It is probable that all our larger ports share the same characteristics and are thus truly national ports.

THE HINTERLAND IN SUMMER

Saint John functions as a national port only during that season of the year when the St. Lawrence River is frozen and the port of Montreal is idle. During the summer months the trade of the port dwindles, and the hinterland boundaries contract. Although Montreal closes during December and reopens in April, May and November are, respectively, the first and last complete months when it is operating fully. The "summer" season of Saint John, therefore, is considered to last from May to November, inclusive.

EXPORTS

The summer export trade of Saint John is dominated by the movements of forest products. Few shipments of highly processed products are made, except for those originating in Saint John itself (Figure 23). However, the

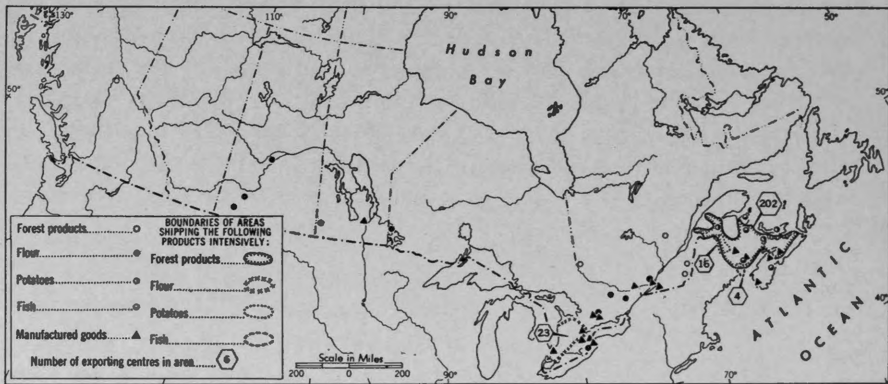

Figure 23. Points of origin of commodities exported through Saint John from May to November.

hinterland for lumber and roundwood within the Maritime Provinces is almost as extensive as in winter, and shipments are frequent. The hinterland for potatoes, on the other hand, is much smaller than in winter (cf.

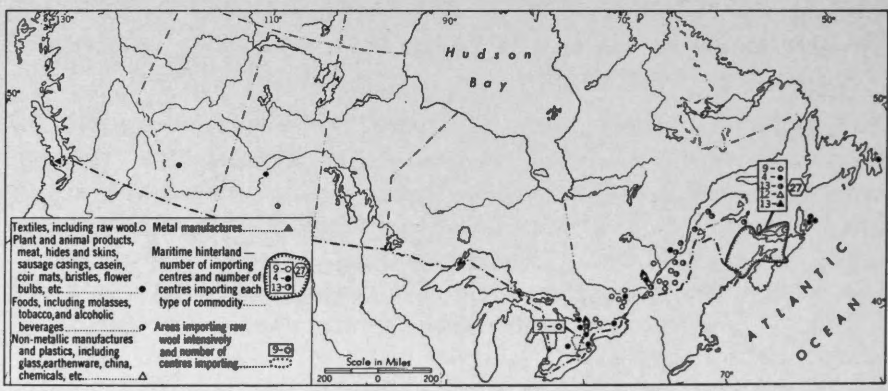

Figure 24. Destination of commodities imported through Saint John from May to November.

Figures 3 and 23), and there are few shipments. The movement of potatoes begins in late autumn, and does not reach its peak until the winter months. Flour is the only product from central Canada exported in any volume during the summer. In 1952, nearly all the exports of flour formed full cargoes for tramp ships that loaded and left directly for their destinations. The fishing season is at its height in summer, but exports from the Bay of Fundy destined for tropical areas are more numerous than those from the Northumberland Strait shore. Some shipments of general cargo for export came from central Canada (Figure 23) in the summer of 1952, but no point made more than two shipments and most one only. Saint John itself was the principal exporting point. During the summer, eleven types of locally produced or processed goods were exported, and eight more were handled by local wholesalers. Apart from a few commodities, therefore, the export hinterland of Saint John is restricted in summer to the Maritime Provinces.

IMPORTS

The import hinterland is likewise less extensive than in winter, but central Canada is somewhat more prominent than in the case of the export hinterland. The principal reason for this was, in 1952, the arrival at Saint John of scheduled liners that did not call at St. Lawrence ports, but carried goods destined for central Canada.

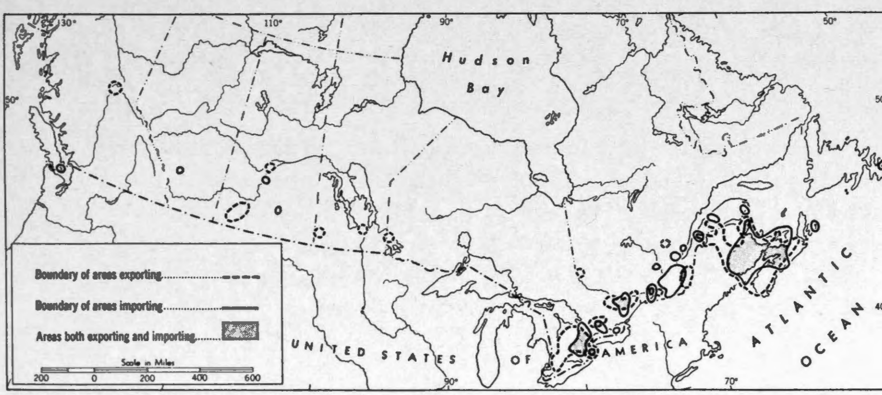

Figure 25. The "summer hinterland" of Saint John.

Some textiles from the United Kingdom are imported in summer for retail sale in Montreal, Toronto, and the Maritimes. Raw wool from Australia and New Zealand moves to milling towns in central Canada and the Maritimes. In 1952, canned meat and other plant and animal products from the same countries moved to points as far apart as Newfoundland and the Prairie Provinces. Tea, jute products, and other commodities from India, Pakistan, and Ceylon were shipped to Montreal, Toronto, and various other points in central Canada, as well as to Maritime points. The food products imported from the West Indies, however, went almost entirely to the Maritimes and eastern Quebec. Raw chemicals and plastics, glass, china, and earthenware from the United Kingdom followed a similar pattern. Raw material for the manufacture of fertilizers, one of the bulkier imports from the Continent and the United States, is processed in Saint

John. Apart from shipments to Montreal and Toronto, and one to Victoria, imports of metal goods moved to centres in the Maritime Provinces only.

From May to November, 1952, central Canada, and especially Montreal and Toronto, received imports from Saint John, but the variety and volume of goods handled were fairly restricted. The hinterland in the Maritimes was not so extensive as the export hinterland (cf. Figures 23 and 24), but Saint John imported a greater volume and variety of goods than did any other point.

THE SUMMER HINTERLAND

The summer shrinkage of the hinterland of Saint John results from the operation of the St. Lawrence ports, located at the head of ocean shipping routes in the centre of the manufacturing belt of Canada. Thus, although there is some movement of goods between western Canada, central Canada, and Saint John, the area where import and export movements are numerous is that most accessible to Saint John, the Maritime Provinces (Figure 25). The basic summer hinterland of Saint John centres on the Bay of Fundy, with Saint John as its core.

