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PREFACE

The articles in the second number of the Geographical Bulletin deal with very different subjects and different regions, but they have one feature in common that is of significance not only to the work of the federal geographical service but to the appreciation of geography itself. This common characteristic is found in the fact that each article has arisen out of projects jointly undertaken with other departments of government and other disciplines. Because the actual geography of any area is made up of the unique organization or relationship within that area of physical, biotic, and human factors, including geology and geomorphology, climate, flora and fauna, human occupancy and settlement, the geographical description of the place concerned must make use of many disciplines to present an adequate and a scientific account.

The field party that surveyed the coasts of Lake Huron and Lake Superior went out with the practical purpose of studying the value of these coasts, both by water and by land, for the tourist trade and for economic development in general. The opportunity was taken of co-operating with the Hydrographic Survey. The party, consisting of geographers and hydrographers, used a hydrographic vessel and made hydrographic soundings and other surveys of the coastal waters, at the same time analysing the shoreline from a geographical point of view to describe its morphology and use.

In the case of the Atlas of Canada (the preparations for which are described in the second article), an even greater degree of co-operation was necessitated and has been achieved. It may be of value to interested organizations in Canada and to the governments of such other countries as are proposing to publish national atlases to have the history of the development of the Atlas of Canada project.

In 1945 a report was published by the Canadian Social Science Research Council concerning the need for a new National Atlas. The matter was also discussed by officers of the Canadian Committee of the International Union of Geographers whose Chairman, the late Col. Grant Suttie, also urged it upon the consideration of the Government. The council concluded that the publication of the Atlas might properly belong to the Government.

By decision of the Cabinet, December 1948, the Government decided to sponsor the project. As the earliest Atlases of Canada had been published by the Department of the Interior and as the Department of Mines and Resources had succeeded to the functions of the former department, it was agreed that the Minister of Mines and Resources should be responsible for the production of the Atlas. However, as the Atlas was to cover, as the article in this bulletin indicates, a wide variety of topics, and was to serve many highly specialized needs, it was recognized that most departments of government would be involved. An Interdepartmental Committee was, therefore, set up to advise the department concerned with the production of the Atlas.

When the Department of Mines and Resources was divided into three new departments in January 1950, it fell to the Department of Mines and Technical Surveys to continue to sponsor the Atlas project. The Director General of Scientific Services of this Department, Dr. G. S. Hume, was confirmed as Chairman of the Atlas Interdepartmental Committee. For practical purposes it was deemed advisable to have the Geographical Branch of the Department act as the agent of production, to help co-ordinate plans and to organize the preparation of the Atlas.

At the same time, an Executive Committee of the Interdepartmental Committee was set up consisting of the Director of the Geographical Branch and the Director of the Surveys and Mapping Branch, Department of Mines and Technical Surveys; the Dominion Statistician, Bureau of Statistics, Department of Trade and Commerce; the Director of the Army Survey Establishment, Department of National Defence; and the Dominion Archivist. The Secretary of the Atlas project is a geographer in the Geographical Branch and the author of the article on the Atlas in this Bulletin.

The Executive Committee reviewed the work of the Geographical Branch in comparing and contrasting all existing national atlases and drew up guides as to the size, shape, projection, scale, and contents of the proposed Atlas. Upon submission of these to the Interdepartmental Committee the Executive Committee was then empowered to set up working sub-committees in every department concerned.

The sub-committees took as a guide the suggestions about contents, but were asked to submit recommendations of their own. In this way, each discipline concerned has been given a view of the project as a whole and has also had a chance to represent itself, with due regard to the needs of others.

The Geographical Branch works with the sub-committees to give information on methods of production gleaned from the examination of other atlases, or in some instances to prepare draught sheets covering the subjects to be shown. The familiarity of the members of the Branch with the varied disciplines that go to form the contents of geography enables them to assist where required.

The third article in this bulletin also arises from a project in which the geographer has worked with other scientists, in this case meteorologists. The study stresses the geographical aspects of the climate of the Island of Newfoundland, the meteorological aspects of which were analysed and recorded for the Meteorological Division of the Department of Transport. As is quite obvious from the article under discussion, the geographer is involved in the study of weather because of the far reaching effects that weather and climate have on the geography of sea and land conditions and of the economic and social development and activity of any region.

Thus, geography is seen as a discipline whose work it is to show relationships of a wide range of physical and human factors within any area. Its task is, in fact, to take cognizance of any factor that has a spatial connotation that helps to stamp a region with individuality. By comparing and contrasting individual regions the wider picture of the nation, or the world as a whole, is obtained and human activities and problems are given their geographic setting.

The bulletin also shows that many government branches and scientific services contribute greatly to geographic knowledge by indicating the geographical basis or limits of their functions and operations. Book and map notes on government publications of geographical interest indicate the many sources that help to supply Canadians with the knowledge of the geography of their country.

J. WREFORD WATSON,
Director, Geographical Branch

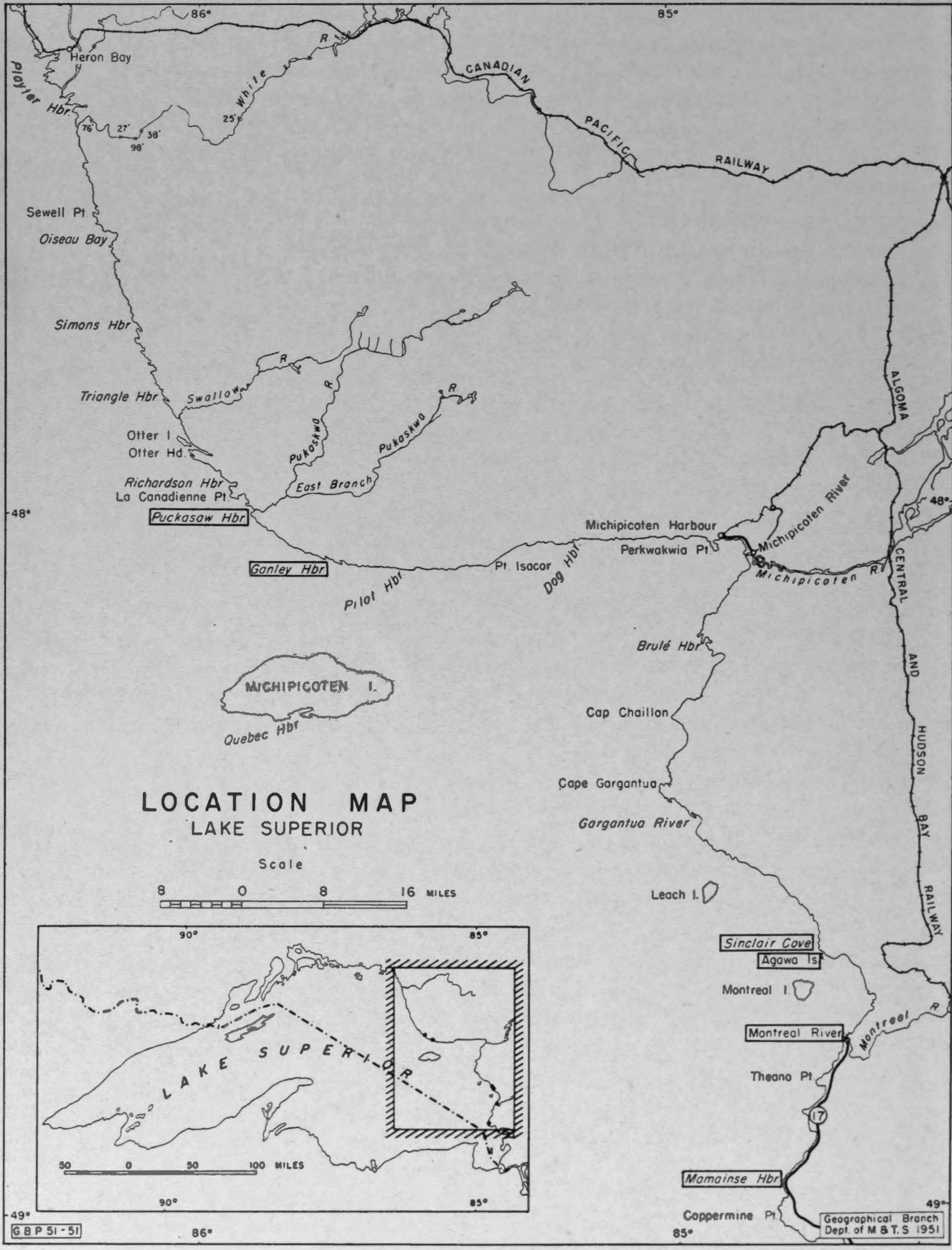

Figure 1. Location map.

THE SHELTERS ALONG THE EAST COAST OF LAKE SUPERIOR

B. V. Gutsell and J. K. Fraser[1]

This account concerns the types of available harbours along a section of the east coast of Lake Superior between Montreal River, which is at the terminus of highway 17 from Sault Ste. Marie, and Heron Bay in the northeast corner of the lake where the Canadian Pacific railway between Sudbury and the lakehead first touches the lakeshore. Between these two points the coast is isolated, undeveloped, and unpopulated except at Michipicoten Harbour where the Algoma Central railway reaches the lakeshore. Along this stretch of coast there are no land communications, and accessibility is only from seaward. The coast has thus remained undeveloped apart from woods operations, fishing, and trapping, and has no recreational centres or developed harbours with facilities except Michipicoten Harbour. This is in contrast with the coast southwards from Montreal River to Sault Ste. Marie where a number of small ports, recreational centres, and summer colonies have developed in connection with the highway. Likewise, along the north shore westwards from Heron Bay to the lakehead, commercial and recreational centres have developed in connection with rail and road communications along the lakeshore.

Few cruising craft sail on Lake Superior, and it is possible that the impression is that no available shelters exist along the east coast. But a survey made in 1949 showed that there are twenty harbours along this coast that can be utilized by small craft, and each was entered by the C.G.L. *Bayfield*, a 48-foot launch with a beam of 11 feet 6 inches and a draught of 3 feet 9 inches, during the course of the survey.

The small scale of the charts for this coast (1 : 73,000 to 1 : 96,000) and lack of detailed information in the Pilot[2] about these smaller harbours may also act as a deterrent to small craft. The scale of the charts and the lack of prominent relief features along this coast makes coastal navigation difficult and the entrances to many of the smaller shelters are difficult to locate because there are no beacons, bull's eyes, or white markers to pinpoint them. This locational difficulty, however, will only be experienced by those unfamiliar with the coast, as the harbours were readily located by the survey party on the return from the lakehead. Other navigational difficulties are the frequent fogs during the summer, and also the floating logs and deadheads that are encountered in great numbers. Pulpwood is still being towed down the coast to Sault Ste. Marie from as far north as White River, a distance of over 200 miles. Driftwood along the entire shoreline gives evidence of the loss of logs from the booms during the towing operations.

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[1] B. V. Gutsell, B.A., Univ. of London, and J. K. Fraser, B.A., Univ. of Toronto, are geographers with the Geographical Branch, Department of Mines and Technical Surveys, Ottawa. Both were members of a Geographical Branch party, led by Mr. Gutsell, which carried out an investigation of harbours along the Canadian shores of Lake Superior during the summer of 1949, in collaboration with the Canadian Hydrographic Service.

[2] Great Lakes Pilot (Vol. III), Canadian Shores of Lake Superior, 2nd. edn., King's Printer, Ottawa, 1944.

The available harbours along the isolated east coast of Lake Superior fall into three main categories: river-mouth shelters, natural bays or coves, and shelters by offshore islands. Six harbours have been selected as examples to illustrate these types.

RIVER-MOUTH SHELTERS

MONTREAL RIVER

The harbour, located 18 miles northward of Coppermine Point, lies midway between Sault Ste. Marie and Michipicoten Harbour. It provides one of the best shelters along the east coast and is important as a re-fuelling point.

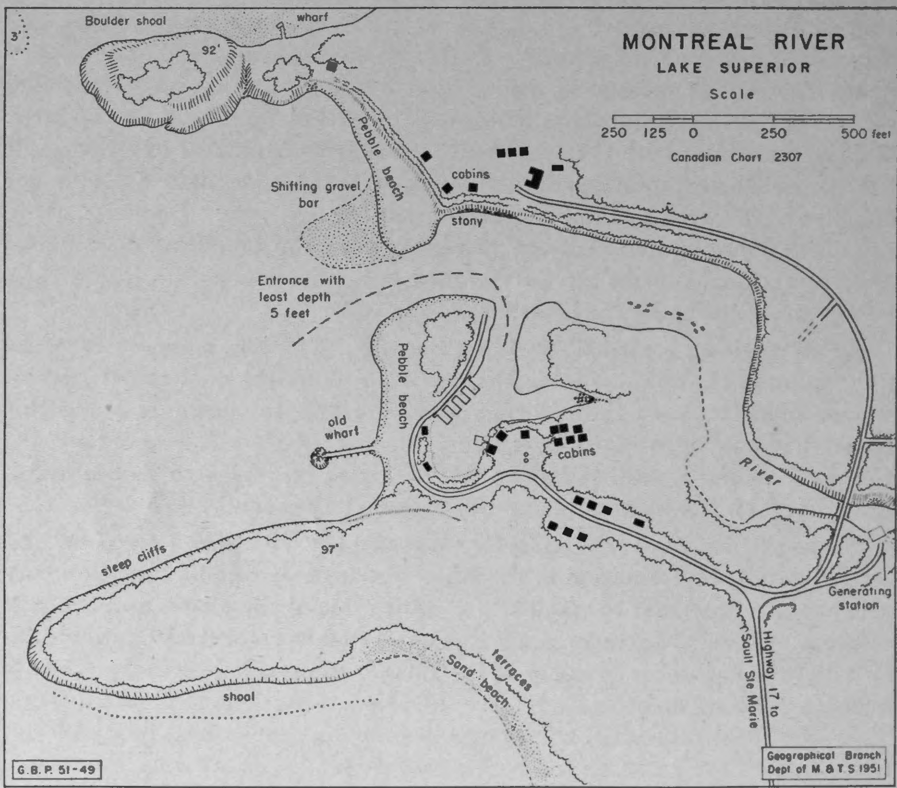


Figure 2. Sketch map of Montreal River harbour.

The river enters the lake between two low rocky headlands or points that rise to about 100 feet above the lake level and form a small bay. The head of this bay is lined with shingle beach surmounted by storm beach. Eastwards of the beach, the river has deposited sand and gravel, and the whole area is now consolidated with scrub vegetation.

The entrance to the river is between the shingle beaches and south of a shoal spit that makes out for 225 feet from the north point in a westerly

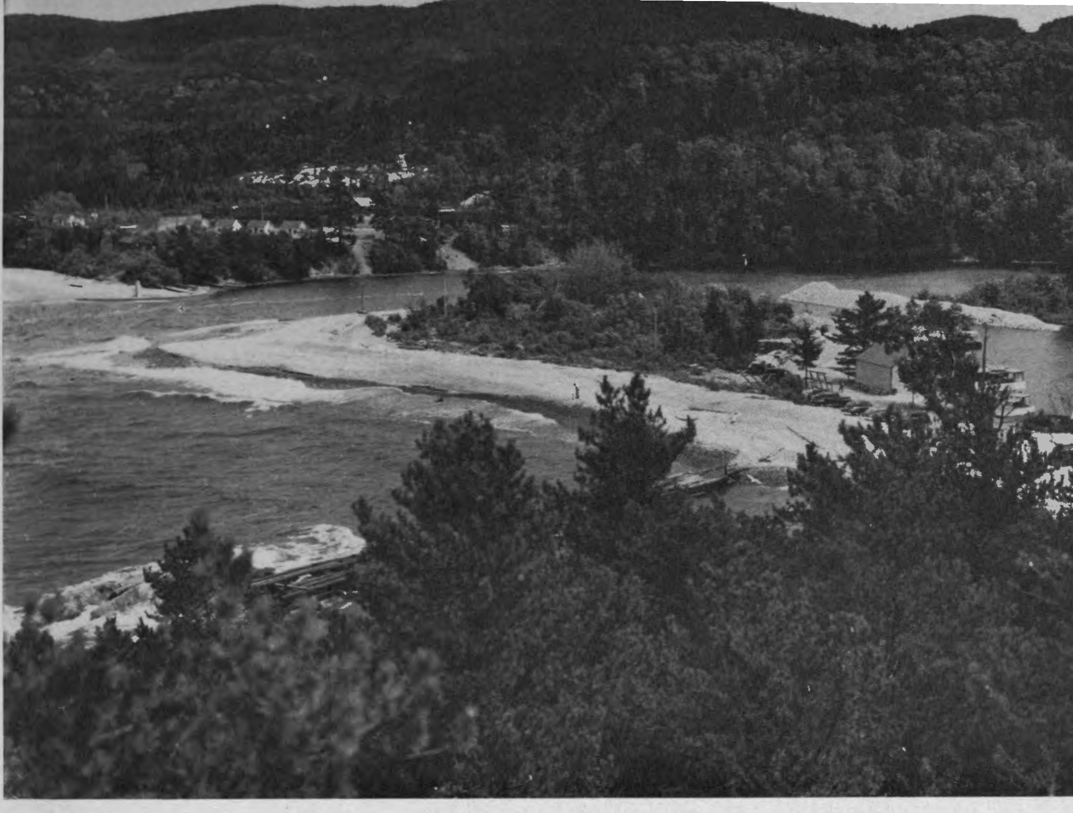
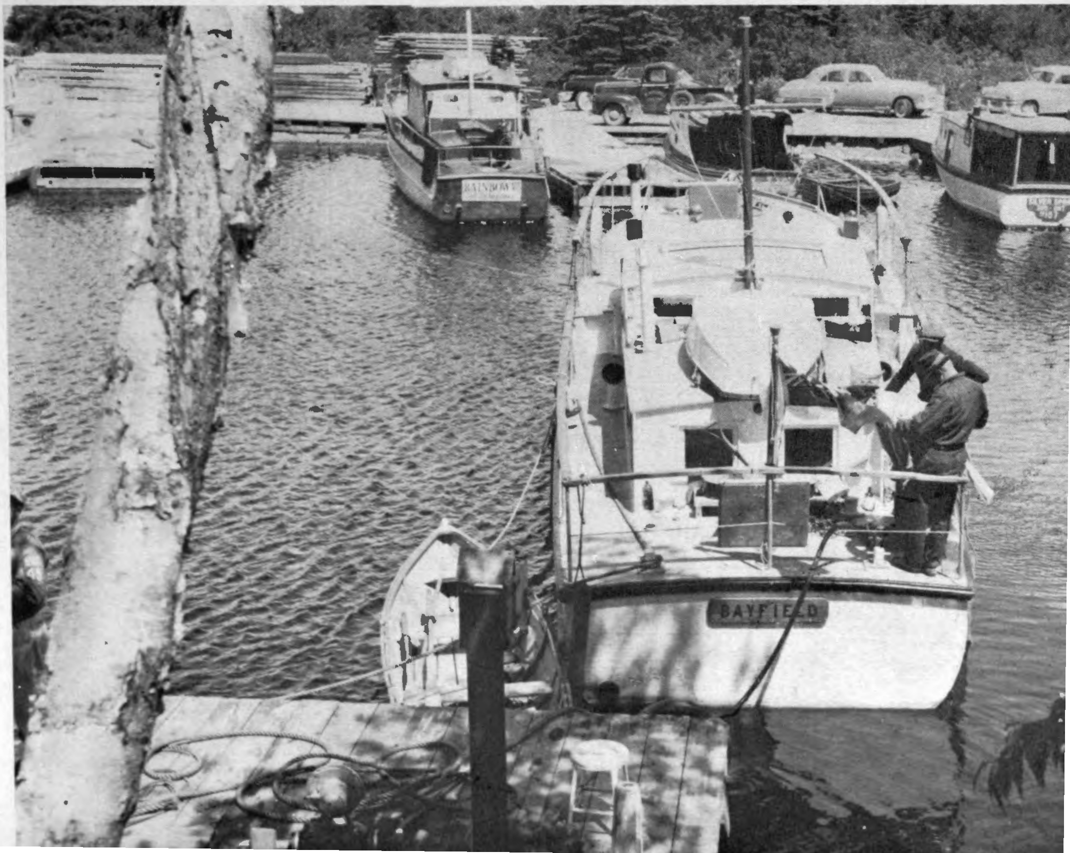


Figure 3. Montreal River harbour with the river entrance, the dredged cut leading to the govern
wharf, and the old wharf in foreground.