THE HINTERLAND WITHIN THE UNITED STATES OF AMERICA

East and south of a line extending from the Pennsylvania-Ohio state boundary to the Gulf of Mexico (Figure 26), freight rates to the American and Canadian ports of the eastern seaboard are equalized. Within this area the influence of the great American ports, with their frequent sailings to all parts of the world, is predominant. Saint John imports and exports to this area only when special conditions prevail.

EXPORTS

The export hinterland within the United States of America has three main parts (Figure 26), but the three sections do not correspond exactly with the three sections of the Canadian hinterland. The Saint John Valley area of Maine, served by the Canadian Pacific Railway, exports potatoes through Saint John. There are a few shipments of cotton goods, chemicals, machinery, and steel from points in the Atlantic states as far south as Wilmington, Delaware. These may be goods of types that cannot be obtained in Canada, or elsewhere in the United States of America. The area north of Ohio and Missouri Rivers exports most frequently through Saint John. The goods moved include lard and horsemeat from Iowa and Indiana, but more usually consist of chemicals, metallurgical products, and metal goods from the manufacturing areas near Detroit and Chicago. These two cities export the greatest variety of American goods that move through Saint John.

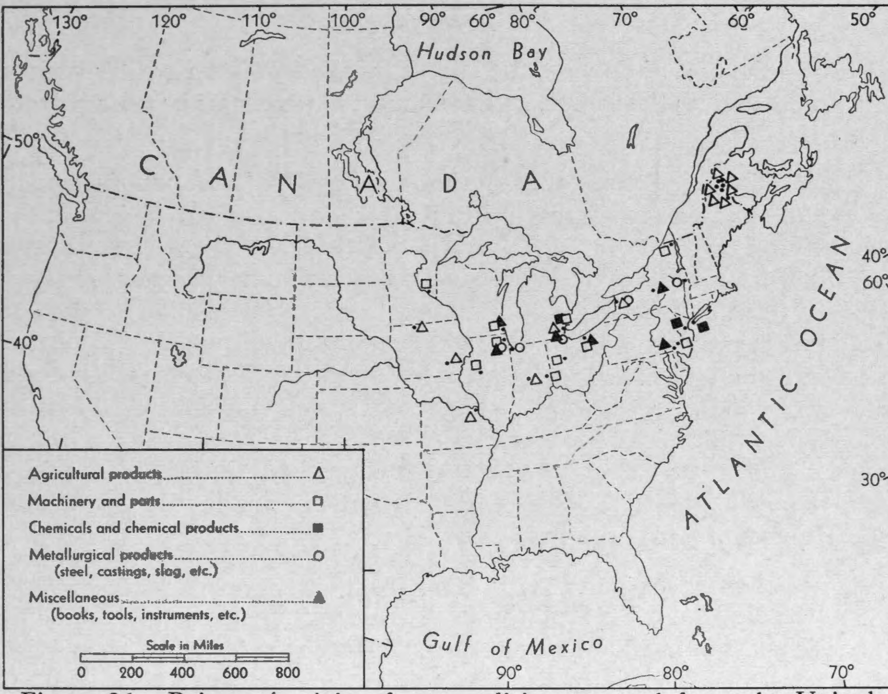

Figure 26. Points of origin of commodities exported from the United States of America through Saint John.

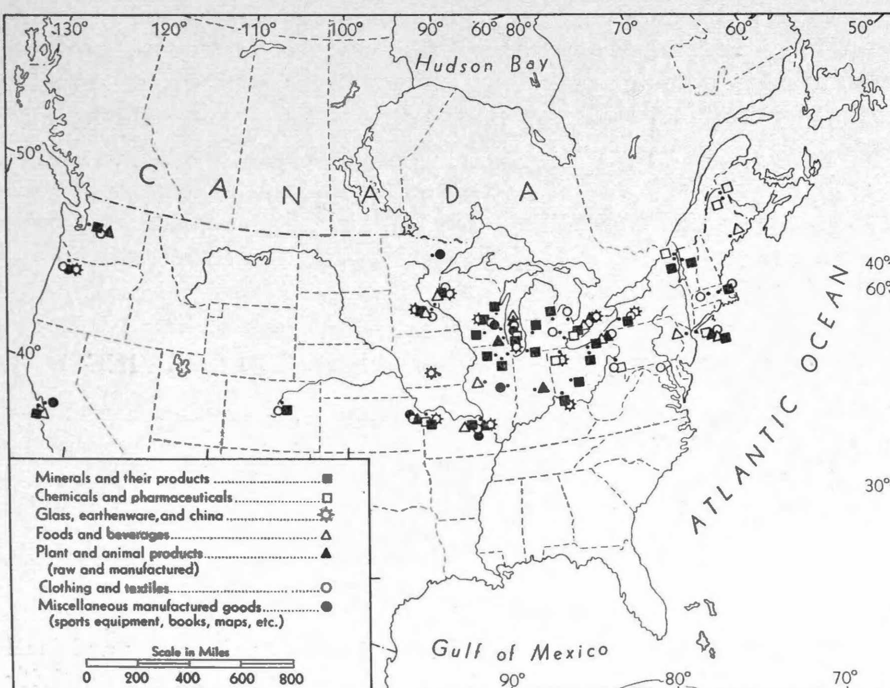

Figure 27. Destinations of commodities imported by the United States of America through Saint John.

IMPORTS

As in the case of Canada, the import trade comprises a greater variety of goods than does the export, and the import hinterland is broader (Figure 27).

The Saint John Valley of Maine imports fertilizer for its potato-growing areas and bulk molasses is shipped to Bangor for packaging. Shipments to the Atlantic states moved as far south as Baltimore, and were comprised in large measure of tropical food products, wool, and other primary products. Some of these movements were, actually, the "overlanding" of goods that should have been unloaded previously at various American ports. The area north of Ohio and Mississippi Rivers imported the greatest quantity and variety of goods, with Detroit and Chicago, again, as the principal centres of activity. Tropical products, machinery, glass and china, whiskey, textiles, and other consumer goods were imported. Outside of this area there were shipments of books, textiles, plants, and other articles able to bear the cost of a long rail haul.

THE UNITED STATES HINTERLAND

That part of the Saint John Valley lying in the state of Maine, because of its geographical similarity and its direct rail connections with the port, exports and imports fewer, but similar, products to those of its Canadian counterpart. In the United States, the area north of the Ohio-Missouri corresponds to the central section of the Canadian hinterland. Because the Canadian Shield does not project far south into the United States, the central and western sections are not separated. However, Saint John is too remote from the American west for economical shipping between them.

Apart from molasses shipments to Bangor, Maine, little import traffic and no export traffic moved through Saint John in the summer of 1952. The United States hinterland of Saint John, therefore, probably represents the area that would be served by the St. Lawrence-Great Lakes water routes in summer.

SAINT JOHN IN RELATION TO WORLD SHIPPING

Apart from the volume of cargoes it handles, the rank of a port may be judged from its importance as a transhipping point, the areas of the world with which it has contacts, and the frequency of its services to all parts of the world. By these standards, Saint John, although not a major world port, occupies a fairly prominent position.

TRANSHIPPING AT SAINT JOHN

The port is not a great entrepôt, but local manufacturing and local resources provide the foundation on which modest transhipping activity has been based (Figure 28).

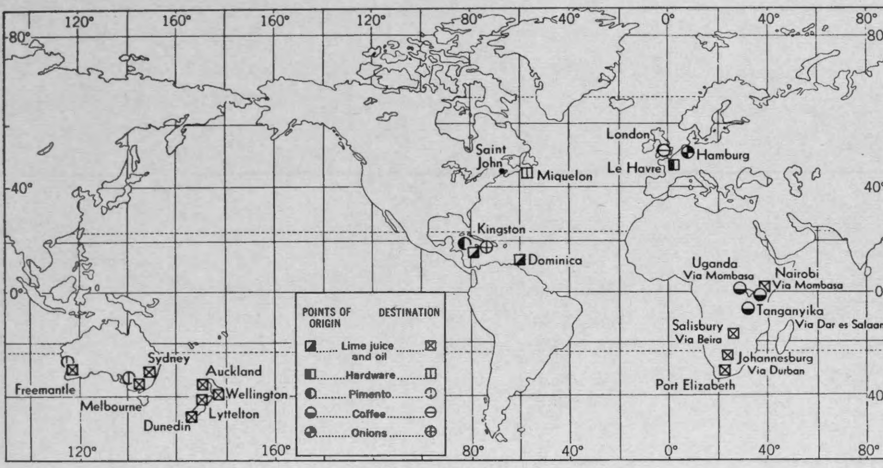

Figure 28. Commodities transhipped at Saint John.

Because Saint John has a sugar refinery and can supply, in return for raw sugar, canned fish and other local products, there are frequent sailings between it and the West Indies. These islands produce lime juice and lime oil, products that command a market in many countries of the world. The numerous small ports of the West Indies are not regular points of call on world shipping routes, but many of them are served by ships coming to load sugar. Lime juice and lime oil are first brought to Saint John and then shipped out on scheduled services, principally to Australia, New Zealand, and Commonwealth countries in Africa. Pimento is also carried on these routes. Small quantities of European goods may be transhipped at Saint John for the West Indies. Ships on scheduled sailings to Africa, attracted by the cargoes of wheat, flour, canned fish, lime juice and oil, and local manufactures available at Saint John, bring sugar, coffee, and other tropical products. Some coffee is transhipped at Saint John and taken to London.

St. Pierre and Miquelon are usually served from Halifax or directly from France. Occasionally, goods for these islands are shipped from France and transhipped at Saint John.

FOREIGN PORTS TRADING WITH SAINT JOHN

Each port has in addition to its hinterland a similar zone of influence overseas, as evidenced by the ports with which it has contacts. As in the case of the hinterland, trade flows in one direction only in some areas, and in others there is two-way trade. In other areas, receiving and shipping points are closely spaced (Figure 29).

Many ports in the United Kingdom and Eire engage in trade with Saint John, and in many cases trade moves in both directions. These ports usually handle general cargoes. Those that have one-way trade with Saint

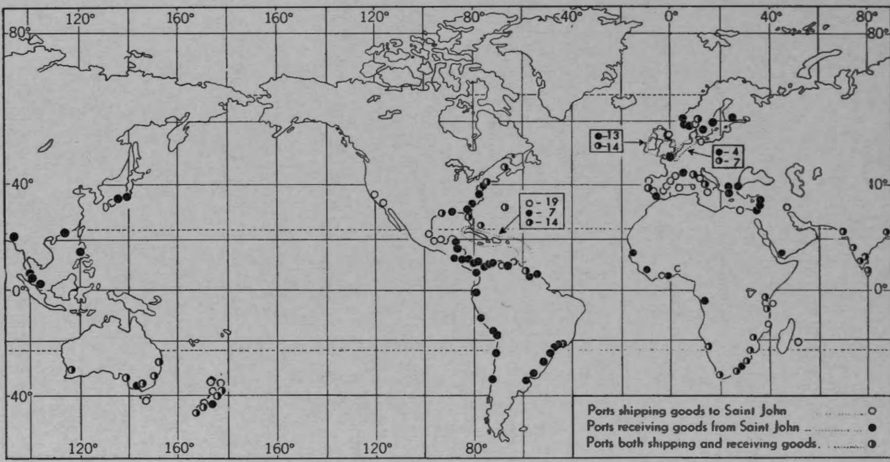

Figure 29. Foreign ports trading with Saint John, 1952-53.

John handle bulk cargoes, for the most part. Coal and steel are shipped to Canada; bulk imports usually consist of wheat or roundwood.

Only the larger ports of the West Indies, acting as collection and distributing centres for the islands, engage in two-way trade with Saint John. The majority of West Indian ports export sugar and its by-products, but receive no goods in return. Small quantities of goods are sometimes delivered to ships en route to load sugar at other West Indian ports.

Continental Europe, from the English Channel to the Baltic, is another area trading fairly intensively with Saint John. All the major ports of the Antwerp-Hamburg Range engage in two-way trade with Saint John; roundwood and grain being imported, fertilizers exported, and general cargo moving in both directions. Outside the range, one-way trading prevails, with pulpwood being imported or steel exported.

Many ports in Australia and New Zealand export wool and grass seed and other agricultural products to Saint John. Goods imported by the two countries consist principally of manufactures and are usually destined for the larger port cities. Somewhat similar conditions prevail with regard to ports in the Indian sub-continent. This is true, also, of non-Mediterranean African ports, although the goods exported to them from Saint John include bulk shipments of grain and flour. Trade with African and Asian ports on the Mediterranean consists very largely of flour exports. European Mediterranean ports engage in two-way trade with Saint John.

Ports in the Scandinavian and Far Eastern countries import small quantities of general cargo from Saint John.

The importance of Commonwealth trading agreements may be judged from the number of Commonwealth ports that both export to and import from Saint John. Areas in which trade flows most strongly in one direction are those in which increased trade might be expected to arise. Central and South America are obvious examples. However, in some of these areas it is unlikely that the volume of trade will ever be high, either because of similarity of the products, as in the case of Norway, or because of distance and location, as in the case of the Far East.