Figure 4. The *Bayfield* re-fuelling at Montreal River harbour; the government wharf is in backg



direction. This shoal spit has only 1 foot of water and any sea breaks on it. The channel at this entrance is 100 feet wide and has a depth of 5 feet. On rounding the south point of the river entrance in about mid-channel, the boat basin can be seen, and entry is made without any difficulty through a dredged channel about 30 feet wide protected by dredged shingle spoil on both banks. The entrance to the channel is about 400 feet from the south entrance point. Above this point, 200 yards from the south entrance, the river is obstructed by two sets of falls.

Within the boat basin, a government wharf has been built consisting of four crib structures each 10 feet wide projecting 40 feet from the shore and with a depth of 5 to 6 feet along the outside end. On the southeast side of the basin, opposite the government wharf, a small wharf has been constructed for fuelling.

On the terraced levels above the gravel flats there are temporary settlements north and south of the river. To the south, there is tourist accommodation, a general store, and dwellings constructed in connection with the hydro-electric development on Montreal River. North of the river are additional tourist cabins and former prisoner of war barracks.

Located at the terminus of highway 17, which runs northwards from Sault Ste. Marie, the settlement has developed, as it is accessible both by land and water. The major developmental factor, however, was the establishment of a hydro-electric power plant. Installations producing 10,000 k.w. were built on the upper falls in 1937 and enlarged to produce 24,000 k.w. by 1940. A second installation producing 10,000 k.w. was built on the lower falls in 1938 and extended to produce 20,000 k.w. in 1942. These installations provide power for Sault Ste. Marie and rural areas as far east as Thessalon on the North Channel, Lake Huron.

The tourist trade is increasing because of the scenic attractions, but mainly because of the good sport fishing off Montreal River. Commercial fishermen who operate from this base charter launches and take fishing parties to the shoals that lie 3 to 4 miles off the coast. It was reported that most visitors who engage in this sport come from the United States.

PUCKASAW RIVER

Puckasaw River was found to be an excellent shelter and one of the most attractive along the east coast of the lake. It is located 50 miles westward of Michipicoten Harbour, 9 miles southeastward of Otter Head, and 2½ miles southward of La Canadienne Point. The river enters the lake by a series of falls and rapids that terminate about ¼ mile from the river mouth. The river mouth is between 40 and 50 feet wide and is obstructed by a gravel bar that extends from a prominent gravel spit on the south bank. About 5 feet can be carried across the bar, favouring the north side of the entrance. A sharp turn is made for the southern bank when clear of this gravel spit and the southern bank is held in order to clear a second and noticeable gravel spit that makes out from the northern bank. The vessel then proceeds in mid-channel to the foot of the rapids where anchorage in 22 feet can be made in the foam itself over a sand and gravel bottom (Figure 5). The channel below the rapids is free from rocks and has a maximum depth of between 20 and 22 feet. The channel is deepest at the foot of the rapids where the scour is greatest and shallows towards the river mouth where the sand and gravel spits have been built up. The spits tend to obstruct the river mouth and necessitate caution in entering, but at the same time they serve to prevent swells and breakers from entering the lower channel. In late August, when the *Bayfield* used this shelter, the current in the channel was not sufficiently strong to cause dragging, but during early summer, with a stronger flow of water, the anchorage at the foot of the rapids is probably untenable and launches would be advised to tie up to the south bank.

The lower channel is enclosed by wooded, rocky banks up to about 50 feet high and is protected from most winds. From the foot of the rapids on the left bank, a narrow trail leads up alongside the rapids to the old Spanish River Company dam. Excellent speckled trout fishing is reported in the river above the rapids.

There is no settlement at Puckasaw River and there are no wharfage facilities. During the period 1919 to 1929, the site was used as the headquarters of the Abitibi Power and Paper Company woods operations in this area. Wood taken from here was towed to Sault Ste. Marie. After 1929, when cutting ceased in this area, operations moved to White River, 45 miles to the north, and the company is still towing pulpwood from this location.

NATURAL BAYS OR COVES

GANLEY HARBOUR

Ganley Harbour, located on the rugged and isolated coast stretching westwards from Michipicoten Harbour, lies 16 miles west of Point Isacor and 12 miles southeastward of La Canadienne Point. The coast is indented with a number of small bays, which, however, offer little shelter for coasting craft as they are, in general, shallow, open, and obstructed with rocks. Ganley, on the other hand, offers good and easily accessible shelter, but it is difficult to locate as the coast has few prominent landmarks on which to navigate. One locational feature is a bare rock 10 feet high lying $\frac{1}{4}$ mile south-southwest of the west entrance to the bay. This rock "looms up fairly conspicuously from eastward or from westward"[1], but may be confused with a similar bare rock 6 feet high lying off Red Sucker Cove, 1 mile east of Ganley Harbour. The rock off Ganley Harbour would prove of considerable use in locating the harbour if marked with a bull's-eye or a beacon.

[1]Great Lakes Pilot (Vol. III), p. 28.

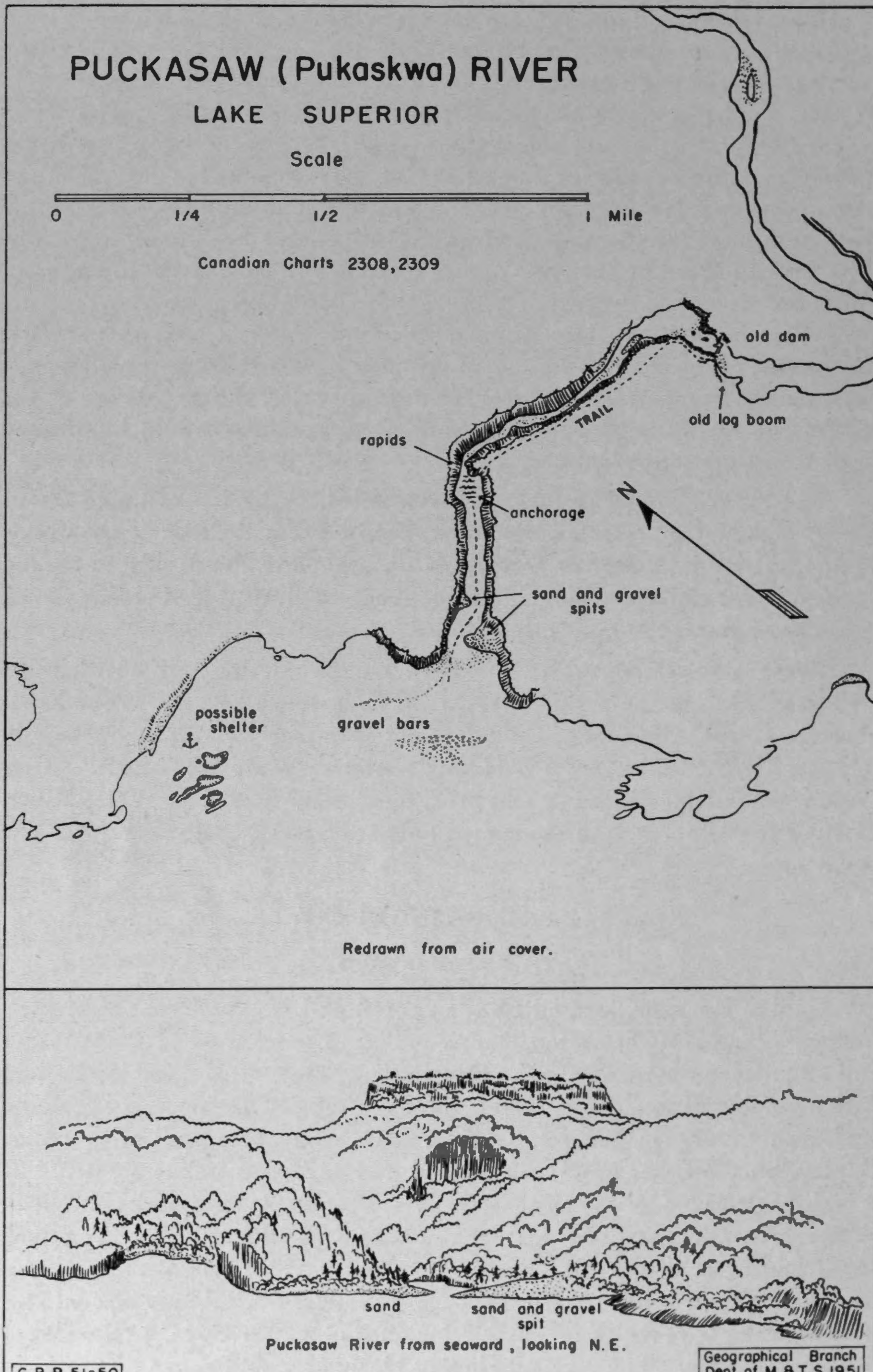


Figure 5. Sketch map of Puckasaw River showing approaches to the anchorage and the shelter. The sketch from seaward illustrates the approach and shows topographic features of use in locating the shelter.

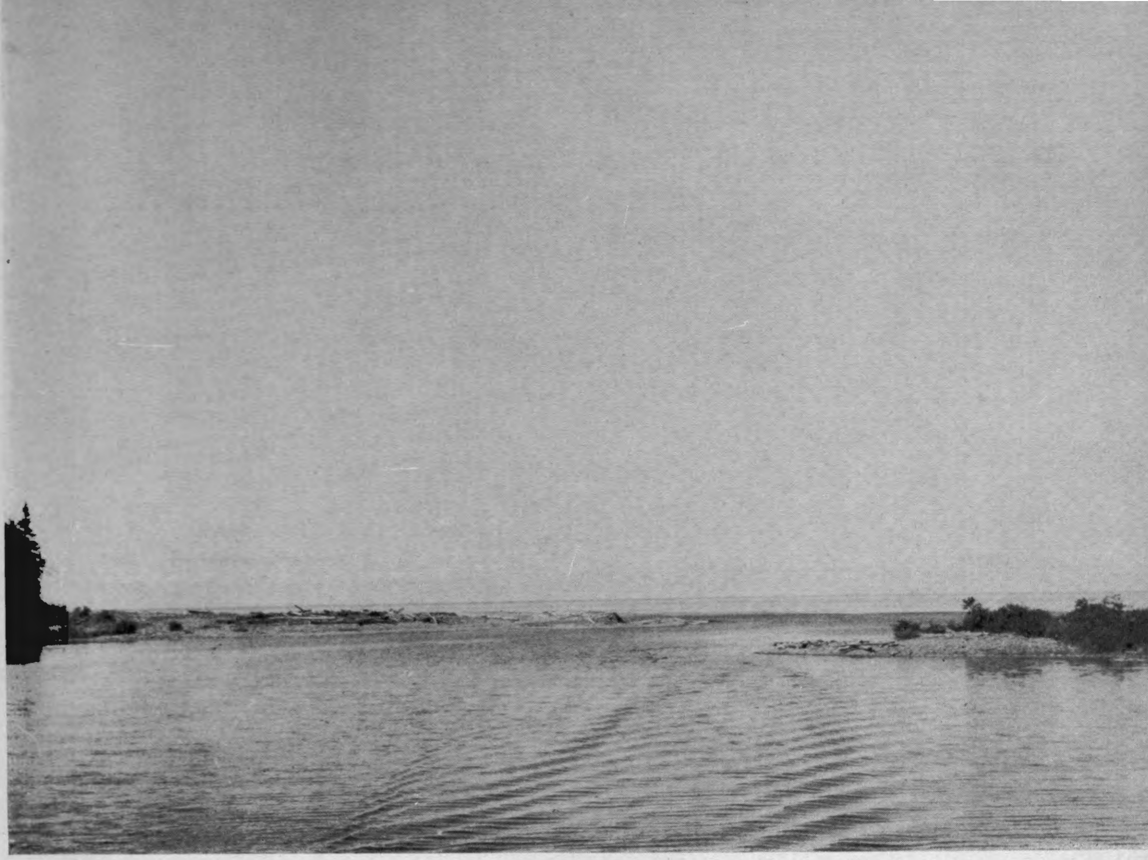


Figure 6. Puckasaw River, looking to seaward, showing the approach between shingle spits obstructing the entrance.

Figure 7. Puckasaw River, looking upstream to the foot of the rapids, and showing the shelter in the lower channel.

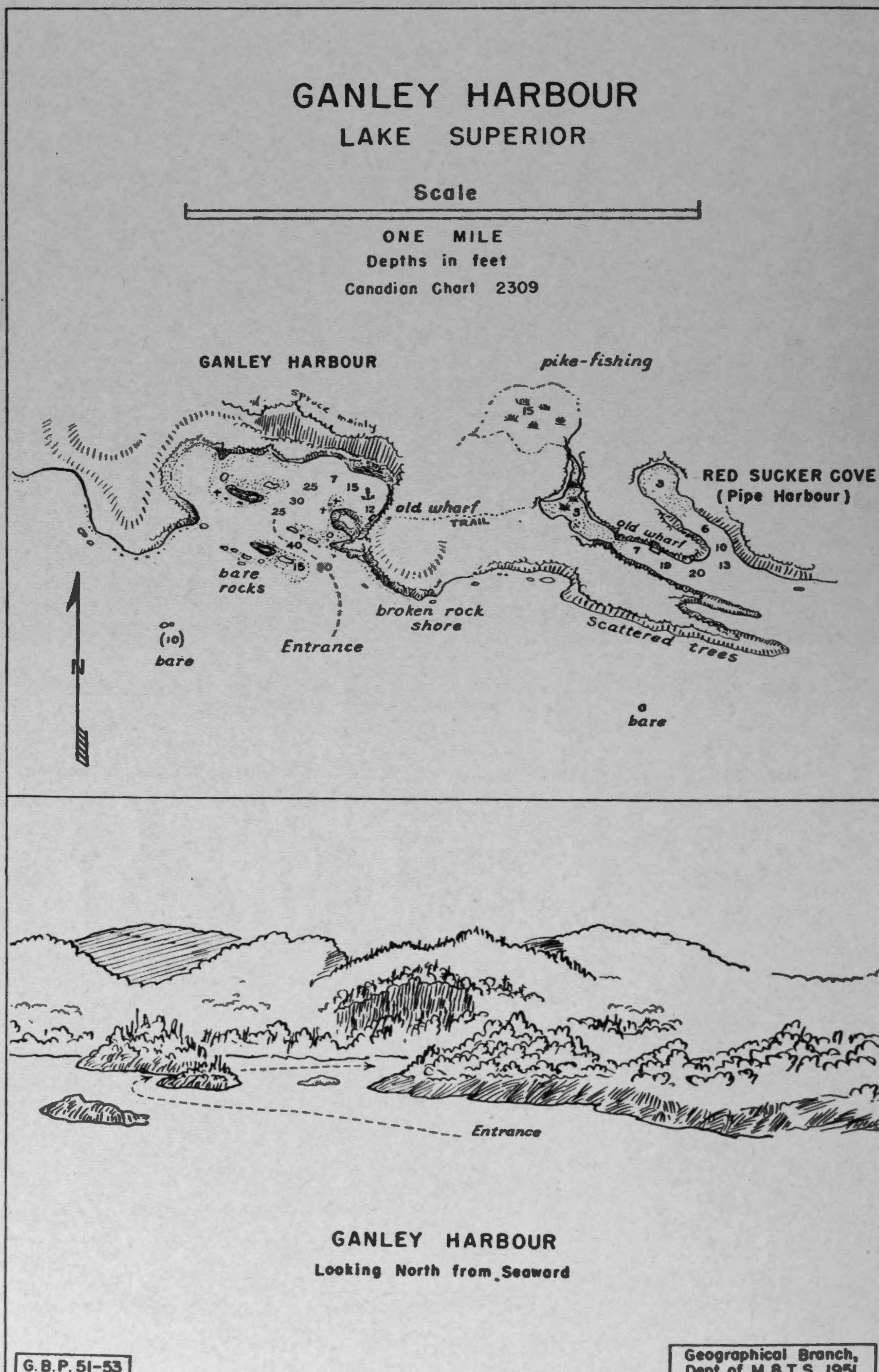


Figure 8. Sketch map of Ganley Harbour with sketch from seaward to illustrate the approach.

Figure 9. Ganley Harbour from seaward showing the rocks off the entrance. The photograph illustrates the difficulty in locating the harbour and underlines the necessity for caution in approaching the shelter.

Figure 10. Ganley Harbour showing the inner approaches to the anchorage.

Red Sucker Cove can be used as an alternative shelter to Ganley Harbour, but the harbour is not as well protected as Ganley as the entrance is open to south and southeast winds. In addition, the bay shallows rapidly and cannot be penetrated far, as investigation showed. A ruined wharf on the north shore of the bay, however, gives evidence of former use by small craft.

SINCLAIR COVE

Sinclair Cove, located on the mainland coast 3 miles north-northeastward of the northeast point of Montreal Island and about 26 miles northward of Coppermine Point, is useful as an alternative shelter to the Agawa Islands anchorage $1\frac{1}{4}$ miles to the southeast. The entrance to the cove is not easily discernible from seaward as the several bays and low rocky islands tend to merge with the rock cliffs backing the lakeshore. As there is no beacon at Sinclair Cove to pinpoint the entrance, the cove can best be located without navigational aids by relation to the main Agawa Island. Extreme caution is required in entering the cove as there are other bays in the immediate vicinity that may be confused with Sinclair Cove, and, in general, they are obstructed with rocks and dangerous to enter.

The cove is about 1,000 yards in length north-south and divided into two unequal parts by Sinclair Island and the rocks and shoals that extend eastwards from the island to the mainland. The northern and larger section of the cove is of little use for shelter as it is open and obstructed with rocks and rock ledges. Sinclair Island, rising to between 60 and 70 feet, is about 350 yards in length northeast-southwest, and about 250 yards wide. The cove is enclosed by low cliffs 40 to 70 feet high surmounted with sparse pine or mixed forest.

Sinclair Cove should be entered south of Sinclair Island where there is good water up to about 60 feet deep. Turning to starboard, after passing the island, small craft may proceed to the southeastern part of the harbour favouring the steep cliffs on the south shore. The southeastern part of the cove shallows gradually to a sand and boulder beach, but anchorage in 12 feet on sand bottom can be found about 300 feet from the beach. In the extreme south of the bay there is a ruined wharf with little water alongside and with an approach obstructed by large, rounded boulders lying in the sand bottom.

Before surveying the cove, the *Bayfield* anchored to the southeast of Sinclair Island with 8 feet of water at the bows and 19 feet at the stern as conditions in the inner bay were not known. Because of the danger of swinging in a confined space in a heavy swell, the launch had to be secured with bow lines attached to the island, and anchored fore and aft.

SHELTERS BY OFFSHORE ISLANDS

AGAWA ISLANDS

These islands, located west-northwest of Agawa Point, which marks the west entrance to Agawa Bay, are composed of two small groups lying in two lines parallel with the coast. These two separate lines run northwest and southeast following the direction of the coast in the immediate vicinity. The outer group, the Agawa Islands proper, lie ½ mile off the coast, whereas the inner group, known as Ganley Islands, are separated from the mainland by a channel between 600 and 700 feet wide. The two groups are separated by a deep water channel about 1,000 feet wide. Northwest and southeast of the two groups extend rocks and shoals following the same orientation as the islands. The largest island in these two groups is ⅓ mile long and 300 yards across, rising to a height of 161 feet. The whole island is thinly wooded, mostly with jack pine, as are the other islands in the two groups.

The shelter, used by fishing craft and other transient craft, lies in the lee of Ganley Islands and may be approached from northwest or southeast following the inner channel. Approaching from the northwest the channel is free of obstructions and deep water extends to the base of the low cliffs that rise sheer from the lake. Good anchorage in 15 to 20 feet may be obtained off the south island in the Ganley group and there is excellent protection from westerly winds. Approaching from the southeast the main island in the Agawa group and the bare rocks off the southeast of the island lie on the port side. Care should be taken to avoid the rocks and shoals fringing the shore northwest of Agawa Point, and the rocks southeastward of the largest island.

The main island in the group forms a conspicuous feature, as it lies off the headland, is wooded, and rises to 161 feet above the lake level. It can be clearly observed when approaching from the north or the south. The shelter is best approached from the north by those unfamiliar with the locality as there is deep and unobstructed water up to the foot of the cliffs overlooking the inside channel and northwards to Sinclair Island.

There is a small commercial fishing establishment located on the southernmost of the Ganley Islands close by the anchorage. The establishment is equipped with living quarters and an ice-house and has a small wooden jetty with very little water alongside.

The shelter has no apparent utilization other than as a base for commercial fishing and as an anchorage.

MAMAINSE HARBOUR

Mamainse Harbour, 13 miles south of Montreal River, lies outside the stretch of coast under consideration but has been included as an example within this category as it shows development through land communications, in marked contrast with Agawa Islands anchorage.

The harbour is formed by the group of islands that lie immediately off Mamainse Point, 3½ miles to the north of Coppermine Point. These islands protect a narrow channel that forms the shelter and is open to the north and south. The islands lie in a narrow coastal shelf up to ½ mile wide and extending southwards from Mamainse Point to St. Mary's Channel. Shallow water with rocks and shoals is thus found fringing the coast within this area. Beyond the shelf, the bottom drops steeply to the

Lake Superior rift that runs parallel with the coast northwards from Whitefish Bay. The westward side of this deep channel or rift is marked by the shoals and islands that lie between 3 and 4 miles offshore northwards to Leach Island off Bald Point. In general, the coastal waters along the north and east shores of Lake Superior are deepto close inshore.

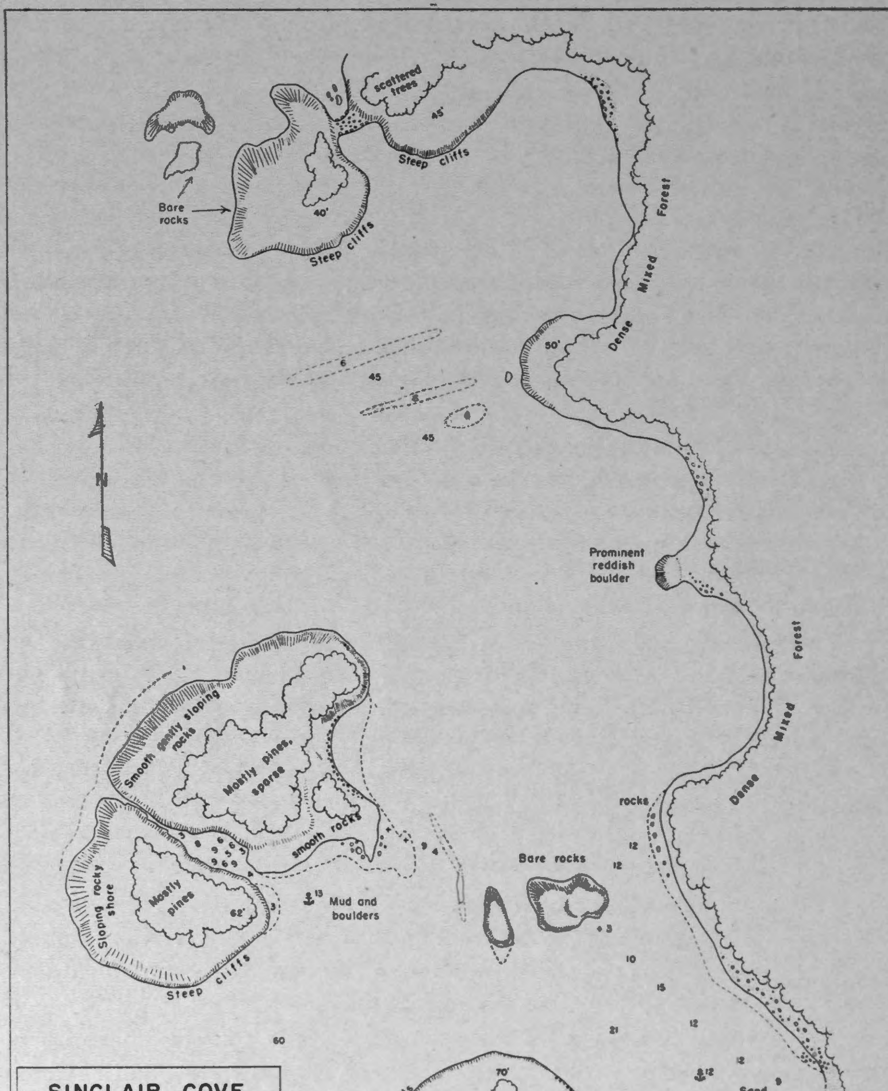


Figure 11. Sketch map of Sinclair Cove.

Figure 12. Sinclair Cove from seaward, showing the approach to the anchorage south of Sinclair Island (left). The rocks dividing the cove into two parts are visible in the background (centre).

Figure 13. Sinclair Cove from Sinclair Island, looking southeast to the anchorage in background (right). The photograph shows the rocks and shoals between the island and the mainland. The *Bayfield* is at anchor in the outer anchorage and tied with lines ashore.

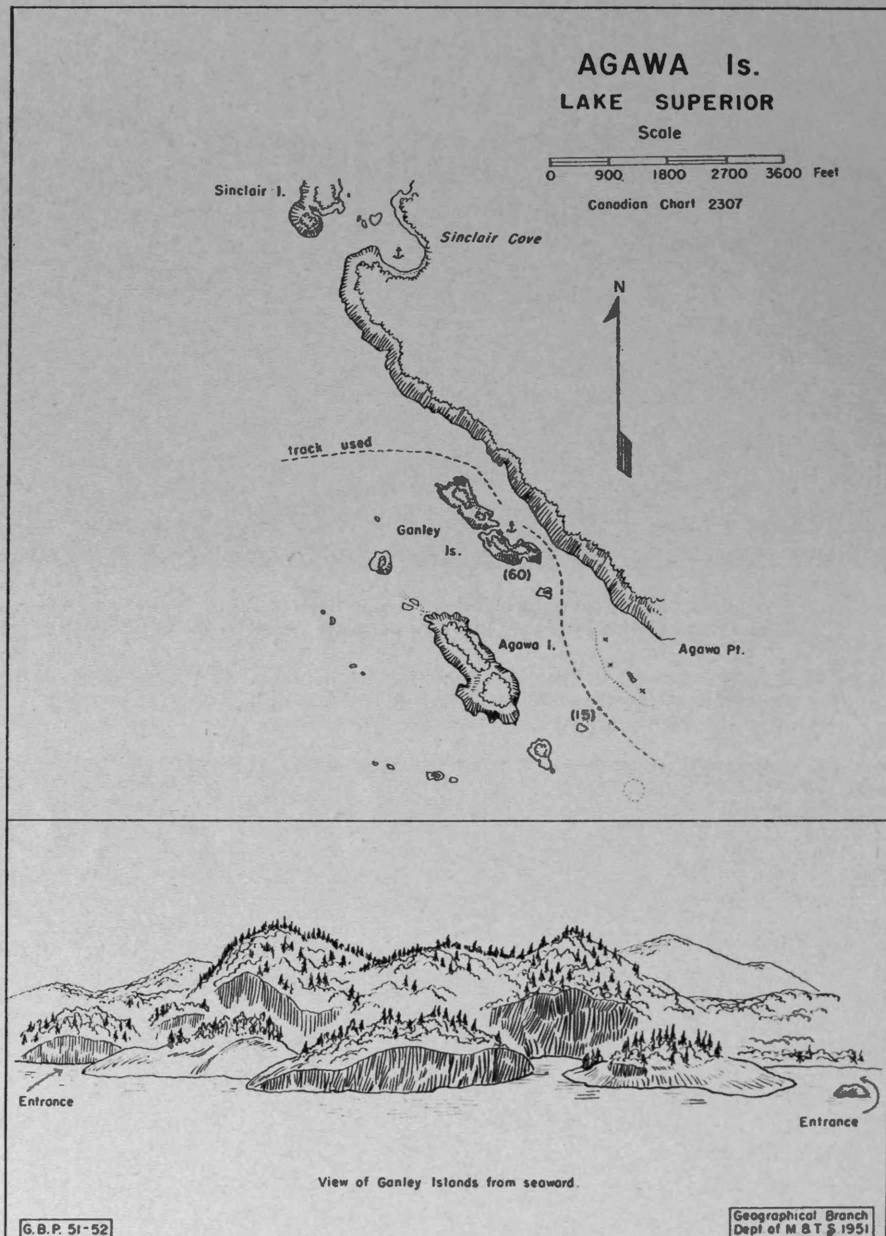


Figure 14. Sketch map of Agawa Islands and a sketch from seaward.

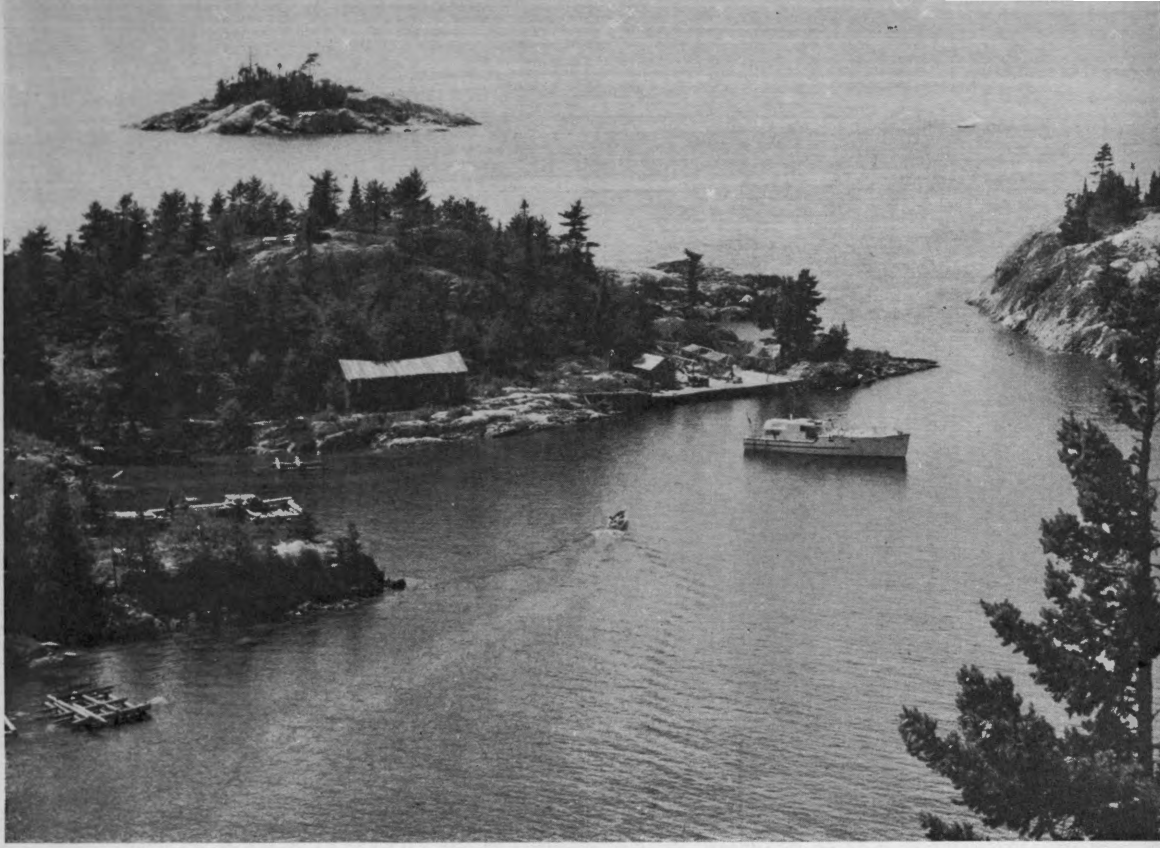


Figure 15 Agawa Islands with the *Bayfield* at the anchorage near the fishing station on Ganley Island.

Figure 16. The approach to Agawa Islands from northward, showing the main island to right and Ganley Island at centre.

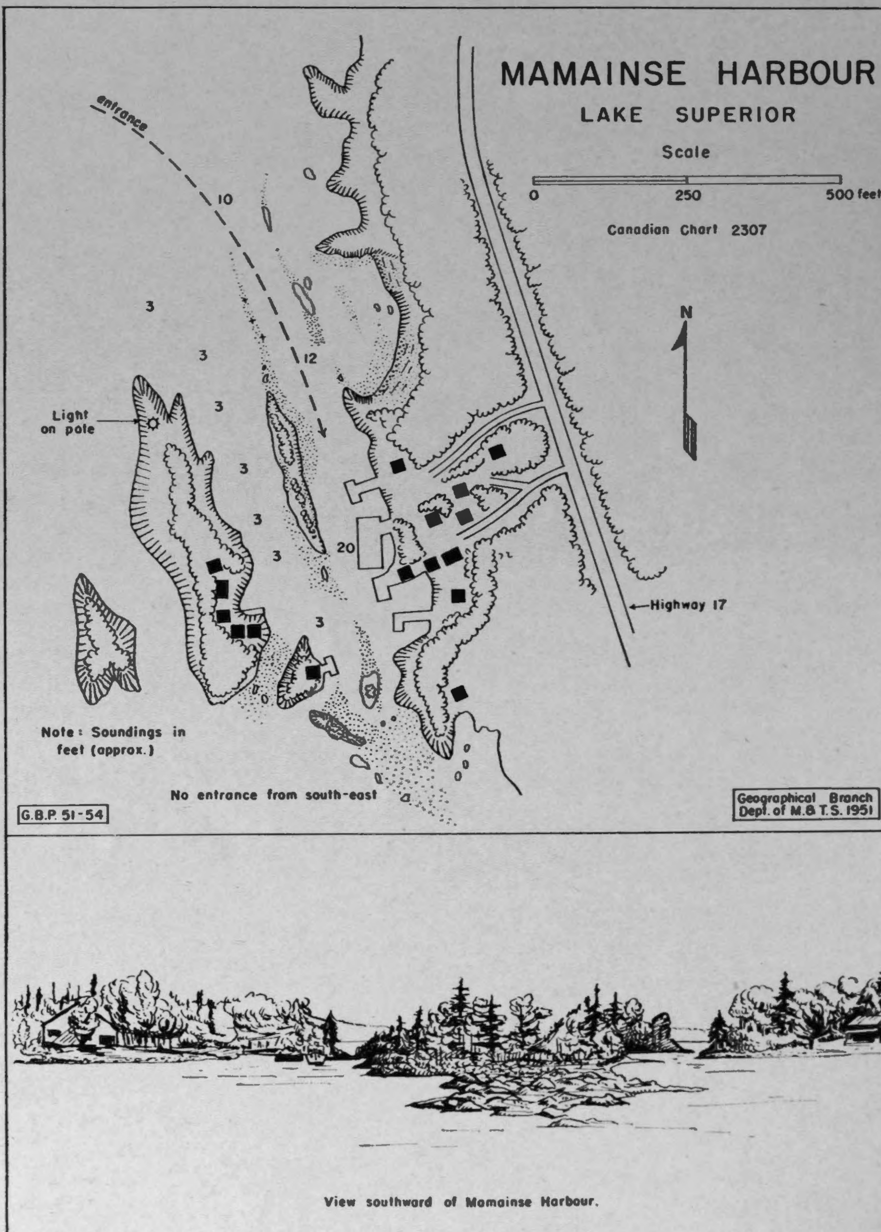
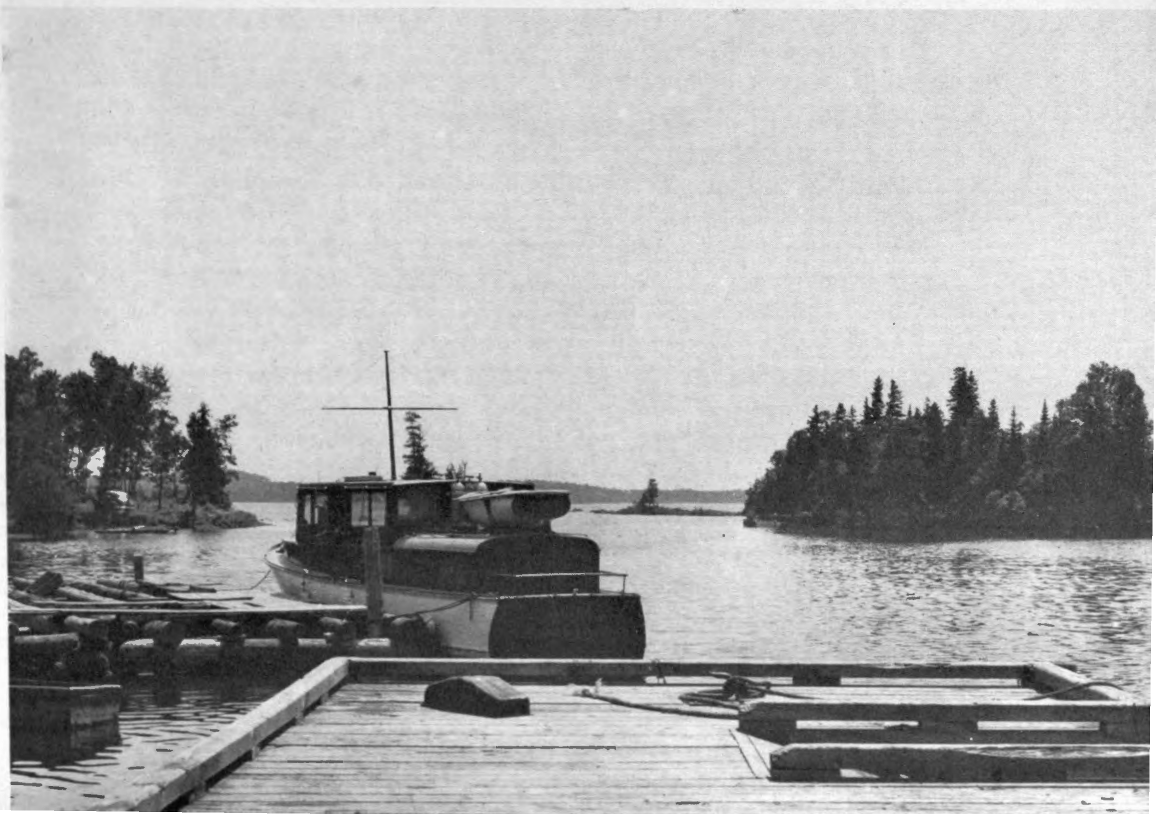