FOREIGN TRAFFIC OF SAINT JOHN

The areas in which Saint John trades are indicated more accurately by the volume of shipping that passes between that port and various parts of the world (Figure 30). Ships in ballast, or with cargoes in transit for

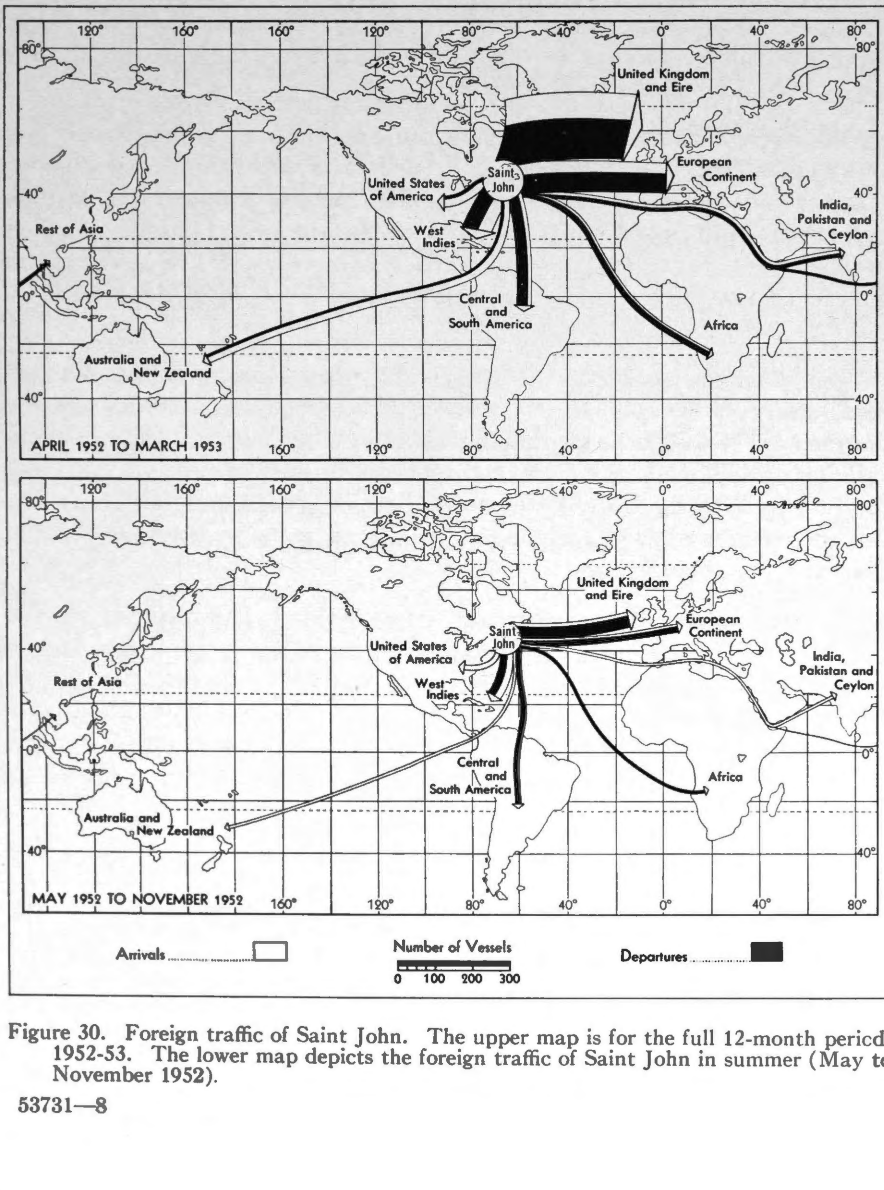

Figure 30. Foreign traffic of Saint John. The upper map is for the full 12-month pericd, 1952-53. The lower map depicts the foreign traffic of Saint John in summer (May to November 1952).

other ports, have been omitted from consideration. Furthermore, intermediate ports of call are significant only if they help to attract ships to the vicinity of Saint John. The important trade routes are those between Saint John and the ports where cargoes originate or are landed.

The North Atlantic is the most important trade route for Saint John, the greater part of the shipping moving between Saint John and the United Kingdom and Eire. This traffic is composed of scheduled liners, especially in winter, and tramp ships carrying bulk products. These last usually make one leg of the journey in ballast, and the numbers that come to Saint John for roundwood or grain account for the greater number of ships departing from the port with cargo. Next in importance in the North Atlantic are the ships plying between Saint John and continental European ports, including those in the Mediterranean. The nature of the cargoes carried is similar to that in the United Kingdom trade, except for the movement of fertilizers to Saint John.

The second most important trade route is that serving the West Indies and Central and South America. Arrivals and departures of ships with cargo are nearly equal. The lack of return cargoes in ships carrying bulk exports to South America is partly balanced by the lack of outgoing cargoes in tankers, so that ships do not all necessarily have cargoes to carry in both directions. In the case of the West Indies, however, most ships do carry cargo to and from Saint John.

Small quantities of general cargo arrive from United States Atlantic ports all year, but any goods loaded by the incoming ships are usually destined for Newfoundland, rather than the United States. Bulk carriers, arriving or departing in ballast, transport goods in both directions but the total traffic with the United States resulted in a greater number of arrivals than departures with cargo. The volume of shipping is about one-third of that with continental Europe.

Ships plying between Australia, New Zealand, and Boston, via the Panama Canal, frequently go on to Saint John to discharge cargo, but do not always load cargo for export to these countries. As a result, nearly all the cargo traffic with this area is incoming. Its total volume is about one-quarter of that with continental Europe. Restrictions on dollar imports to New Zealand have been relaxed, and a greater volume of export cargoes from Saint John may result.

Two-way traffic in general cargo with African ports is fairly important in winter, but the number of ships carrying flour and grain to Egypt and other ports of Africa is much greater. The volume of traffic with Africa is approximately equal to that with Australia and New Zealand. North Africa is served via Gibraltar, East Africa via the Cape of Good Hope.

The volume of shipping to India, Pakistan, and Ceylon is less than that to Africa, but traffic is more evenly divided between arrivals and departures. This traffic, which carries on all year, consists of the import of tropical products and the export of general cargo. These countries are served via Suez.

The volume of traffic with western Asia is very small and consists almost entirely of ships departing with bulk cargoes. Far Eastern ports are reached via Panama and the Pacific.

Many ships touch at other Canadian and American ports before or after calling at Saint John, and the variety of cargoes available in the area as a whole attracts shipping as a single port could not do. Ships carrying ore from South America to aluminium plants in Quebec, for example, may call at Saint John on either stage of their voyages. Proximity to Boston has resulted in the development of trade with Australia and New Zealand. Ships from the United Kingdom, especially in summer, may go on to United States Atlantic ports to pick up cargo before returning, and all the scheduled shipping with Africa and Asia makes such calls. The number of ships calling at both Saint John and Montreal, however, is very small, and the influence of United States ports is much more important, in this respect, than is the influence of other Canadian ports.

Saint John possesses certain specific advantages that attract shipping to the port. It is in operation all year and is easily accessible from American ports. It can supply bulk cargoes of grain, flour, or forest products at any time and has local industries that use large volumes of fertilizer and raw sugar. As a Canadian port, it is of considerable importance to the Commonwealth countries in the Americas. In addition, it has local industries that process tropical products, and others producing commodities that are in demand in tropical countries.

FOREIGN TRAFFIC IN SUMMER

During the 7 "summer" months, the volume of shipping in the port of Saint John amounts to about 30 per cent of the annual total. Similar proportions of the total annual arrivals and departures occur during this period. In addition to the diminished volume of traffic, the proportion of arrivals and departures of cargo-carrying vessels in the traffic with some areas changes according to the nature of trading activity with each area.