Figure 17. Sketch map of Mamainse Harbour.

Figure 18. View northwards from the government wharf showing the approach to Mamainse Harbour.

Figure 19. Mamainse Harbour looking south from the government wharf.



The entrance to the harbour is to the north of Mamainse Island and is not easily discernible. In order to enter, Mamainse Island should be passed $\frac{1}{2}$ mile off, and then a course set to pass within $\frac{1}{4}$ mile of the northern end of this island. The shelter behind the islands then opens up and the entrance to the main channel will be observed lying between the mainland and a low, sparsely wooded island immediately east of Mamainse Island. A shoal extends north from the inner island and may be crossed with 10 feet of water at a point about 350 feet north of the government wharf. A second shoal parallel with the outer shoal runs northward from a low rocky point immediately north of the government wharf. The entrance channel to the shelter lies between these two shoals. The harbour should be entered with extreme caution by those unfamiliar with the locality, and it should not be entered during a northeast wind when waves sweep into the channel and roll the gravel bottom.

Inside the shelter there is a government wharf with a pierhead 116 feet long and with 6 feet of water alongside. In addition, there are three small jetties for use by small boats. A small summer colony has sprung up on the islands and the mainland, and provisions, ice, and fuel may be obtained from the general store. There is no permanent settlement, but now that the area is connected by road with Sault Ste. Marie, tourist and recreation facilities are likely to develop further. Originally, Mamainse was connected with the mining of copper, and as early as 1770 attempts at this were made by Alexander Henry. Further attempts to mine the copper were made about 1850 following the discovery of rich deposits on the south shore of the lake, but Mamainse was never a successful venture.

RÉSUMÉ

Les havres qui peuvent servir de refuge ou d'abri, le long de la côte est du lac Supérieur, entre l'embouchure de la rivière Montréal et la baie Héron, sont au nombre d'une vingtaine. Voila l'un des résultats d'une expédition entreprise par le petit navire canadien C.G.S. *Bayfield*, en 1949.

Cette expédition avait pour but de découvrir et de signaler les principaux abris que les petits navires peuvent utiliser en cas de tempête, de grands vents ou d'accident, lorsqu'ils croisent le long de cette côte inhospitalière.

On a choisi six havres pour illustrer les trois types de refuges que l'on rencontre le plus souvent dans ces parages. Ce sont les havres situés à l'embouchure des rivières Montréal et Puckasaw, le havre de la baie naturelle de Ganley et celui de l'anse Sinclair, enfin les abris qui résultent de la proximité des îles avec le rivage, espèces de chenaux étroits et profonds, soit le havre des îles Agawa et celui de Mamainse.

A SURVEY OF SINGLE-COUNTRY ATLASES

Norman L. Nicholson[1]

The simplest definition of an atlas is that it is a collection of maps bound together. If this is accepted, the first known atlas was the twenty-eight page work that accompanied Ptolemy's *Geographia* some time in the second century A.D. According to Raisz[2] no real atlases were published in the Middle Ages, and the first modern geographical atlas was the famous *Theatrum Orbis Terrarum* of Ortelius. This appeared in 1570, and its commercial success led to other collections of maps being published. Some of these atlases were general in nature, being primarily concerned with location in as many parts of the world as possible, and the development of these has led to what have become known as world reference atlases.[3] Others devoted their attention to collections of maps of a single country, which evolved into "national" atlases. The first of these was compiled by Christopher Saxton from 1574 to 1579, which covered the counties of England and Wales, and in 1594 the first real atlas of France appeared.[4] Since that time national atlases have increased in number and quality as rapidly as developments in surveying and cartographical reproduction would allow. As this occurred, national atlases, although primarily concerned with maps covering one country, came to include some maps showing that country's relationships with other countries and with the rest of the world. The word "national", therefore, has come to refer to a viewpoint rather than a restricted content, but as many atlases are now being produced that cover single political units that cannot be described as "nations", such as Tanganyika and British Honduras, the term "single-country atlas" will be used as if it otherwise had the meaning of "national atlas" mentioned previously. Single-country atlases, although differing from world reference atlases in content, may be, and generally are, the same in physical form.

One of the main characteristics of single-country atlases was that they dealt with the broader aspects of geography, usually presented on a systematic basis, and were not primarily concerned with geographical locations. This distinction is still noticeable, although since World War I the trend away from mere location has spread to world reference atlases.[5] Single-country atlases possess this feature because they have come to serve many highly specialized needs within the community, and people look to them for information on a wide variety of topics. Therefore, they can be categorized as "special atlases" that "serve the needs of professional geographers, historians, economists, and other researchers by providing specific, and often detailed, information for a limited area or of a definite type".[6]

[1] Dr. Nicholson is Secretary of the Atlas of Canada project. This paper was presented at the annual meeting of the Association of Canadian Geographers held in Montreal, May 1951. The material for the tables and diagrams was compiled with the assistance of J. W. Waters, B.A., M.Sc., Univ. of Western Ontario, Geographer, Geographical Branch.
[2] Raisz, E.: General Cartography; McGraw-Hill, New York, 1938, p. 219.
[3] World Reference Atlases; Bull. Amer. Soc. for Prof. Geogs., vol. 3, Nos. 5–6, p. 1 (Sept.-Oct. 1945).
[4] Brown, L. A.: The Story of Maps; Little, Brown and Co., Boston, 1949, p. 167.
[5] Joerg, W. L. G.: Post-War Atlases, A Review; Geog. Review, vol. 13, No. 4, p. 583 (Oct. 1923).
[6] World Reference Atlases; op. cit., p. 1.

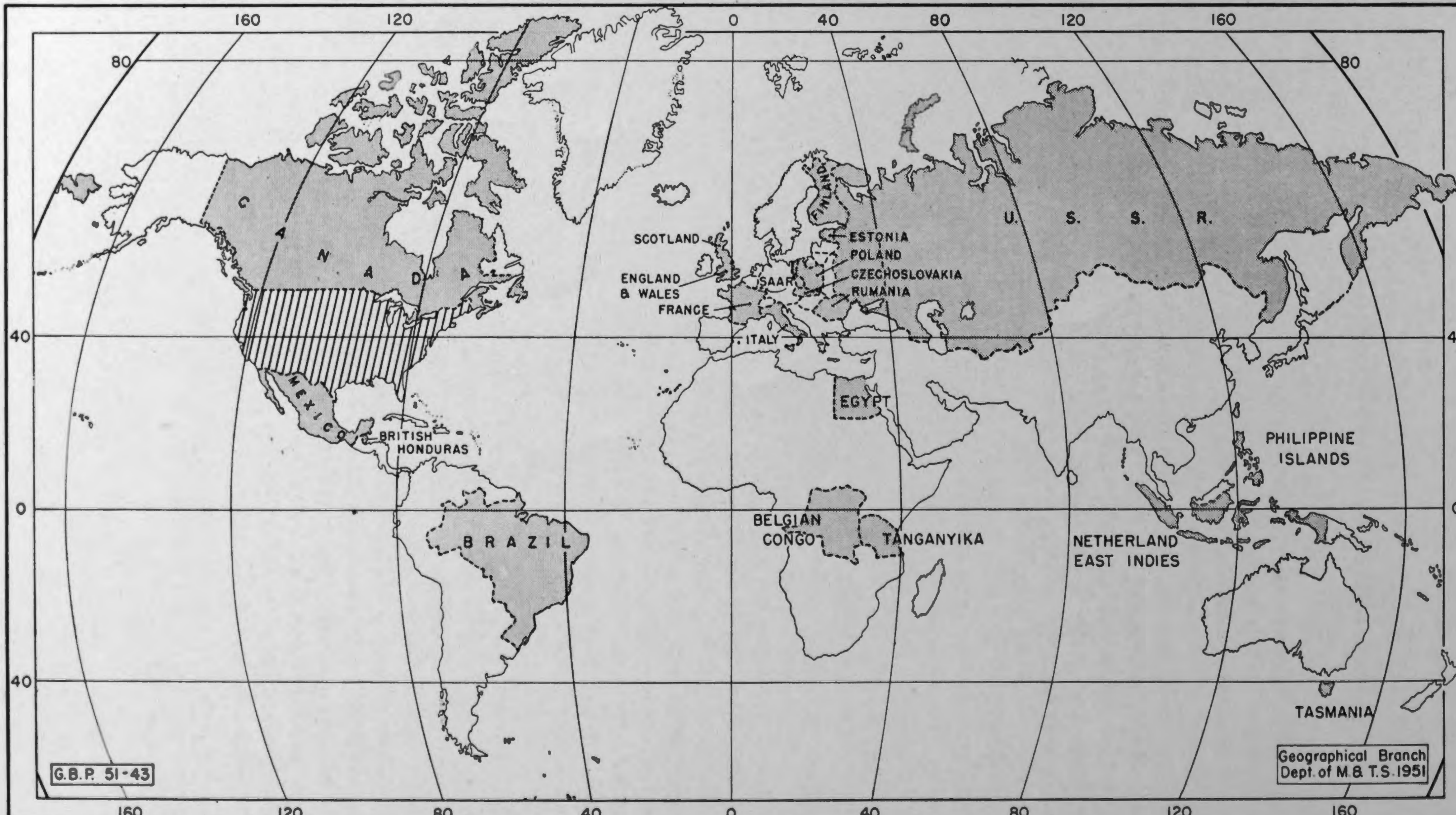


Figure 1. **The distribution of the single-country atlases examined during the course of the survey. The U.S.A. is shaded because the atlas is still in the planning stage.**

During the past half century a number of these single-country atlases have been published, one of the earliest being produced by the Government of Canada in 1905. But the last edition of this *Atlas of Canada* appeared in 1915, and, consequently, when the preparation of an up-to-date volume was commenced, cognizance had to be taken of the developments in the field of single-country atlases since that time. It was necessary to establish afresh what a single-country atlas was, what it looked like, what information it contained, and so on. To do this the importance of examining the works of other countries was realized and an analysis was made of the main features of as many single-country atlases as could be conveniently obtained in addition to the proposals emanating from several parts of the world for new atlases of this type. Twenty-one published single-country atlases were examined, together with the plans for atlases of Belgium, Denmark, Great Britain, Morocco, Sweden, and the United States of America. The list of publications examined was not intended to be exhaustive, but it included atlases dealing with much of the earth's surface (Figure 1).

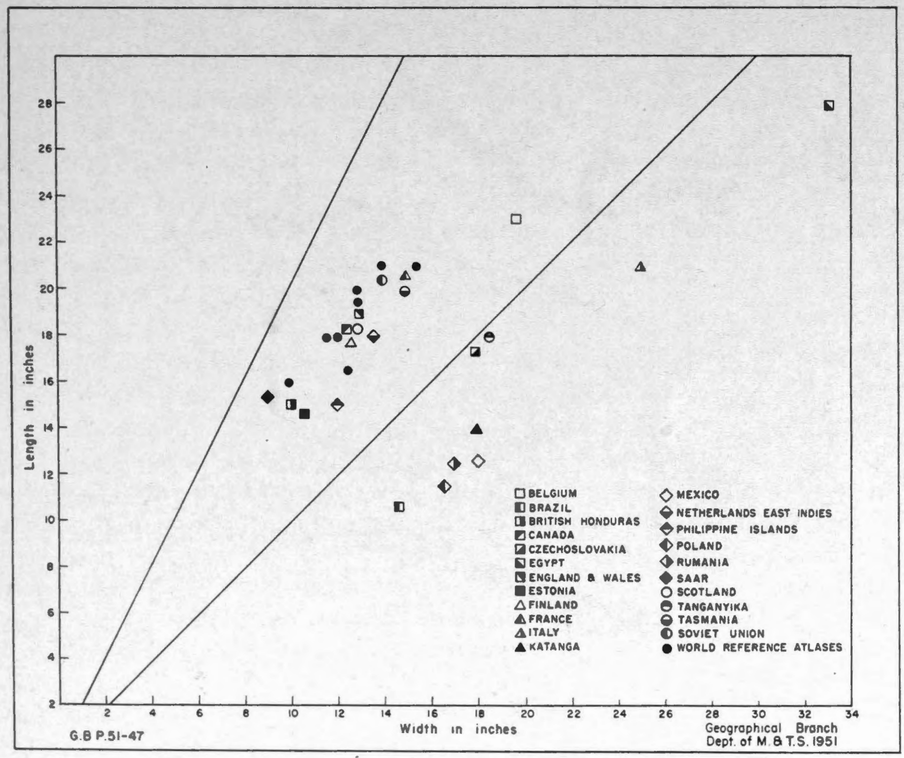


Figure 2. The sizes and shapes of the single-country and world reference atlases examined.

PHYSICAL PROPERTIES

As the atlases obviously varied with regard to their outward characteristics, attention was first paid to such physical factors as shape, size, weight, and type of binding. But as a single-country atlas is usually a

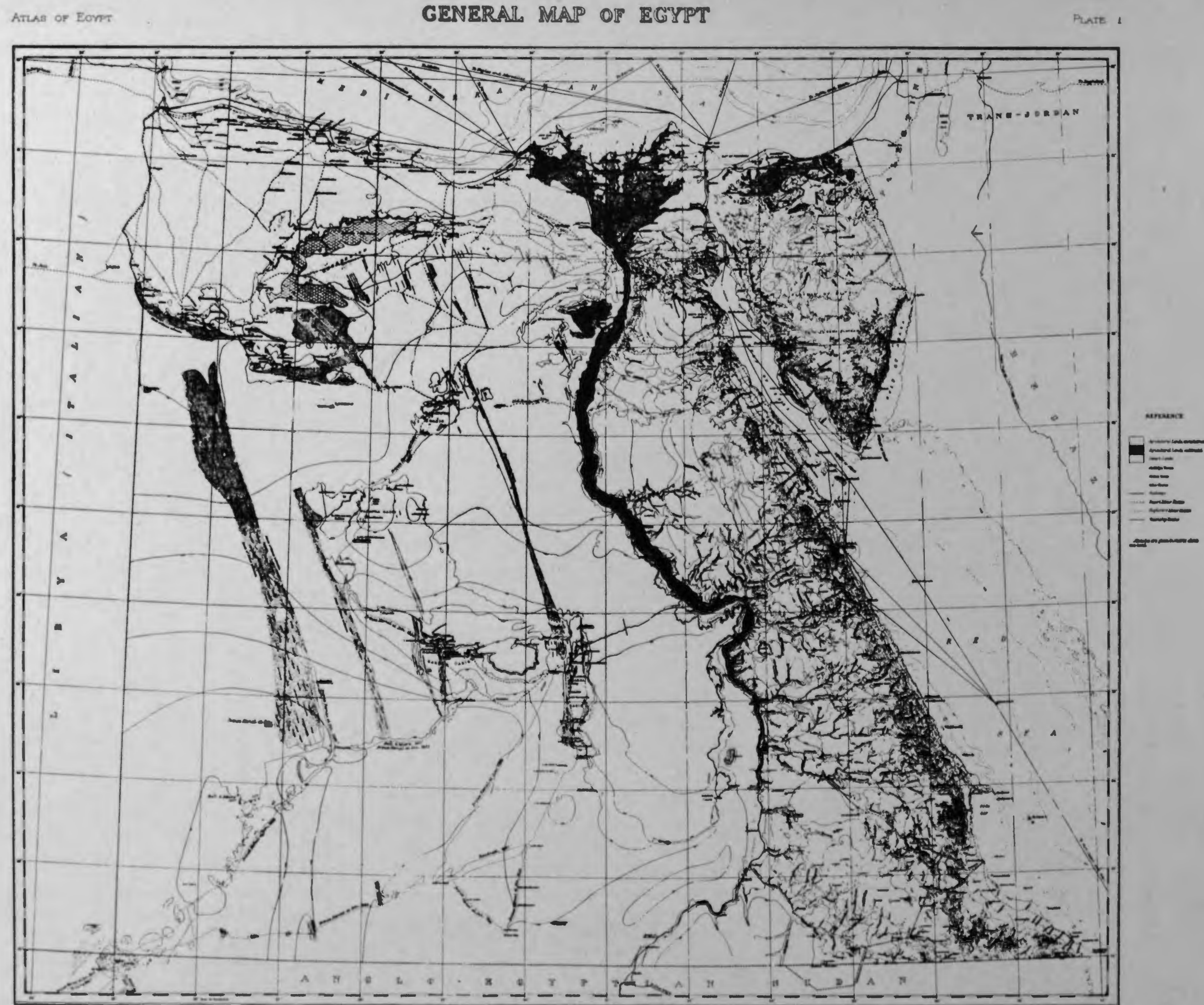


Figure 3. Plate I of the *Atlas of Egypt* showing the proportions dictated by the shape of the country. The scale of the original map is 1 : 2,000,000. It measures $27\frac{1}{4}$ inches by $23\frac{3}{4}$ inches.

reference atlas as well, twelve well-known examples of world reference atlases were also examined for the purpose of comparing these factors. Figure 2 shows graphically a comparison between the sizes and shapes of forty-three single-country and world reference atlases. Special symbols have been used to indicate those that are better known.

SHAPE

Atlases vary considerably in shape—from long to square to broad. This graph of the more common shapes is very revealing; two diagonal lines indicate two shapes—one square and the other with a length that is twice the width. They represent shapes that seem to be unpopular. Atlases having sides in the proportion of three to two seem to be the most common. The shape of an atlas often bears some relationship to the shape of the country concerned. Egypt (Figure 3) and Tanganyika as political entities are almost square, and this shape has been retained for the atlases of these countries. Atlases that are half as wide as they are long are also often works pertaining to "compact" political units, but they differ from the square format in that the single sheets depicting the whole country are folded once ("in folio") and not kept flat.

Maps of countries that have proportionally great longitudinal extent are often exhibited two to a sheet in order to give an atlas of acceptable shape. This has been done in the *Atlas Republiky Ceskoslovenske* (Figure 4).

But these generalizations are not always true, as is well exemplified by the *Atlas de France*. The maps showing the whole of France are square, but in order to provide a volume of better dimensions, insets are added around the map of the country so that the single sheet, in folio, has dimensions in the proportion of four to three (Figure 5).

To show the whole of Canada from Middle Island in Lake Erie to the North Pole would also require an almost square sheet, which could be the determining factor in the overall shape of an atlas of Canada. In the 1906 and 1915 editions of the *Atlas of Canada*, this problem was overcome by eliminating the extreme north from most sheets. This reduced the shape of the area mapped to a much more convenient one for folded sheets. For an atlas it was also a convenient method of eliminating an area about which little was known; but today this is not the case. Fortunately, however, by adjusting the north-south dimension to cover the land from Middle Island to the northern tip of Ellesmere Island and the east-west dimension to extend into the Pacific and Atlantic Oceans, a sheet of suitable atlas proportions can be arrived at.

SIZE

For those atlases that were longer than they were wide, the average dimensions were 17½ by 12½ inches. This size appears to be about the limit of practicability for an atlas that has to be handled very much.[1] That there are limits of practicability is demonstrated by the fact that the size

[1] Joerg, W. L.: op. cit., p. 597.

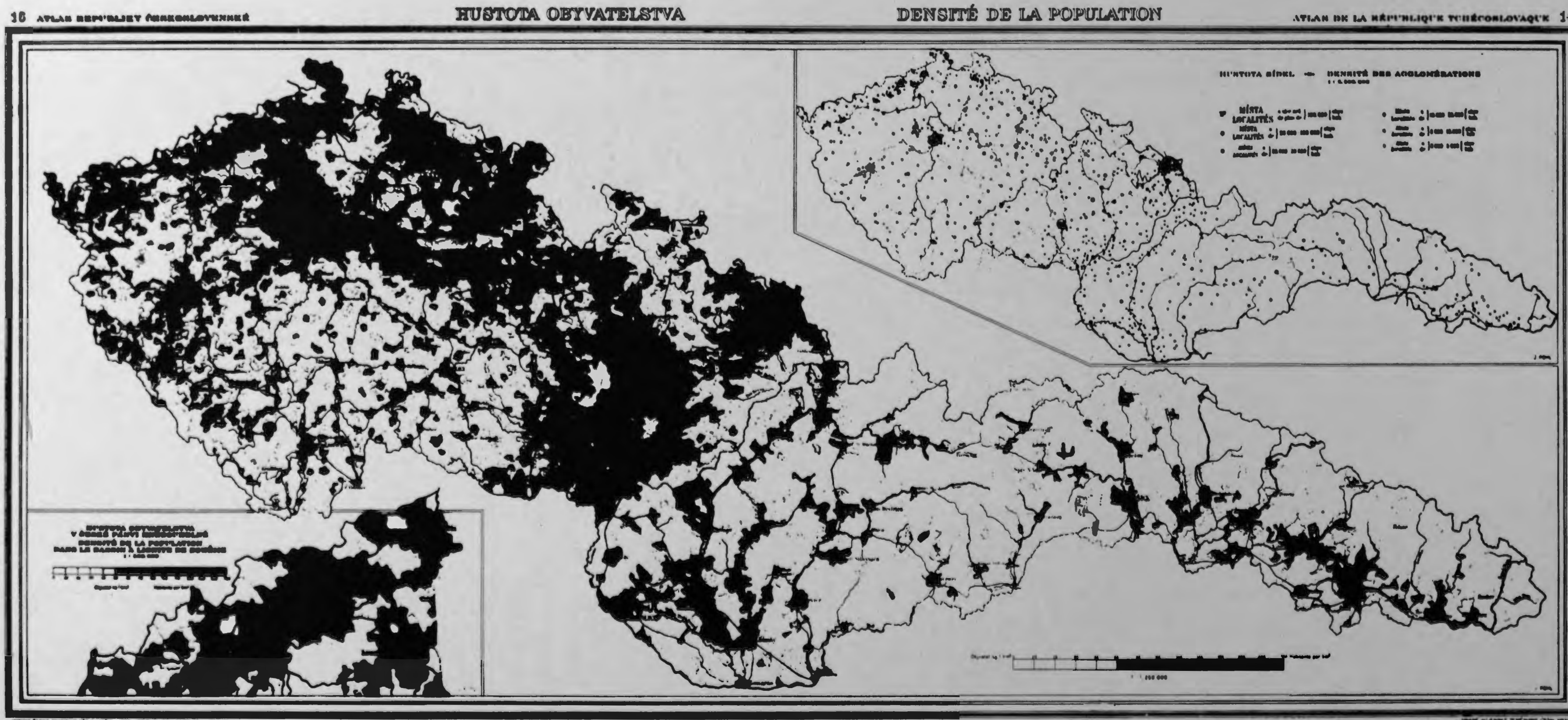


Figure 4. One of the plates from the *Atlas Republiky Ceskoslovenske.* Maps of these proportions, in folio, make an atlas of acceptable shape.

of single-country atlases has not increased, on the average, with time. In Figure 6 the combined length and width of the single-country atlases has been plotted against the date of publication and, though there are many departures from a "norm", the general trend has been for such atlases to have a total girth of about 30 inches. The average buyer looks for an atlas that can easily be placed on a standard library shelf, lay flat on an ordinary desk, and be studied without rising or craning the neck.[1]

WEIGHT

The average weight of twenty of the atlases examined was 11 pounds. The *Rand McNally Commercial Atlas and Marketing Guide* was the heaviest and weighed 20 pounds. The 1915 *Atlas of Canada* weighed only 8 pounds. As with size, the practical weight of an atlas has limits. A committee of the American Society for Professional Geographers has suggested that these limits should be such as to enable the atlas to be lifted easily with one hand.[2] Joerg suggests that 17 pounds is near the upper limit, and would appear to favour something between 10 and 17 pounds[3].

BINDING AND FORMAT

Most of the atlases examined had hard covers and permanent bindings. The most outstanding exception to this was the *Atlas de France*, which is loose-leaf. This atlas was published in 1933, but 20 years before this the *Times Survey Atlas of the World* had appeared in loose-leaf form and the success of this method in connection with these publications, coupled with the additional ways in which the maps in such atlases could be used, have caused loose-leaf bindings to be highly advocated in modern times.[4] A loose-leaf binding not only allows new editions of sheets, or entirely new maps, to be added to the atlas but also allows sheets to be temporarily removed for special study, tracing, or reproduction. The disadvantages of atlases bound in this way, particularly from a librarian's point of view, is that they are more easily damaged with heavy use and that individual sheets when removed are not always replaced.[5] The first of these disadvantages can be overcome if the loose-leaf binding is carefully designed. The *Atlas International Larousse*, published in 1950, is the most modern example of this.

So far as format is concerned, most of the atlases presented sheets in folio, although the *Atlas of the Tanganyika Territory* is a recently published atlas that did not do so.

From the point of view of mere physical properties then, an "average" modern single-country atlas is about 17 inches long and 13 inches wide, weighing about 12 pounds. The maps are in folio and are bound loose-leaf in a hard cover.

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[1] World Reference Atlases; op. cit., p. 3.
[2] Ibid.
[3] Joerg: op. cit., p. 597.
[4] *See*, for example, Plans for a National Atlas: Discussion; Geog. Jour., vol. 95, No. 2, pp. 98–108 (Feb. 1940).
[5] World Reference Atlases; op. cit., p. 4.

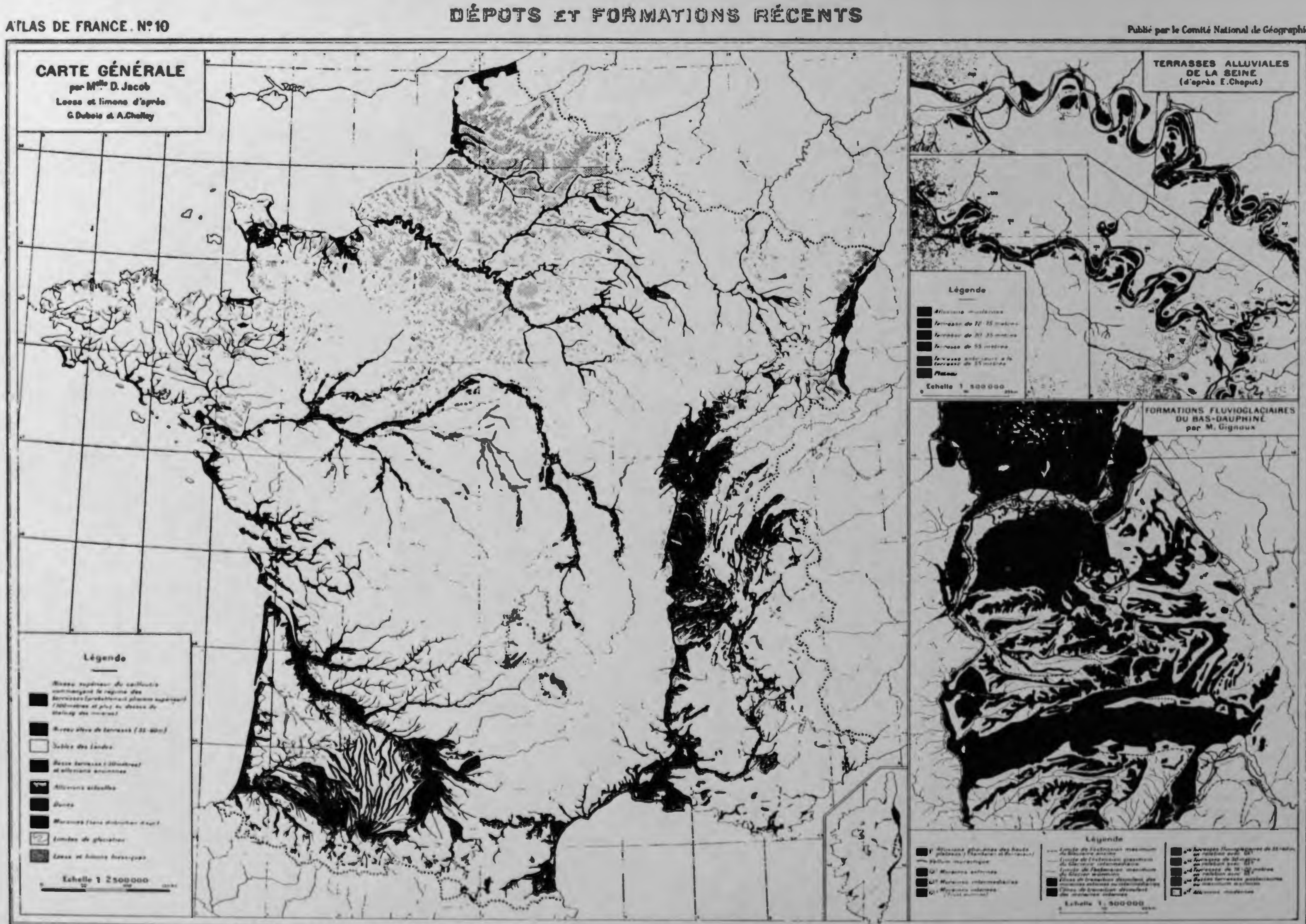

Figure 5. Plate 10 of the *Atlas de France*. The two insets have been placed on the same sheet as a map of the whole of France so that the maps, in folio, have convenient dimensions.

PROJECTION AND SCALE

It might well be argued that to consider the physical properties of atlases before considering their contents is the reverse of a geographical approach, as what is more important in an atlas is the information it contains rather than the structure that houses it. No one will dispute the fact, however, that both form and content have to be considered and that the links between the two are the scale and projection, and particularly the scale, of the largest area it is wished to depict on a single map. In the case of single-country atlases this area is invariably the country concerned.

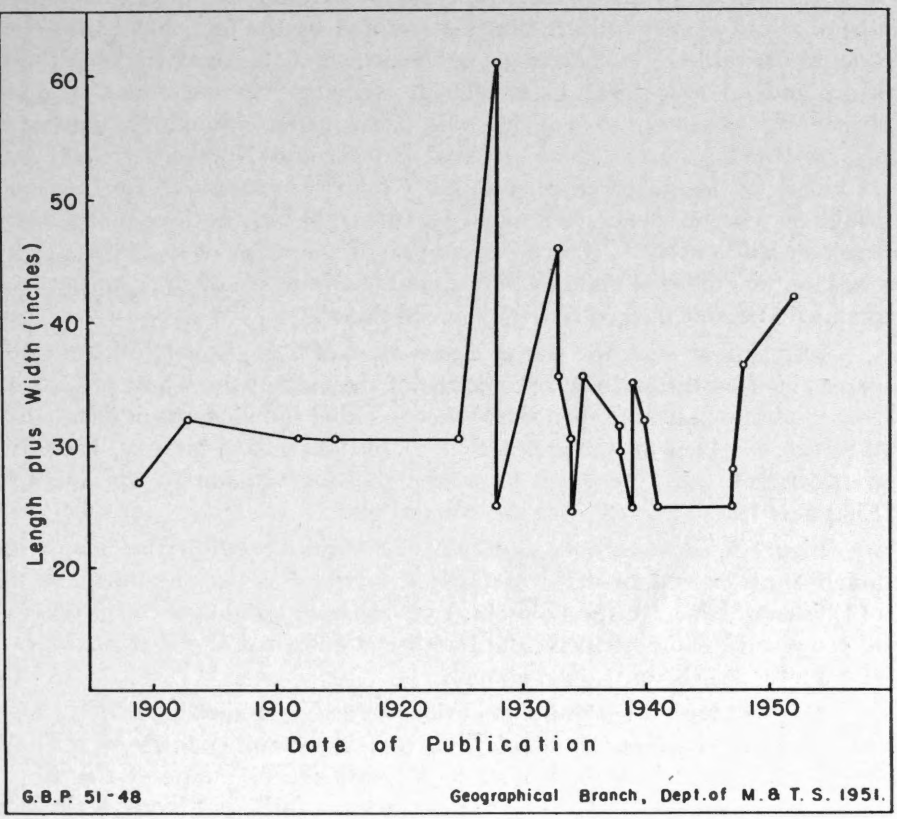

Figure 6. The variations with time in the combined length and width of the single-country atlases examined.

PROJECTION

The choice of the projection on which the maps of the whole of a single country are published is usually limited because of the shape and/or extent of the area concerned. Preferably there should be only one basic projection. If the projection used for the whole country is constantly changed throughout the atlas, it can lead to difficulties in technical production, and it certainly makes it impossible to compare accurately one map with another. This is particularly true of large areas such as Canada, when an effort is made to keep distortion of both area and shape to a minimum. The maps in the *Bolshoi Sovetski Atlas Mira* (The Great Soviet Atlas of the World)[1] of the whole of the Soviet Union, an area over twice as large as Canada, were on a Conical Equidistant Projection, preserving the length along all meridians and on parallels 47 and 62 degrees north. The Lambert Conformal Conic Projection with two standard parallels (49 and 77 degrees north) is a suitable projection for the whole of Canada.

SCALE

The shape and size of the *Atlas of Egypt* have already been commented upon. Both appear to have been determined by the fact that it was considered desirable to include maps of the whole of that country on a single sheet and on a scale of 1 : 1,000,000. In such circumstances an atlas measuring 28 inches by 33 inches was unavoidable. Similarly, the size of the proposed National Atlas of Great Britain and Northern Ireland was 21 inches by 14 inches in order to allow for the inclusion of England and Wales on a single sheet on a scale of 1 : 1,000,000 and Scotland on the same scale on half a sheet.[2] The proposed size of the atlas of Belgium, 47½ by 58½ cm., was decided upon so that a map of the whole of the country on a scale of 1 : 500,000 could be fitted on one sheet[3].

In a similar way, the size of a new atlas of Canada would have to be determined by the scale and projection of the map of the whole of Canada that might be published on a single sheet—either in folio or kept flat. For the reasons given at the conclusion of the discussion on size, however, consideration could be given to a map showing Canada to the north of Ellesmere Island as well as to the North Pole.

Figure 7 shows graphically the relationship between the length, or north-south extent, of maps of Canada to the Pole, or the northern tip of Ellesmere Island (Cape Columbia) and the scale, assuming the projection to remain the same (namely, the Lambert Conformal Conic with the two standard parallels mentioned above).