In summer, North Atlantic traffic amounts to about 20 per cent of the year's total and approximates in volume that of the summer traffic with the Americas. Liner traffic with the Continent ceases, and with the United Kingdom declines greatly. However, the movement of bulk carriers continues, resulting in a proportionately greater number of departures during the summer season.

Trade with the Americas does not decline so noticeably, and about 44 per cent of the year's shipping calls at Saint John in summer. The increased activity in winter is probably due less to the closing of the St. Lawrence than to the seasonal increase in potato shipments to Latin America. This surmise appears to be borne out by the decreased proportion of ships leaving Saint John with cargo during the summer season.

About one-third of the traffic with Australia and New Zealand arrives in Saint John in summer, but no ships load cargo for these countries during that period. Most exports destined for this area come from central Canada, and are not available at Saint John. The proportion of traffic with the Indian sub-continent is similar to that with Australia and New Zealand; export trade is negligible, and for the same reasons. Trade with Africa and the rest of Asia, on the other hand, consists almost entirely of exports. This reflects the decrease in liner traffic and the continued activity of tramp shipping loading bulk cargoes. About one-third of the year's African traffic reaches Saint John in summer, and 40 per cent of the other Asiatic traffic.

CONCLUSION

The greatest problem confronting the port of Saint John is the seasonal nature of its activity, and it is unlikely that it will be soon solved. When the St. Lawrence is ice-free, it offers direct access to the manufacturing belt of Canada, the centre of the country's population, and the major producing and consuming area. The hinterland to which Saint John has direct access, the Maritime Provinces, does not have the resources and population to sustain one, much less two, national ports. Even if the Maritimes should attain levels of population and economic activity considerably higher than those of today, it seems probable that the major function of Saint John must continue to be that of a winter port.

There can be no doubt that Saint John functions as a national port during the winter season. Its hinterland covers most of the populated areas of Canada, and the patterns within this hinterland reflect most phases of Canadian economic life.

Although, from the point of view of volume, the maritime hinterland is not of first importance to Saint John, it is of considerable strategic value to the port. It is the maritime hinterland that supports the port during the summer season, and many of the goods it produces and consumes have helped to establish trade between Saint John and other parts of the world. The maritime hinterland is particularly significant in relation to Saint John's trade with tropical countries. If port activity is to increase, it seems probable that it would be in the volume of tropical trade. In such a case, the value of the maritime hinterland would increase proportionately.

The western Canadian hinterland is of greatest value to the port as the source of its principal export, wheat. Until Saint John obtained access to the Prairie Provinces and set up local facilities for handling grain, it could not regain the status it had as a shipbuilding centre in the era of sail.

It is, nevertheless, the traffic in general cargo between Saint John and the central Canadian hinterland that has brought those liners to the port whose scheduled sailings have attracted trade and increased Saint John contacts with many parts of the world. Without liners, the port might have become merely a centre for the import and export of primary products carried by tramp shipping.

Each of the major areas of the hinterland, therefore, has played a part in the development of the port of Saint John as it is today.

RÉSUMÉ

L'arrière-pays du port de Saint-Jean s'étend aux régions peuplées du Canada et, en particulier, à celles situées à l'est des montagnes Rocheuses. Il peut se subdiviser en trois zones: celle des provinces des Prairies, celle du sud de l'Ontario et du Québec (surtout les basses-terres du Saint-Laurent et des Grands lacs) et celles des provinces Maritimes, le Nouveau-Brunswick, l'Île du Prince-Édouard, et l'ouest de la Nouvelle-Écosse.

Les exportations qui proviennent des points les plus éloignés sont le grain et la farine, tandis que les produits lourds et importés s'arrêtent dans les limites immédiates du port. Deux groupes de pays jouent un rôle primordial dans la vie portuaire de Saint-Jean, ce sont le Royaume-Uni, l'Irlande et l'Europe continentale qui reçoivent environ 75 p. 100 des exportations et expédient 36 p. 100 des importations, et les pays d'Amérique du Sud qui reçoivent seulement 10 p. 100 des exportations mais expédient plus de 45 p. 100 des importations.

Les principales denrées exportées sont les produits agricoles et forestiers, et celles importées sont le sucre brut, les produits pétroliers et les engrais.

Les denrées qui entrent ou sortent du port et qui ne sont pas importées ou exportées proviennent des ports de la baie de Fundy, en particulier Digby, des grands ports de Montréal et d'Halifax (produits pétroliers), enfin du port de Vancouver. En effet, des tonnages négligeables de denrées qui passent par Saint-Jean sont destinés ou proviennent d'aussi loin qu'Edmonton, par voie de Vancouver et du canal de Panama, à destination d'un centre de l'est du pays et aussi loin que Toronto. Un courant en sens inverse est aussi possible.

Le trafic avec les ports des États-Unis est assez volumineux durant l'hiver, surtout avec les ports de Détroit et de Chicago. Les ports de la côte du Maine entretiennent aussi des relations maritimes avec le port de Saint-Jean.

La fonction de transbordement se limite au sucre brut importé des Antilles, déchargé dans le port, et destiné aux raffineries de l'intérieur du pays. Les ports du Commonwealth sont les plus fréquemment visités par

les navires en provenance de Saint-Jean et les routes commerciales les plus importantes sont celles du nord de l'Atlantique, celles des Antilles et de l'Amérique du Sud.

Le grand problème du port de Saint-Jean est la mauvaise répartition de son trafic durant l'année. C'est un port saisonnier à fonction nationale durant l'hiver, alors que plus de 70 p. 100 de son trafic est manutentionné sur ses quais, et à fonction régionale, pendant les autres saisons.

MAP NOTES

SELECTED CANADIAN MAPS

Map of The World. 1:29,000,000 (approx.).

Canada, Dept. of Mines and Technical Surveys, Surveys and Mapping Branch, Ottawa, 1954. Price 50 cents.

The full title of this map is "Map of The World Showing Trade Routes and shortest Sailing Distances between Canada, other Commonwealth Countries, and Foreign Ports". The map is printed in thirteen colour tints with the countries of the Commonwealth and British colonies and protectorates shown in red. Post-war boundaries are indicated in addition to areas of trust territories, joint administration, and occupation zones. The location of Canadian trade commissioner offices abroad as well as diplomatic missions and consular offices are shown by coloured symbols. A table gives the distances in nautical miles between principal Canadian ports and other world ports.

Canada. Principal Mining Areas and Producing Mines (Map 900A, 4th ed.). 1:7,603,200. Price 10 cents.

Canada, Dept. of Mines and Technical Surveys, Mines Branch and Geological Survey of Canada, Ottawa, 1954.