Many of the atlases examined utilize three predominating scales. One scale is used to present a complete map of the entire country on a single plate. A second scale is smaller and shows several maps of the entire country on a single sheet. Most atlases have a third and larger scale that is used for regional maps of smaller areas. If the number of scales is kept to a minimum, and particularly if they bear a simple numerical relationship to each other, as for example, multiples of a single scale, study and comparison of the maps is facilitated.

In Canada it has been the practice for the Dominion Government, when producing small-scale maps, to adopt a scale that could be expressed in a convenient number of miles to the inch rather than a natural scale in "round numbers". The 1906 and 1915 editions of the *Atlas of Canada*

[1] This atlas is in two volumes. Volume I includes maps of the Soviet Union as a whole. Volume II is devoted entirely to more detailed maps of the Soviet Union.
[2] Taylor, F. G. R.: Plans for a National Atlas; Geog. Jour., vol. 95, No. 2, p. 96 (Feb. 1940).
[3] The Professional Geographer; new series, vol. 1, No. 1, p. 33 (March 1949).

partly overcame this as the maps of Canada to the north of Ellesmere Island were on a scale of 1 : 12,500,000, or 197·3 miles to the inch. But the sectional maps of eastern and western Canada were on a scale of 1 : 6,336,000, or 100 miles to the inch, and some of the regional maps were on a scale of 1 : 2,217,600, or 35 miles to the inch. Of the single-country atlases exam-

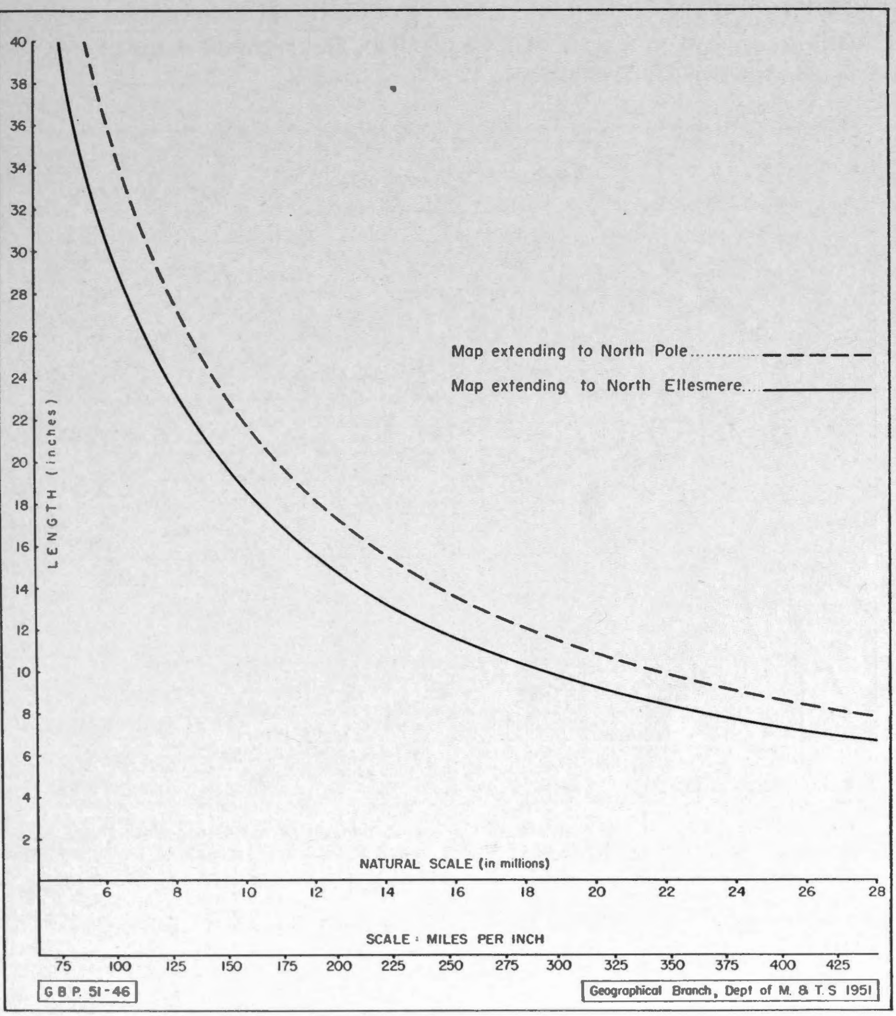

Figure 7. The variation with scale of the north-south extent of: (a) maps of Canada to Cape Columbia; (b) maps of Canada to the North Pole; keeping the projection constant.

ined, almost all use natural scales that can be expressed in simple multiples of 1 : 1,000,000 for all maps. A glance at Figure 7 shows that a map of Canada to the north of Ellesmere Island, on the scale of 1 : 10,000,000 and on the projection stated, would have a length of about 18½ inches. Almost the same length would accommodate a map of Canada to the

North Pole on a scale of 1 : 12,000,000. The width of the first of these alternatives would have to be at least 21 inches in order to accommodate all of Canada. If this width were increased to 26 inches, the resulting sheet, 26 inches by 19 inches, could be folded in the centre to give a page size of 19 inches by 13 inches. These are precisely the dimensions of most modern single-country reference atlases, without margins (Figure 8). These dimensions will also allow sectional maps of northern, eastern, and western Canada to appear on a scale of 1 : 5,000,000, and regional maps of smaller areas on a scale of 1 : 2,500,000.

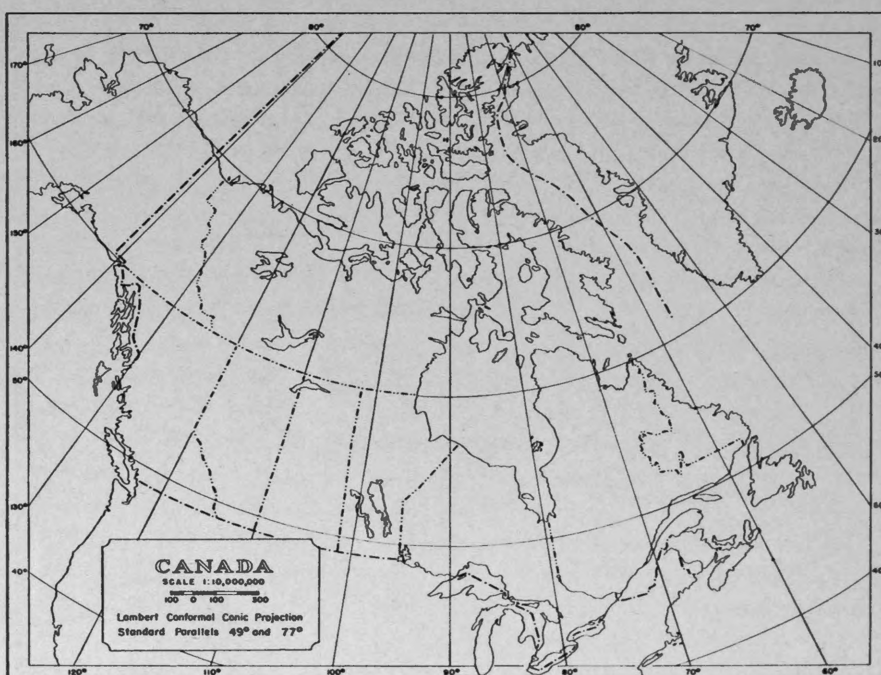

Figure 8. Outline of a map of Canada on the Lambert Conformal Conic Projection with standard parallels of 49° N. and 77° N. The original map, on a scale of 1 : 10,000,000 measures 25 inches by 19 inches.

CONTENTS

The chief problem in making an atlas is to decide on the contents and on methods of showing the desired data. An analysis of the contents of the single-country atlases is summarized in Figure 9, which indicates the number of plates and maps that are devoted to various subjects. These subjects have been grouped under four major divisions—general, physical, economic, and social.

COVERAGE BY ATLASES

It is evident from this table that only a few of the atlases include maps covering almost all of the thirty-four topical divisions. Those covering half of this number are the atlases of Brazil, Estonia, Finland,

AN ANALYSIS OF CERTAIN SINGLE COUNTRY ATLASES SHOWING THE NUMBER OF SHEETS AND MAPS DEVOTED TO VARIOUS TOPICS

DESCRIPTION			GENERAL			PHYSICAL											ECONOMIC									SOCIAL								
COUNTRY ATLAS TITLE	DATE OF PUBLICATION	A NUMBER OF SHEETS B NUMBER OF MAPS	CARTOGRAPHY	SPACE RELATIONSHIPS	HISTORICAL	TOPOGRAPHY	GEOLOGY	TEMPERATURE	PRECIPITATION	SUNSHINE, WINDS AND PRESSURE	GEOMORPHOLOGY	SOILS	HYDROGRAPHY AND HYDROLOGY	BIOGEOGRAPHY	GEOPHYSICS	OTHER PHYSICAL	AGRICULTURE	FORESTRY	FISHING	MINING	POWER DEVELOPMENT	INDUSTRY	TRANSPORTATION AND COMMUNICATIONS	TRADE	OTHER ECONOMIC	POPULATION, DISTRIBUTION	POPULATION ORIGIN AND MIGRATION	ANTHROPOLOGY, RELIGIONS AND LANGUAGES	PUBLIC HEALTH	EDUCATION	RECREATION	URBAN SETTLEMENT	ADMINISTRATION	OTHER
BELGIUM (PROPOSED)		A	1½				7						2	2	1½	5	6					5											2	2
		B																																
BRAZIL ATLAS ESTATISTICO DO BRAZIL	1941	A		2		1	1	1	1				1	1		1	33			7	1	3				1	4			1			3	5
		B		5		1	1	1	1				2	1		1	54			7	1	3				1	4			1			3	5
BRITISH HONDURAS ATLAS OF BRITISH HONDURAS	1939	A			1	7	1		2					1												1						1	1	
		B			1	7	1		13					1												1						1	1	
CANADA ATLAS OF CANADA	1915	A		1	1	2	2	1½	½	1			3			1		2		2						2	2	1				6	3	
		B		1	1	2	2	19	4	9			3			1		2		2						8	8	1				13	8	
CZECHOSLOVAKIA ATLAS REPUBLIKY ČESKOSLOVENSKÉ	1935	A		1	1	2	1	1	1	1		1	1	2	¼	2¾	9	2		1	1	10	2	1		1	7	1	1	3	1			
		B		2	12	2	2	8	8	8		3	3	15	1	11	91	7		2	10	97	24	6		3	102	6	16	34	14			
EGYPT ATLAS OF EGYPT	1928	A				5	5	7	1½	2						½	4								1	2								
		B				5	5	14	5	4						6	10								1	5								
ENGLAND and WALES THE SURVEY ATLAS OF ENGLAND AND WALES	1903	A				68	1	1	1					1						1½		½	2			1						6	2	
		B				68	2	15	15					1			2			2		2	3			3						16	6	
ESTONIA STATISTILINE ALBUM AGRICULTURE EN ESTONIE	1925	A		1	1	1	1					1	1			5	27	2				8	1	1	1	2	1	4	1	5		4	1	
	1928	B		1	9	1	1	5	5	6		1	9			9	104	2				8	2	1	1	2	1	6	2	5		12	1	
FINLAND ATLAS OF FINLAND	1925	A	½	1		3	1				1		1	5		2	3½	3			1	2	2	1½	1	1	½	1	1	2			1	4
		B	5	28		8	1	4	5	5	1		16	22	3	8	45	26	1	2	4	25	5	11	6	5	6	6	15	21	1		13	4
FRANCE ATLAS DE FRANCE	1933	A	2			4	1	2	2	½	5		6	8	1	3	8	1	1	2	1	7	8	2		6	2	2	1		1	1	2	4
		B	16			4	3	12	8	14	7		49	35	7	38	97	7	6	10	6	66	56	13		16	25	21	14		6	20	25	6
ITALY ATLANTE STATISTICO ITALIANO	1929	A				90																				56	68							
	1933	B				22																				56	68							
KATANGA ATLAS DU KATANGA	1928	A	5	4	13	12	8					9		4		5																2		
	1940	B	5	4	13	12	8					9		5		5																3		
MEXICO MEXICO EN CIFRAS	1934	A		1				2	1							1	32	2		5	1	2	10	1	2	4	3	4	3	2				
		B		2				2	1							1	33	2		5	1	2	10	1	2	4	3	4	19	2				
NETHERLAND EAST INDIES ATLAS VAN TROPISCH NEDERLAND	1938	A		1½	1	11	½					½	2	1	2	2	½	1					½		½	½				1½		½	1½	½
		B	1	3	5	18	8	2	7	4		1	1	14	19		3	4		1			1		2	3				4		11	4	4
PHILIPPINE ISLANDS ATLAS DE FILIPINAS	1899	A		1		25										2											1						1	
		B		1		42										2											1					1	1	
POLAND ATLAS ZIEM ODZYSKANYCH	1947	A				1					1	1	1				1	1		3	2	6	2			5	2			2		2		5
		B				1					1	1	1				1	1		3	2	6	2			8	2			2		2		5
RUMANIA L'AGRICULTURE EN ROUMANIE	1938	A				1		1	1			1		1			31	1												2				4
		B				1		1	1			1		1			31	1												2				4
SAAR SAAR ATLAS	1934	A		½	9	2	1										2			1	1	7	3	2	2	2		½				3		2
		B		1	50	2	1										15			1	3	25	12	26	3	2		1				20		2
SCOTLAND THE SURVEY ATLAS OF SCOTLAND	1912	A			9	46	½	1	1														2		1	½						7		
		B			18	47	1	12	12		1												2		1	1						12		
TANGANYIKA ATLAS OF THE TANGANYIKA TERRITORY	1948	A			8	1	1	½	1		1	1	1	3	½		2	1		2			1			3		1	2	1		1	1	
		B			22	1	1	2	1		1	1	1	3	2		2	1		2			1			3		1	2	1		1	1	
TASMANIA REGIONAL PLANNING ATLAS	1947	A				1	1		1			1				1	10	1	1	1	1	1	3			1				1	1		1	1
		B				1	1		1			1				1	10	1	1	1	1	1	3			1				1	1		1	1
USSR BOLSHOI SOVIETSKI ATLAS MIRA	1939	A		1	5½	34	2	6	1	1	1½	2½		3		5½	2½	1½		2	1½	11	3		22½	3						1½	5½	2
		B		4	23	94	4	18	3	3	3	6		5		32	6	4		6	2	35	6		54	10						4	9	8
UNITED STATES (PROPOSED)		A																																
		B		15		14	2	4	6	4	3	5	24	1		6	44	19	8	41	13	36	37	40	1	25					11	44	31	20

Figure 9.

France, Netherlands East Indies, USSR, and U.S.A. Closer examination of these atlases shows that they were all published later than 1925, that is, they are all of comparatively recent origin.

Of the remaining atlases, the lack of complete topical coverage may be accounted for by one of two reasons. The atlas may never have been intended to depict more than one or two categories of information or it may not have been possible, at the time the atlas was published, to map many of the items because their extent was not known. It is quite clear, for example, that the *Atlante Statistico Italiano* was not intended to convey much more than certain statistical information on the population of Italy and possibly its relationship to topography. The latest edition of the atlas was published in 1933, so that the fact that the other topics are not dealt with could by no means have meant that not enough mappable information existed on these subjects. Atlases such as this, which are concerned only with one or two topics as they relate to one country, might be termed particular single-country atlases.[1]

On the other hand, the 1915 edition of the *Atlas of Canada* was intended to cover all aspects of Canadian geography, but it included very few physical maps because the knowledge of the soils and surface formations was almost completely lacking at that time. Geology, forestry, mining, transportation, and population distribution and origin were highlighted and indicate the main activities and preoccupations that accompanied the period of large scale immigration during which the two editions of the *Atlas of Canada* were produced.

COVERAGE BY SUBJECTS

In general, atlas coverage can be divided by subjects into four major groups—general, physical, economic, and social. Six of the atlases examined paid no attention to the three subjects in the general group—cartographic representation, space relationships, and historical geography. But of these six atlases, five are of the particular single-country type. All of the atlases devoted some space to the physical and social groups, and all but two to the economic group. But the two exceptions are understandable, as the *Atlas de Filipinas* was an early work, having been published in 1899, and the *Atlante Statistico Italiano* is a particular single-country atlas. Hence, it is a safe generalization to say that single-country atlases today should include maps in each of the four major groups.

The results of an examination of the coverage accorded to each of the subdivisions of the four major groups is summarized below. No account has been taken of the *amount* of coverage. For the purposes of this list, one small map devoted to a particular subject in one atlas is given equal weight with several pages of maps devoted to the same subject in another atlas.

[1] Without trying to categorize atlases too much, it can be said that they fall into three groups, according to the intensity or degree of specialization: (a) General World Atlases, which include all aspects of the whole world presented according to systematic and/or political geography; (b) atlases devoted to *all* aspects of one branch of systematic geography, such as zoogeography, for the whole world, or atlases devoted to *all* aspects of a political unit, such as single-country atlases; (c) atlases devoted to one aspect, or group of apsects, of a single political unit. It is for this type of atlas that the term "particular" is suggested.

Subject	Number of atlases devoting some space to the subject
Topography	20
Population distribution	19
Geology	17
Transportation	17
Agriculture	16
Climate	16
Forestry	13
Mining	13
Administration	13
Industry	12
Urban settlement	12
Biogeography	11
Other economic subjects	11
Population origin and migration	11
Education	11
Others	Less than half the atlases examined

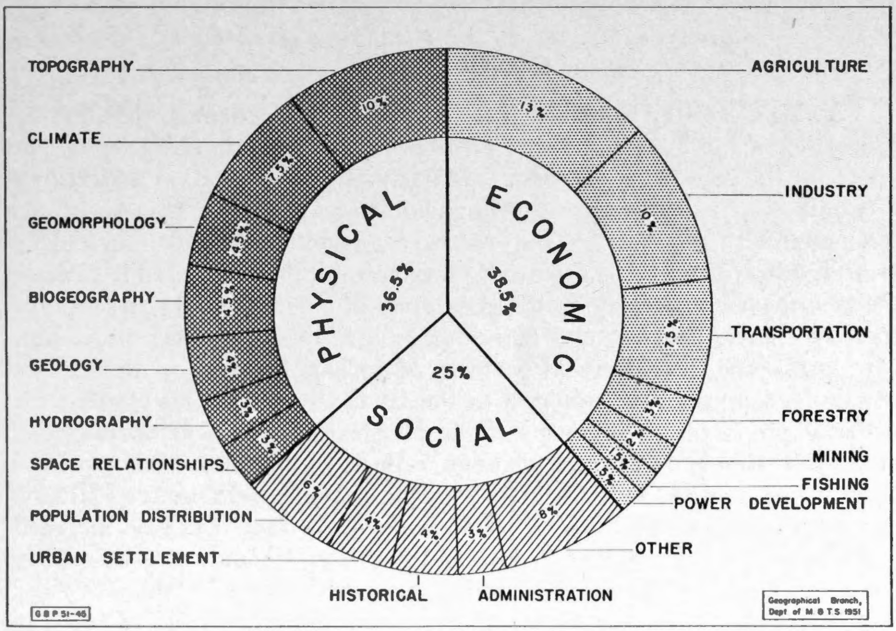

Figure 10. The average amount of space devoted to various subjects in ten single-country atlases (Belgium, Brazil, Canada, Egypt, Finland, France, Netherlands East Indies, Tasmania, U.S.A., USSR).

Despite the fact that the atlases examined were published over a wide range of years, that they include "special" single-country atlases, and that they by no means exhaust the list of those published, the above analysis shows clearly that a single-country atlas should be primarily concerned with the land, the people, and the human activities. In connection with the land, topography is generally considered the most important feature, followed by climate. The geographical distribution of the population is considered the most important feature to represent the people. How the land is used and how these uses have influenced settlement and the population pattern is the story that the rest of the maps tell.

SPACE COVERAGE

Consideration was then given to the amount of space allocated to various subjects and groups of subjects. Figure 10 shows the average space distribution for ten of the single-country atlases. The general group of topics was considered to be part of the social group for the purposes of this compilation. Although the diagram has its limitations because the selection of the atlases was rather arbitrary and because there is a spread of some 35 years between the dates of their publication, the distribution of space between the major divisions—physical, social, and economic—is striking. For if the social division is considered as being devoted to human geography, approximately equal space is devoted to man, the environment and the relationships between the two.

CONCLUSION

A single-country atlas is a collection of maps to depict the physical properties of the land and water areas occupied and administered by the people of the country concerned, together with the adaptation and utilization of those physical resources through human occupancy. It is essentially concerned with the distribution of these items and with their relationship to each other; hence, it is essentially a geographical survey, and is perhaps the best means of portraying the geography of a country. It presents the country's land, peoples, and activities in a form that makes it possible to compare the distributional patterns of various factors and thus to see how human occupancy is related to the land. Such an atlas clarifies the scientific study of the influence of the physical environment on man and man's adjustment to his environment. As such, its publication can have far reaching uses for, as the British Minister of Town and Country Planning said in writing of the work being done on maps that could be included in a National Atlas of Great Britain and Northern Ireland, "In these early enquiries I see a token of the unforeseen services which this ...... is destined to render. In such patient and accurate amassing of facts, in such clear presentation of them as these maps exemplify, lies one of the best insurance policies that any country could take out in preparing itself to steer a straight course into the uncharted future"[1].

RÉSUMÉ

Les recherches préliminaires sur l'Atlas du Canada consistaient, au tout début, à étudier un certain nombre d'atlas nationaux et quelques atlas mondiaux. Les résultats de cette étude sont présentés dans cet article.

[1] Silkin, L.: Mapping a Country; Canadian Geographical Journal, vol. 34, No. 5, May 1947, pp. 240-245.

D'abord on détermine les dimensions et le poids des atlas, pour arriver à la conclusion qu'un atlas national ordinaire mesure 13 pouces de largeur et 17 pouces de hauteur et qu'il pèse environ 12 livres. Les cartes sont groupées par planche et chaque planche est détachable; toutes les planches sont placées à l'intérieur d'une couverture spéciale et épaisse.

On examine ensuite les principales projections et échelles. Une carte du Canada, incluant le nord de l'île Ellesmere, remplit exactement une feuille-planche ordinaire, si l'on utilise l'échelle au 1/10,000,000^e et la projection conique équivalente de Lambert à deux parallèles (parallèles nord du 49^e et du 77^e degré). Presque tous les atlas nationaux utilisent des échelles très simples pour leurs cartes régionales et locales. Ces échelles sont des multiples ou des fractions de l'échelle de la carte de base.

Enfin, la matière ou le contenu des atlas nationaux est catalogué d'après le sujet, premièrement, en quatre grandes parties (générale, physique économique et sociale) et deuxièmement en trente-deux subdivisions. Les résultats sont groupés dans un tableau. Ces résultats sont discutés brièvement; on souligne le contenu de quelques atlas, l'importance et l'espace consacrés à certains sujets.

En conclusion, on définit un atlas national comme: "une collection de cartes qui décrit les propriétés physiques de la terre et des eaux, occupées et administrées par les citoyens du pays intéressé, en même temps que l'adaptation et l'utilisation de ces ressources physiques par l'homme."

THE CLIMATE OF THE ISLAND OF NEWFOUNDLAND: A GEOGRAPHICAL ANALYSIS

F. Kenneth Hare[1]

Though weather records have been maintained at points on the coast of the island of Newfoundland for more than half a century, there are few accounts in print of its climate, and none that attempts to treat the subject in its geographical content. Most of the existing accounts are brief, and are based on only a small part of the observational material.

This paper reviews the climate as it affects the geographer rather than the meteorologist. Consequently, discussion is omitted of circulation types, storm tracks, and the like, and attention is directed towards mapping the main climatic elements, such as temperature, precipitation, and humidity, and the effect of climate on vegetation, and transportation by air and sea.

Most of the observations[2] used in preparing this paper were made at stations reporting to or maintained by the Canadian Meteorological Service, which opened its first stations in Newfoundland at St. John's in 1884, and St. Georges in 1889. Since 1910 the Canadian Service has issued forecasts and storm warnings for the Newfoundland coasts, and in doing this has established many telegraphic reporting stations around the coast. Since 1934 a number have been established inland, particularly since 1938 when new airfields began to be opened in the province. A complete list of climatological stations is given in the Appendix[3].

THE PHYSICAL SETTING[4]

Essentially the island of Newfoundland consists of a tilted plateau of slight to moderate relief, rising northwestwards from the east coast. The western side of the island is almost mountainous, as the high plateau that rises to over 2,000 feet in some areas is heavily dissected. There are several deep, lake-studded basins that are almost surrounded by hills, the Deer Lake and Grand Lake basins being good examples. The central and eastern parts of the plateau are lower and less dissected, a large part of the island consisting of a bleak, monotonously flat surface at 800 to 1,500 feet. The easternmost region has been extensively drowned, the old valleys now forming large bays separated by elongated peninsulas.

[1] F. Kenneth Hare, B.Sc., London, Ph.D., Montreal. Associate Professor of Geography, McGill University. This paper is part of a larger study that the author is carrying out for the Controller, Meteorological Division, Department of Transport.

[2] These were either unpublished or available in the following sources:
Boughner, C. C., and M. K. Thomas: Climatic Summaries for Selected Meteorological Stations in Canada, Vol. II; Canada, Dept. of Transport, Toronto, 1948.
Canada, Department of Transport, Annual Report, 1944–47; Ottawa, 1948.

[3] All temperatures given in this paper are in Fahrenheit degrees.

[4] For a longer summary *See* Gutsell, B. V.: An Introduction to the Geography of Newfoundland; Canada, Dept. of Mines and Resources, Geographical Bureau, Ottawa, 1949, pp. 7–14.

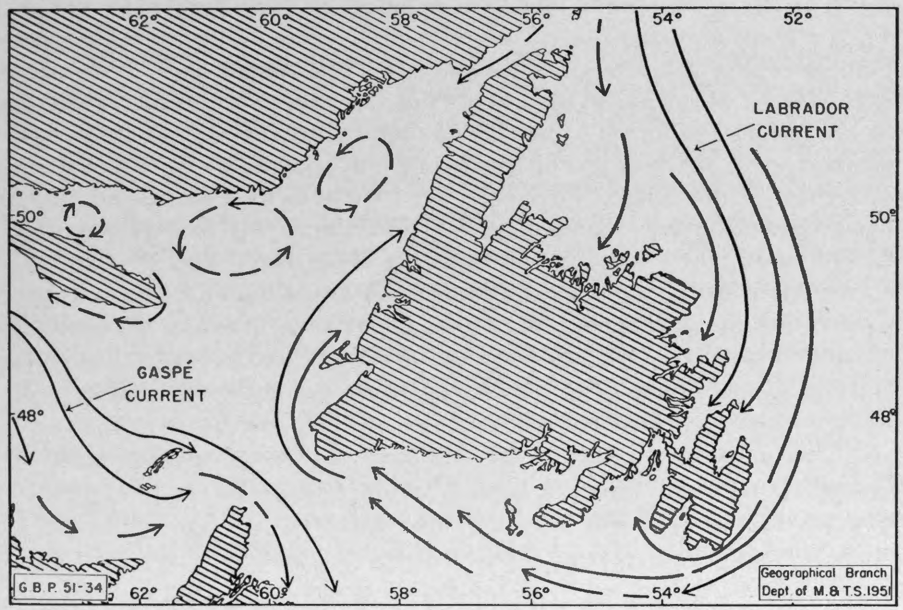

Figure 1. Circulation of surface waters of the island of Newfoundland (after J. W. Sandstrom).

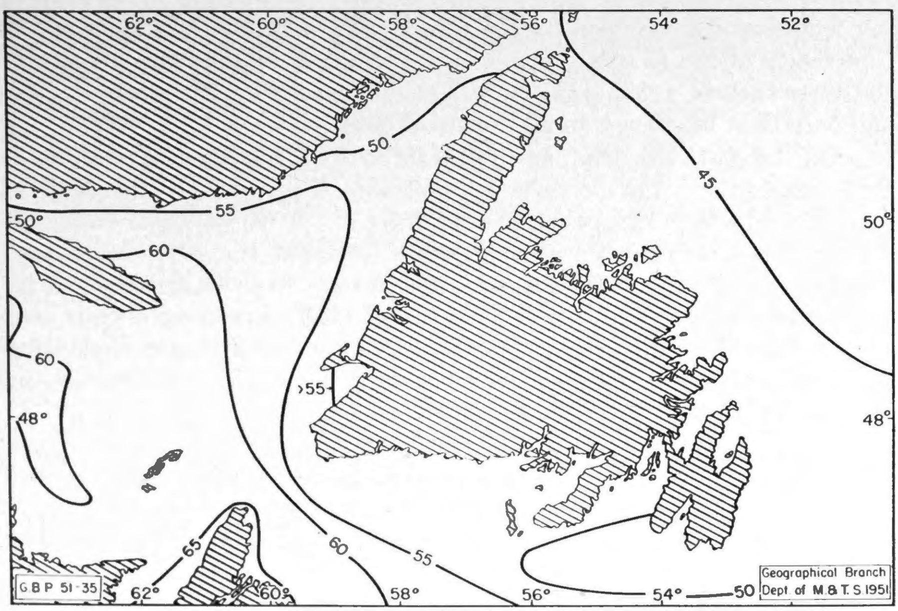

Figure 2. Temperature (degrees F.) of the sea surface in July (after Fothergill, Bell, Dawson, and others).

The sea is the dominating local influence in Newfoundland's climate. Figure 1 shows diagrammatically the marine circulation off the Newfoundland coasts. The conspicuous feature of the map is the virtual encirclement of the island by a branch of the Labrador current, consisting at least in part of Arctic water. This current sets into all the bays of the northern part of the island of Newfoundland, and swings hard against the east coast of the Avalon Peninsula. A part of it then swings westwards along the south coast, rounds Cape Ray into the Gulf of St. Lawrence, and finally turns north towards the Strait of Belle Isle. The effect of this current is to bathe the east, south, and southwest coasts with cold water throughout the spring and summer. In winter, however, the water is warm and saline relative to other water masses in the Gulf of St. Lawrence, and the part of the gulf occupied by Labrador current water is usually the least continuously frozen.

The southwestern part of the Gulf of St. Lawrence is occupied by the Gaspe current. From June until October this water is substantially warmer than that against the Newfoundland coast, so that southwesterly air streams reach the island having crossed first fairly warm and then much colder water.

Figure 2 shows the distribution of sea-surface temperature typical of mid-July. The pattern over the Gulf of St. Lawrence was drawn by N. O. Fothergill, chiefly from very recent oceanographic data in the files of the Joint Oceanographic Laboratories at St. Andrews, N.B. The rest of the map has been drawn partly from Dawson[1] and partly from an atlas of sea temperatures compiled by the United States Navy[2]. In view of the complexity of the factors controlling sea temperature, and the sparsity of the observations available, Figure 2 should be used with great caution, and only then to convey an approximate picture.

Off the southeast, east, and northeast coasts of the island of Newfoundland and in the Strait of Belle Isle, offshore temperatures are below 50 degrees, and over wide areas below 45 degrees. It is over these very cold waters that sea-fog is most widespread. Around the southwest coast, temperatures in the Labrador current water are 50 to 55 degrees, i.e., far below mean air temperatures. Most of the Gulf of St. Lawrence is near 60 degrees. It is of interest to compare this map with Figure 8, showing mean air temperature for the same month. The cooling influence of the cold offshore waters is at once apparent.

In August and early September the pattern is similar, but the coldness of the offshore waters becomes less pronounced. In October and November all the nearby seas cool rapidly, but by late November the Gaspe current is as cold as, or colder than, the Labrador current. Finally, from December until May all the sea areas have a temperature close to the freezing point, or become covered with ice. To this important topic attention must now be given.

[1] Dawson, W. Bell: Temperatures and Densities of the Waters of Eastern Canada; Canada, Department of the Naval Service, Ottawa, 1922.
[2] World Atlas of Sea Surface Temperatures, 2nd ed.; Hydrographic Office, Pub. No. 225, United States Navy Department, Washington, 1944.

SEA-ICE

The importance of sea-ice to the climatologist is very real. Itself the product of a cold climate, it acts as a source of cold both summer and winter. In winter it permits considerable radiative cooling of the air above it. An unfrozen sea can never cool below the freezing point (about 29 degrees), and in regions of cold winters, open seas act as important sources of warmth; thus, southern Newfoundland profits from the unfrozen seas to the south. But an ice-cover, once consolidated, may cool the air above it almost as greatly as a continental land-surface[1]. Hence, it is of vital concern to the climatologist to know the extent of winter ice accurately. In summer, the presence of thawing ice-floes keeps the sea temperature down to the freezing point. The Labrador current bears great quantities of such ice in May and June, and is hence able to retard the spring rise of air temperature over the nearby coasts.

Figure 3 shows the extent of sea-ice in a typical January. The main sea-areas are covered with pack-ice, some locally formed, but much of it belonging to two great pack-ice drifts, that of the Labrador current, and that of the Gaspe current. Both are indicated by drift arrows. There is also land-fast ice along many of the coasts. Noteworthy are the open areas off southwest Newfoundland and between the land-fast ice and the Labrador pack on the north coast. Both these open areas are responsible for abnormally high air temperatures in January; the 20-degree isotherm of mean air temperature has been added to show this effect; it will be noted that the isotherm bends northwestwards (i.e., towards the great cold) over the open areas. Both areas close up in the later winter.

Figure 4 shows the position in March. The pack-ice, now at its greatest extent, invests all of Newfoundland except the south coast, which is alone able to profit from marine warming. In April the Gulf ice begins to break up, as does the Labrador pack. By mid-May the Gulf has normally cleared, but disintegrating pack may lie off the north and east coasts well into June or even early July. Considerable numbers of icebergs also infest these waters. In short, all the coasts of Newfoundland suffer to some extent in spring from the retarding influence of melting ice offshore, but the effect is far more pronounced on the east and north shores.

It must be remembered that ice conditions are actually highly variable from year to year. An unusually ice-free winter may produce quite startling mildness over Newfoundland: often it is hard to say whether the mildness of the winter is the cause or the effect of the absence of ice. In February 1947 strong east winds destroyed the Labrador pack completely, and temperatures were strikingly above normal for the rest of the winter over Newfoundland.

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[1] *See*, for example, Hare, F. K., and Montgomery, M. R.: Ice, Open Water and Winter Climate in the Eastern Arctic of North America; Arctic, vol. 2, No. 2, Sept. 1949, pp. 79–89.

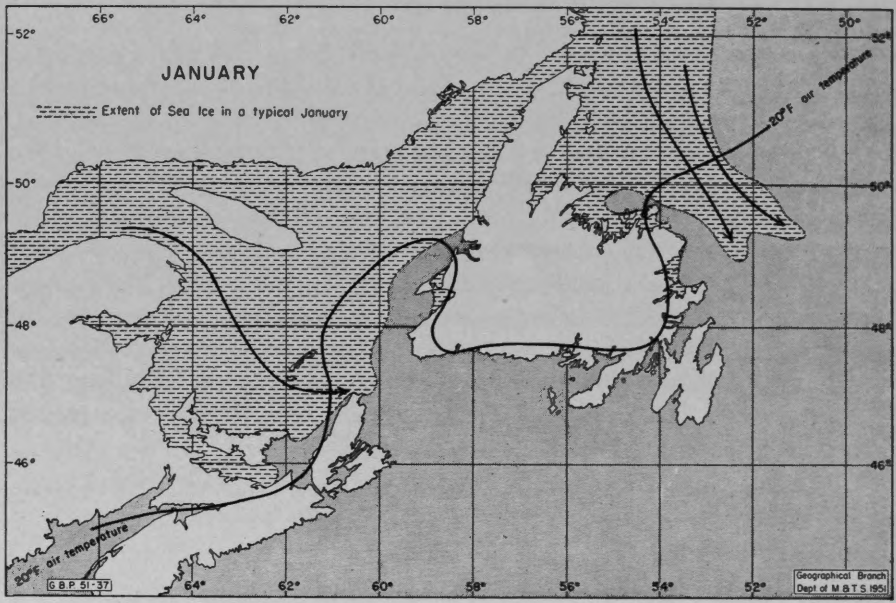

Figure 3. Extent of sea-ice in a typical January (after *Ice Atlas of the Northern Hemisphere*). Main pack-ice drifts are shown by arrows. The isotherm of 20°F. mean air temperature shows the areas of warmth over the open water off southwest and northeast coasts.