The latest edition of this map is similar in type and content to its predecessors showing the physiographic divisions of the country with mineral information overprinted. There is one exception to this, however, in that the Innuitian region of the Queen Elizabeth Islands has never been previously shown. Both metallic and non-metallic mineral properties are indicated in addition to coal properties, mining areas, oil and gas fields and pipe-lines. Of special interest is the indication of the completion of the oil pipe-line from Superior, Wisconsin, to Sarnia, being the final link of this line from Edmonton. Seven insets show the distribution of metallic and non-metallic minerals in addition to important potential producing areas. Two useful tables show first the value of mineral production of Canada for 1953, both metallic and non-metallic, and second the value of mineral production of Canada from 1939 to 1953.

Canada. Federal Electoral Districts as Defined in the Representation Act, 1952.

Canada, Dept. of Mines and Technical Surveys, Surveys and Mapping Branch, Ottawa, 1953. 261 sheets. Price 25 cents per sheet, $28 per set.

These maps are conveniently arranged in five folios, which constitute one set. Each black and white sheet contains a definition of, and delimits, one electoral district by means of a red overprint. There are also general maps showing the electoral districts in each province. The scales vary with the area mapped.

Canada. Condition of Geodetic Operations at end of year 1953. 1:6,336,000.

Canada, Dept. of Mines and Technical Surveys, Surveys and Mapping Branch, Geodetic Survey, Ottawa, 1954. Price 25 cents.

The latest edition of this map shows areas where triangulation has been completed, reconnaissance areas, and lines of precise traverse and levelling. Of special interest are the points of precise astronomical fixation, particularly in the north.

Canada. Canadian Broadcasting Corporation Networks as at April 1, 1954.

Canada, Canadian Broadcasting Corporation, Commercial Division, Statistics Department, Toronto, 1954.

A set of four black and white maps includes a composite map showing all network and non-network stations together with their wire lines; the Trans-Canada Network and wire line; the Dominion Network and wire line; and the French Network and wire line. A fifth map shows the C.B.C. Television Network, including stations in operation, recommended stations, and the micro-wave relay system.

Ontario. (Aeromagnetic Series.) 1:15,840.

Ontario, Dept. of Mines, Toronto, 1953.

This new series is compiled and drawn from aerial surveys flown by the Aeromagnetic Surveys Ltd. in 1953. The sheets are in black and white and show isogammic lines (gamma contours) for 25, 50, 100, and 500 gammas.

British Columbia, Southeast. Southeastern British Columbia. 1:633,600.

British Columbia, Dept. of Lands and Forests, Surveys and Mapping Branch, Victoria, 1954.

These two maps, numbered respectively 1 EL and 1 EL Special, are on a universal transverse mercator projection. Map 1 EL shows roads, railways, and airports in addition to the boundaries of cities, municipal districts, and developed and undeveloped provincial parks on a base that delineates landforms by means of shading. Map 1 EL Special is a supplementary edition of the same area that omits cultural features and emphasizes landforms by means of shading.

[E.L.B.]

BOOK NOTES

CLIMATOLOGICAL ATLAS OF CANADA. Prepared by Morley K. Thomas. Canada, Dept. of Transport, Met. Div., and Nat. Res. Council, Ottawa, 1954, 253 pp., maps, diags., biblio. Price $2.

This publication contains 84 maps of climatic data relating to Canada grouped into eight sections—temperature, humidity, wind, snow, rain, sunshine and insolation, seismological disturbances, and permafrost, each map being accompanied by a short description of the distribution of the element plotted. The base maps, drawn before the discovery of the islands in Foxe Basin and other topographic changes, are all printed in brown on a scale of about 450 miles to 1 inch (the projection is not stated). On these, the isopleths or other scientific data and the explanatory information is overprinted in blue.

The last fifty or so pages of the book are occupied by black and white hythergraphs —24 for Canadian stations as well as those for London, Washington, and Paris, in order to give comparison with climates of other countries. An innovation is the inclusion on these graphs of mean wind speed and prevailing direction for the mid-season months of January, April, July, and October

[N.L.N.]

VARIABILITY OF ANNUAL PRECIPITATION IN CANADA. By Richmond W. Longley. Monthly Weather Review, vol. 81, No. 5, 1953, pp. 131-134, map, tbls. Price 50 cents.

The abstract preceding this article is as follows: "From computed values of the coefficient of variation of precipitation for Canada and northern United States, the distribution of this variable across Canada is determined. The minimum variability increases as one moves poleward. Also the variability is great in the central prairies. The pattern among the mountains and valleys of British Columbia is irregular".

[N.L.N.]

PROCEEDINGS OF THE SEVENTH PACIFIC SCIENCE CONGRESS OF THE PACIFIC SCIENCE ASSOCIATION 1949. Vol. VI, Soil Resources, Forestry and Agriculture. Auckland and Christchurch, New Zealand, 1953.

The Congress, of which Canada is a member, was founded for the study of scientific problems relating to the Pacific region. Volume VI of the proceedings of the 1949 meeting contains a number of papers on Canadian subjects: Soil Conservation in the Tobacco Belts of Ontario; Soils of the Canadian Cordillera in British Columbia; Factors affecting the extent of Arable Lands and the Nature of Soils in the Yukon Territory; Soil Resources and Land Use in British Columbia; Soil Classification Schemes in Canada; Grassland Investigations in the Pacific Coast Region of British Columbia; Grazing Conditions and Range Management in the Southern Interior of British Columbia; Minor element deficiencies affecting Canadian Crop Production and Fruit Growing under Irrigation in British Columbia.

[R.H.D.]

WATER SUPPLY PAPERS OF THE GEOLOGICAL SURVEY OF CANADA. Canada, Dept. of Mines and Tech. Surv., Geol. Surv., Canada, Ottawa, tbls., maps, mimeo.

This series of over 325 papers deals chiefly with southern Saskatchewan, but parts of Alberta, Manitoba, Ontario, and Prince Edward Island also are covered. They are intended for the use of farmers, well-drillers, municipalities, and industry, and include water analyses, data from drillers' records, surface and bedrock geology, and climatic summaries. Many are out of print, but may be borrowed for consultation by applying to the Geological Survey.

[J.K.S.]

BOTTOM TEMPERATURES OF THE SCOTIAN SHELF. By H. J. McLellan. Joint Committee on Oceanography, St. Andrews, 1953, 16 pp., figs., biblio., mimeo.

This report is part of a program initiated by the Atlantic Oceanographic group to make observations regularly each season over a fixed network on the Scotian Shelf. It is hoped that the data will serve for a study of the best fishing temperatures and to bring to light significant differences between fishing areas on the shelf.

[W.A.B.]

WATER CONDITIONS IN THE STRAIT OF CANSO. By D. G. MacGregor. Joint Committee on Oceanography, St. Andrews, 1953, 15 pp., figs., tbls., mimeo.

The purpose of this study is to present data on the temperature and salinities under varying conditions of the Strait of Canso before it becomes blocked by the construction of the causeway joining Cape Breton Island to the mainland. The results are given in the six points of summary.

[W.A.B.]

Soil Survey of Hants County, Nova Scotia. By D. B. Cann, J. D. Hilchey, and G. R. Smith. Canada, Dept. of Agri., Exp. Farms Serv. and Coll., Truro, and the Nova Scotia Dept. of Agri., Ottawa, 1954, 65 pp., illus., tbls., map.

The soils of the county and their utilization are discussed in detail, supplemented by an excellent contour map in colour. The legend of the map contains a vast amount of information such as acreages of various soils, parent material, topography and drainage, present land use, and use capability. A discussion of potential evapotranspiration is an addition to this series of soil reports. Other sections deal with population, transportation, industry, history, and development of agriculture, land use and management, and land use capabilities.

[B.C.]

Soil Survey of Southwestern New Brunswick. By R. E. Wicklund and K. K. Langmaid. New Brunswick Soil Sur. Rept. 4, Canada, Dept. of Agri., Exp. Farms Serv., in co-operation with New Brunswick Dept. of Agri., Fredericton, 1953, 47 pp., tbls., maps.

The fourth soil report of the New Brunswick Soil Survey in co-operation with the Federal Department of Agriculture supplies basic information about the soil, its geological origin, and its physical characteristics. The report considers the influence of drainage, climate, and vegetation on the soils, and describes recent land use and recommendations for crop management on the basis of current agricultural information, partly derived from the analysis of each soil type. A map on a scale of 2 miles to 1 inch shows the location of the various soil types.

[S.S.B.]

The St. Lawrence Spring Run-off and Summer Salinities in the Magdalen Shallows. By Louis Lauzier. Jour. Fisheries Research Bd. of Canada, vol. X, No. 3, 1953, 2 pp., graph.

This brief paper calls attention to the fact that it is possible, on the basis of run-off data, to calculate the salinity of the Gulf of St. Lawrence during the summer months—a factor of great importance in relation to the fisheries.

[W.A.B.]

Climate of Montreal. By R. W. Longley. Canada, Dept. of Transport, Meteorological Div., 1954, 46 pp., illus., tbls., graphs.

The information presented in this booklet will be of interest to all people in the Montreal area. Mean, maximum, and minimum temperatures, rainfall, snowfall, sunshine, frost, and below-zero temperatures are analysed for each month. The temperature statistics are shown on a graph and the probable variations from the normal for each date discussed. The weather is related to human comfort, e.g., probability of January thaws, coming of spring, ice break-up in the St. Lawrence, time of first and last frosts, influence of tropical hurricanes, Indian summer, and the period when heating is necessary in apartments. In addition to the monthly analysis, special sections are devoted to such topics as winter's cold and summer's heat, frosts, drought, storms, wind, climatic trends, sunrise and sunset, and weather services in Montreal.

[R.H.D.]

SOIL SURVEY OF MONTREAL, JESUS AND BIZARD ISLANDS IN THE PROVINCE OF QUEBEC. By P. Lajoie and R. Baril. Canada, Dept. of Agri., Expt. Farms Serv., and Quebec Dept. of Agri., Div. of Soils, Ottawa, 1954, 85 pp., tbls., illus., maps.

Ce rapport d'une étude pédologique des îles Jésus, Bizard et de Montréal, dans la province de Québec, s'inscrit dans la série des rapports d'études similaires entreprises sur une base fédérale-provinciale.

Les trois premiers chapitres sont consacrés à la description générale du territoire étudié, à l'explication des facteurs de formation du sol et à la classification des sols. Les chapitres suivants décrivent de façon très détaillée chaque type de sol des îles ci-haut mentionnées. Dans chacune de ces descriptions on traite des caractéristiques physiques de chaque sol et l'on discute leur emploi et leur rendement. Les sols sont classifiés d'après leurs traits pédologiques et groupés selon leur exploitation et leur aptitude à l'agriculture.

Plusieurs photographies et croquis servent à illustrer les profils des principaux sols ainsi que la végétation qu'ils portent. Une carte pédologique en couleur accompagne cette étude scientifique.

[J.P.St-P.]

LIST OF PUBLICATIONS, INCLUDING REPORTS (Vols. I-LXII, 1891 to 1953), MAPS, BULLETINS. Ontario Dept. of Mines Bull. 25 (sixth ed.), Toronto, 1953, pp. iv-60, maps. Price 25 cents.

This lists the publications of the Department (formerly Bureau) of Mines dating from its inception in 1891. It includes reports and maps, together with a short list of other publications relating to kindred subjects, such as Mining in Ontario, which were printed by order of the Legislative Assembly of Ontario. There is also a section listing the principal reports, in chronological order, by main topics.

[N.L.N.]

REPORT OF THE SELECT COMMITTEE OF THE ONTARIO LEGISLATURE ON LAKE LEVELS OF THE GREAT LAKES. Toronto, Queen's Printer, 1953, illus., maps, graphs.

As a result of the widespread damage caused by flooding during the winter and spring of 1952, the Ontario Legislature appointed a Select Committee to report on factors affecting water levels of the Great Lakes and on shore protection measures. The published report includes a description of the six lakes and technical data concerning the lake levels and factors likely to cause variations. The basic principles of shore protection measures are set out, the various factors of erosion discussed, and the different types of shore protection described. The report includes the results of a lakeshore survey carried out in 1951 by the Ontario Department of Planning and Development at Long Branch, a community on the north shore of Lake Ontario near Toronto. Maps, graphs, and shoreline photographs illustrate the text.

[B.V.G.]

UPPER SAUGEEN VALLEY CONSERVATION REPORT 1953. Ontario Dept. of Planning and Development, Toronto, 1953, 170 pp., diag., tbls., maps.

This is a summary of a full report noted in Geographical Bulletin No. 5. It contains the information that is of more general interest and much source material for those working on the geography of the area, such as the history of settlement, physiography, soils, land use, forests and wildlife, and the regime of the river.

[N.L.N.]

PLANTS OF THE FARMING AND RANCHING AREAS OF THE CANADIAN PRAIRIES. By A. C. Budd. Canada, Dept. of Agri., Expt. Farms Serv., 1952, map, illus.

This handbook provides a ready field reference key for the identification of flora found in various zones and regions from the Foothills of Alberta to the eastern boundary of Manitoba and from the International Boundary north to North Saskatchewan River. Plants are classified in divisions, subdivisions, classes, families, genera, species, and finally in forms, subspecies, and varieties. Adequate line sketches, illustrating all plant characteristics, are provided along with a glossary of terms.

[M.R.D.]

SOURCE AND NATURE OF THE REGOLITH IN THE VARIOUS LANDSCAPE AREAS OF SOUTHERN MANITOBA. By J. H. Ellis and L. E. Pratt. Proc. of the Sixth Can. Soil Mech. Conf., Canada, Nat. Res. Council, Assoc. Comm. on Soil and Snow Mech., Tech. Mem. No. 27, Ottawa, 1953, pp. 3-20.

A brief description of soil and its horizons introduces an outline of the source and nature of the surface geological deposits in the various landscape areas of southern Manitoba. It deals with the effect of ancestral rock on the texture, mineral composition, and altitude at which the regolith is found.

Southern Manitoba is divided into three major physiographic regions: (i) the Western Uplands, (ii) the Manitoba Lowlands, and (iii) the Laurentian or Precambrian region. The regions are further subdivided into landscape areas on the basis of topography, altitude, and natural vegetation cover, which are described in detail.

[S.S.B.]

FARMING IN THE ARMSTRONG DISTRICT OF MANITOBA, 1948. By T. O. Riecken. Canada, Dept. of Agri., Econ. Div., and the Univ. of Manitoba, Dept. of Pol. Econ., Winnipeg, 1953, map, illus.

This study sets out the progress and development of the farms on the poorer soils of the Armstrong district between 1939 and 1948. Data collected in an economic study of 55 farm records made in 1939 were compared with that obtained from 44 farm records in 1948. The material is presented under the headings: description of the area, history of development, farm business in 1948, changes in farm organization, productivity, and variations in farm returns.

[M.R.D.]

SASKATCHEWAN: ITS RESOURCES AND INDUSTRY. Saskatchewan, Industrial Development Office, Regina, 1953, 76 pp., maps, illus., tbls., graphs.

This booklet contains the latest information on the growth and development of the province of Saskatchewan. The description is set out in three sections, each dealing in turn with resources, industry, and the possibilities for future development of local resources. In the appendixes, data are presented on existing industries and on Saskatchewan cities.

[M.R.D.]

POCKET GUIDE TO TREES AND SHRUBS IN BRITISH COLUMBIA. Revised by E. H. Garman. British Columbia, Dept. of Lands and Forests, pub. B 28, 1953, 102 pp., map. Price 75 cents.

A small, yet comprehensive, handbook, revised to meet the need of woodsmen and students for a simple guide to the identification of trees and shrubs of British Columbia. It uses a minimum of botanical terms, with keys taking the place of the pictures that are normally used for ready but rough identification in more general publications. Notes of historical significance are included, and the ranges of many plants have been extended in the light of recent information. An analytical Key to the Families is followed by descriptions of other important characteristics of each family. The height and size of the tree and its distribution is given, followed by a detailed account of its leaves, fruit, or flower. A Key to the Genera accompanies these family descriptions.

[S.S.B.]

GAZETTEER OF CANADA, BRITISH COLUMBIA. Ottawa, Canadian Board on Geographical Names, 1953, Queen's Printer, Ottawa. Price $3.

This is the second volume to appear in the new Gazetteer of Canada. (*See* Geographical Bulletin No. 4, p. 71.) It contains the names of all populated places, the names of coastal features, and the names of the rivers, lakes, mountains, and other topographical features presently listed in the records of British Columbia. Locations are given by Land Districts, and, in addition, the position of the feature is listed by the quadrilateral indexing system. The introduction includes an historical sketch and a description of the physical subdivisions of the province and its climate. This is followed by four tables setting forth climatic data; the main rivers and their drainage areas; islands and their areas; and cities, districts, and villages with their populations.

[N.L.N.]

INDUSTRIAL WATER RESOURCES OF CANADA—COLUMBIA RIVER DRAINAGE BASIN IN CANADA, 1949-50. By J. F. J. Thomas. Canada, Dept. of Mines and Tech. Surv., Mines Br., Water Surv. Rept. No. 4, Ottawa, 1953, 80 pp., stat., tbls., graphs, map. Price 75 cents.

INDUSTRIAL WATER RESOURCES OF CANADA—SKEENA RIVER DRAINAGE BASIN, VANCOUVER ISLAND, AND COASTAL AREAS OF BRITISH COLUMBIA, 1949-51. By J. F. J. Thomas. Canada, Dept. of Mines and Tech. Surv., Mines Br., Water Surv. Rept. No. 5, Ottawa, 1953, 53 pp., stat., tbls., graphs, map. Price 75 cents.

These two reports are the continuation of a series on the chemical quality of surface waters and municipal water supplies available for industrial and domestic use in Canada. Both, therefore, follow the same pattern. They each begin with a short description of the area surveyed, followed by a short account of the survey and analytical procedures. The bulk of the reports consists of the data collected, first on the surface waters and then on the municipal waters. The latter section begins with a description of municipal water systems, by municipalities, of interest to urban geographers.

[N.L.N.]

SURFACE WATERS OF THE CANADIAN PACIFIC COAST. By J. P. Tully and L. A. E. Doe. Pacific Oceanographic Group, Nanaimo, B.C., 1953, 15 pp., maps, graphs.

The report contains the summarized results of four surveys conducted by the Pacific Oceanographic Group. The brief text deals with the structure, physical properties, origins, and circulation of the water. This text is illustrated with maps and graphs and a list of references is supplied.

[C.N.F.]

DAILY SEAWATER OBSERVATIONS ON THE PACIFIC COAST OF CANADA. By H. J. Hollister. Pacific Oceanographic Group, Nanaimo, B.C., 1953, 16 pp., maps, graphs.

The importance of building up a long and continuous record of observations of surface seawater temperatures and salinities is emphasized. Knowledge of the pattern of seasonal and annual fluctuations makes possible the prediction of certain oceanographic conditions. These observations also assist fishery investigations by showing important relationships between water temperatures and salinities and the abundance of fish.

[C.N.F.]

SURFACE TIDAL CURRENTS IN JUAN DE FUCA STRAIT. By R. H. Herlinveaux. Pacific Oceanographic Group, Nanaimo, B.C., 1953, 28 pp., maps, graphs, tbls.

Surveys of tidal currents were carried out in 1952 with the aim of ascertaining the tidal velocity cycle. Measurements were taken at three stations across the strait during successive days over a period of time. As a result of the study, simple rules were outlined to predict surface currents in the area with an accuracy of half a knot.

[C.N.F.]

LIST OF PLANTS COLLECTED ON PRINCE CHARLES AND AIR FORCE ISLANDS IN FOXE BASIN, NORTHWEST TERRITORIES, AND PLANTS FROM TWO SMALL ISLAND HABITATS IN JAMES BAY. By W. K. W. Baldwin. Ann. Rept. of the Nat. Museum of Canada for the Fiscal Year 1951-52, Bull. 128, Ottawa, 1953, pp. 143-153 and 154-167. Price $1.50.

To the account of the voyage of the *Nauja*, which appeared in Geographical Bulletin No. 4 (pp. 1-31) can now be added the report of the botanist on this expedition to Foxe Basin. Although Prince Charles and Air Force Islands were "generally well covered with vegetation, chiefly the characteristic wet meadows of grass and sedge, there was little variety of habitat". Nevertheless, 75 species and major varieties of vascular plants are listed and the report includes four photographs. On the other hand, 86 different species were collected from the two much smaller habitats, Gasket Shoal and Solomon's Temple Island, in James Bay, which the writer discusses in his second paper.

[N.L.N.]

LIST OF LABRADOR ESKIMO PLACE NAMES. By E. P. Wheeles 2nd. Canada, Dept. of North Aff. and Nat. Res., Nat. Mus., Canada, Bull. 131, Anth. Ser. 34, Ottawa, 1953, 105 pp.

This handbook provides an alphabetical list of some 523 place names on the Labrador coast. Each name is discussed systematically and covers pronounciation, source of information, nature of the feature, location, and the Eskimo meaning of the name.

[W.A.B.]

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1955