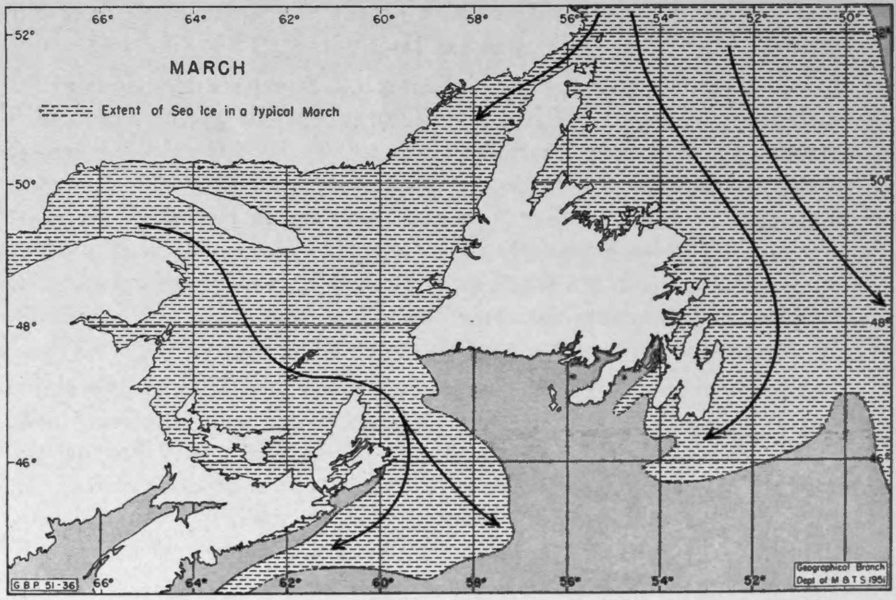

Figure 4. Extent of sea-ice in a typical March (after *Ice Atlas of the Northern Hemisphere*). Main pack-ice drifts are shown by arrows.

TEMPERATURE

The annual cycle of air temperature resembles that experienced in other parts of eastern Canada, though the presence of the sea reduces the observed extremes considerably. Newfoundland's reputation for bleak cold at all seasons is far from justified; in winter the whole island is milder, for example, than the Montreal plain, and in summer much of it compares well with Edmonton. The closest summer parallel is perhaps with southwest England.

WINTER (DECEMBER-FEBRUARY)

The maps of mean temperature for January may be taken as representative of midwinter. Figure 5 shows mean daily temperature (i.e., the mean of daily maxima and minima), referred for the purposes of standardization to the decade 1938–1947. The use of the short standard period of 10 years (1938-1947) is made necessary by two facts: first, the shortness of the actual period of observation from two-thirds of the stations; and second, the remarkable upward swing of secular mean temperature since 1920. Even a 20-year mean tends to obscure the reality of this dramatic change. Figure 8 shows mean monthly maximum temperature, which is the mean maximum temperature of the warmest day in the month. On the average, half the Januaries will produce at least 1 day whose temperature will exceed the values shown on this map; it may thus be looked upon as showing the *probable* upper extreme for the month. The corresponding map of mean monthly minimum temperatures is given as Figure 7. By analogy, this clearly shows the probable *lower* extreme.

The striking features of winter temperature distribution are: (i) the coldness of the interior; (ii) the warmth of the coasts, especially the south and east; and (iii) the day-to-day variability of temperature, not readily derivable from the maps given here. Within the interior, mean January temperature is between 15 and 20 degrees on the lower ground (Figure 5). Temperatures descend below zero not infrequently, mean monthly minimum averaging about −15 degrees; these figures are a little higher than those experienced in Montreal and Ottawa. The warmest regions are the Avalon and Burin Peninsulas, where mean temperatures approach 25 degrees, a value comparable with the figures for Toronto or Portland, Maine. Even in the coldest weather, temperatures in these favoured parts rarely fall below zero along the coasts, though the same is not true of inland areas.

The mean daily range of temperature is between 13 and 18 degrees at all stations. Values of mean daily maximum and minimum temperatures are presented in the Appendix, but rough estimates of these quantities can be obtained by adding or subtracting about 8 degrees to or from the values of mean daily temperature read off Figure 5. It is noteworthy that even in January mean daily maximum temperature is above freezing in southernmost Avalon (e.g., Cape Race, 33 degrees).

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The coldest weather of winter comes in the clear and often strong currents of continental polar air that sweep across the island from Labrador in the rear of cyclones moving into the Atlantic. Paradoxically, these storms may also bring very mild weather; if their course lies north of Newfoundland, southwesterly air streams often bring thawing temperatures to the whole island. The extreme southeast is especially liable to such invasions,

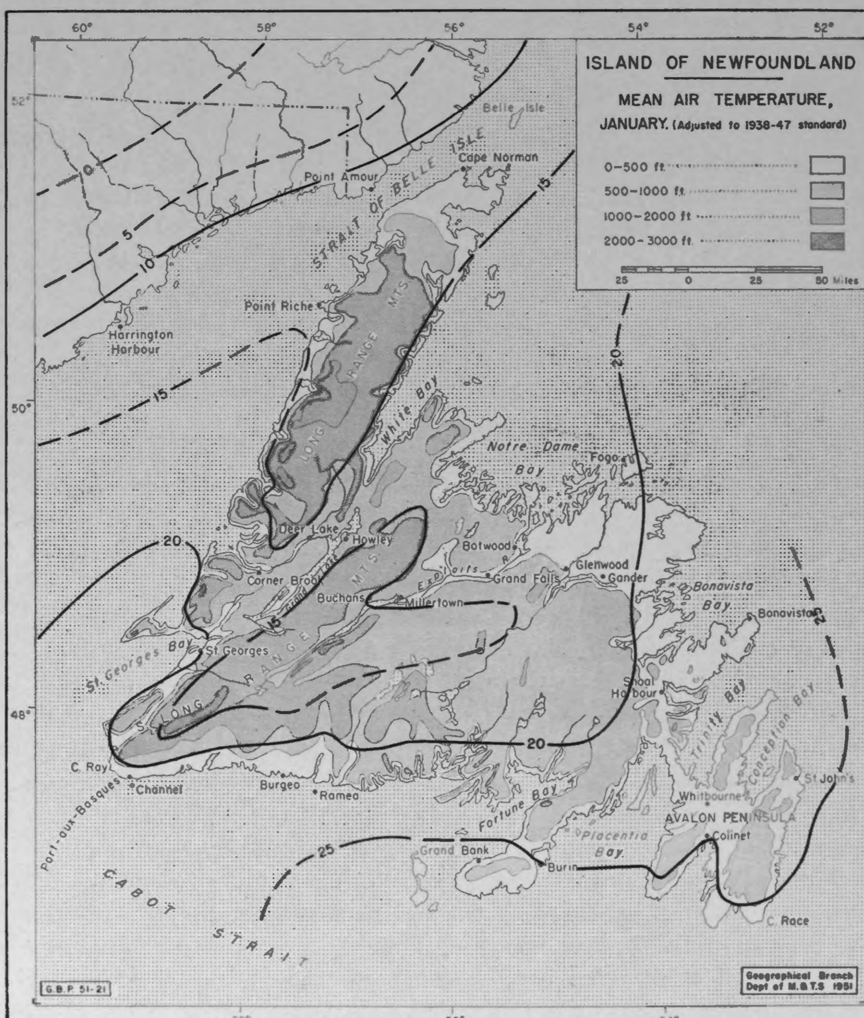


Figure 5.

and temperatures may attain 50 degrees or more. Mean monthly maximum temperatures in this region exceed 45 degrees (*See* Figure 6). Over most of Newfoundland the "January thaw" is often accompanied by heavy rain and strong winds. It is usually followed by a sudden and drastic drop in temperature behind the cold front of the passing cyclone.

SPRING (MARCH-MAY)

Spring is remarkably late. The stream of pack-ice that almost encircles the island keeps sea temperatures close to the freezing point until late May. Warm air streams approaching the island are hence chilled at low levels, and the strength of the inland sun is not enough to dispel the chill entirely.

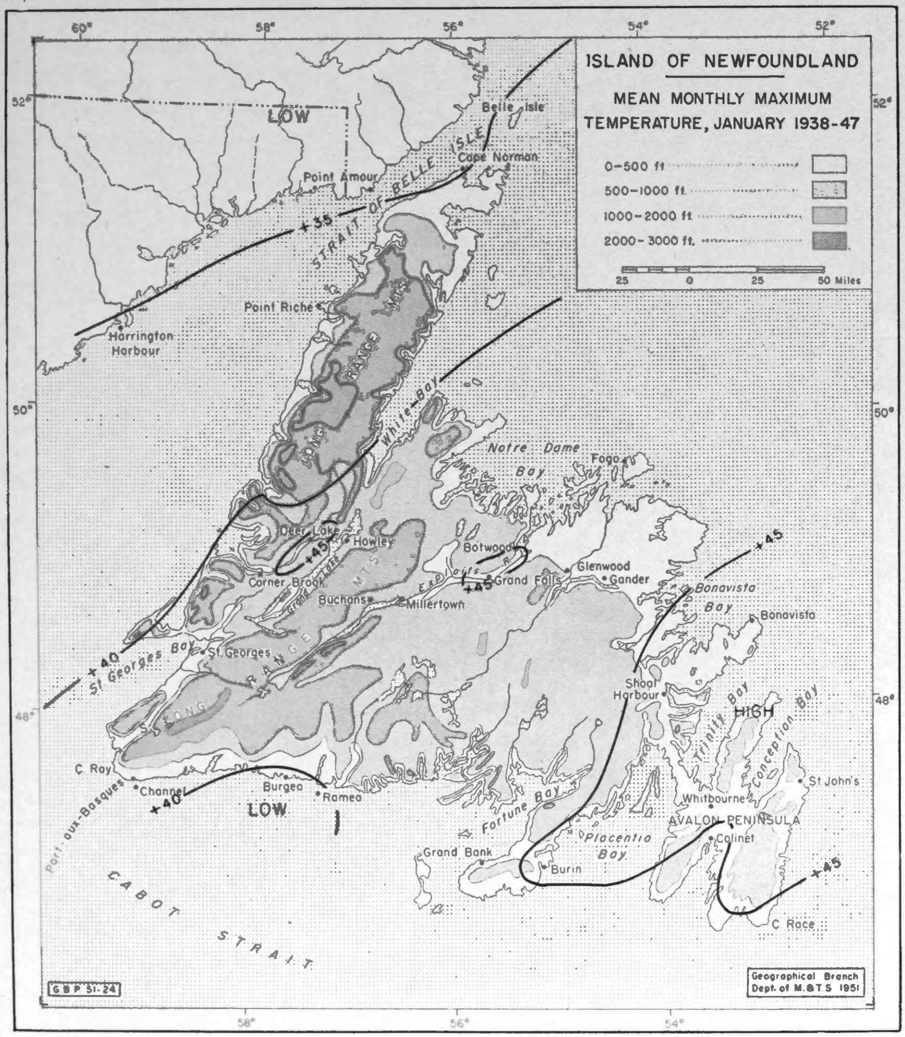


Figure 6.

In May mean air temperatures only just exceed 40 degrees in coastal localities, and are no more than 4 degrees higher inland. It will be shown later that frosts are widespread even in May. No distribution maps are shown for these spring months, but the Appendix gives adequate statistics for the principal stations.

SUMMER (JUNE-AUGUST)

Summer is a brief but pleasant season. Throughout the period Newfoundland appears as an island of relative warmth set in a cold, marine environment. Though mean temperatures inland are often quite high, the coasts remain much cooler.

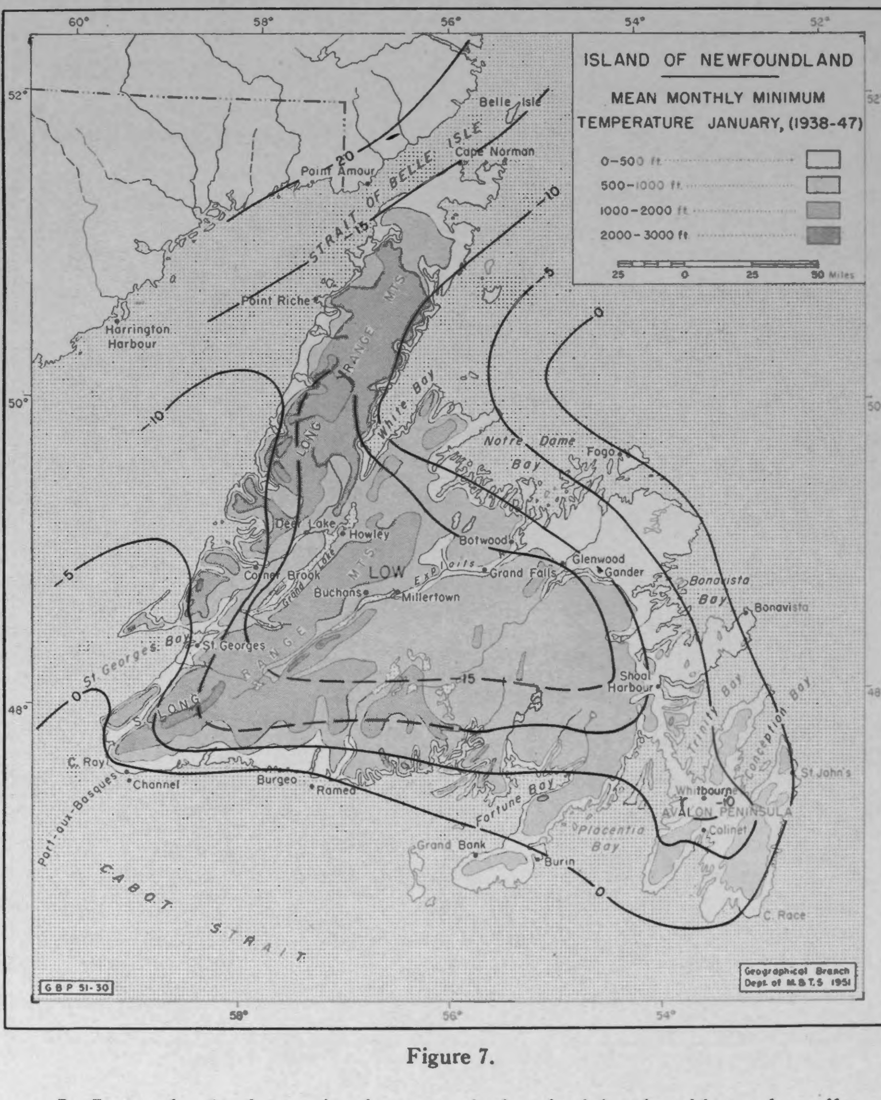


Figure 7.

In June, the 50-degree isotherm encircles the island. Along the railway belt mean temperatures are between 52 and 55 degrees, but very cool conditions persist on the south coast (e.g., Cape Race, 47 degrees; Channel, 49 degrees). The Labrador current water off the east, south, and southwest coasts remains very cold, and the prevailing southwest winds bring this coolness onshore. In July this curious pattern is even more pronounced (*See* Figure 8). Mean daily temperatures are from 60 to 63 degrees in the railway zone and north coast, with mean daily range about 20 degrees F., but along the south coast temperatures are much lower (e.g., Cape Race, 55 degrees; Burgeo, 55 degrees; Channel, 56 degrees): this contrasts with Fogo (60 degrees) off the north coast, with even colder water offshore, but with fewer winds from the seaward quarter. In August the contrast is less pronounced, but still real.

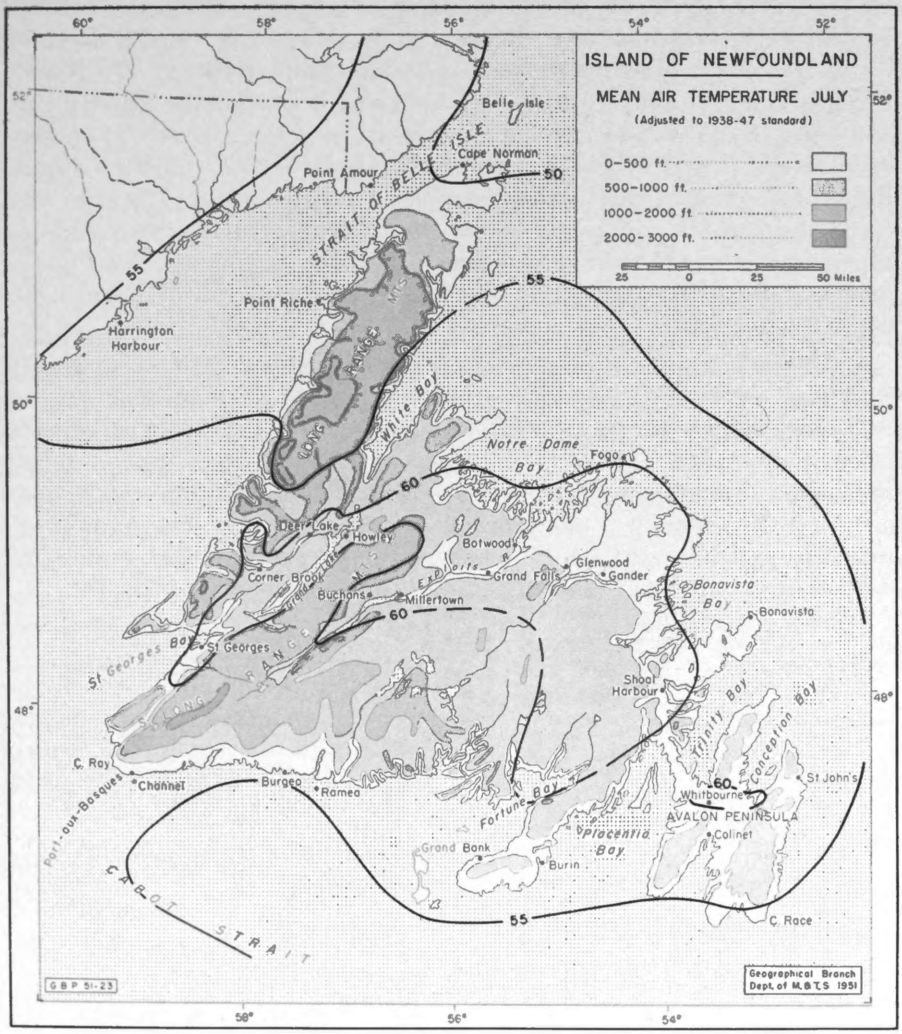


Figure 8.

As most of the old established climatological stations in Newfoundland are on the bleak south coast, the remarkable warmth of the northern region has been appreciated only recently. Formerly it was assumed that the coolness of the coast extended north across the island. Actually (Figure 8) the cool coastal belt is extended inland over the high southwestern plateaux, but goes no farther north. The Avalon Peninsula, scene of the densest rural settlement, has all too long a coastline, and is distinctly in the cool belt.

Hot spells occur at intervals throughout the summer. As in other parts of eastern Canada, hot weather occurs in moist southwesterly currents of sub-tropical origin, and the heat is usually humid and oppressive. Along the south coast surface chilling almost totally inhibits great heat in such air streams. July mean monthly maximum temperature does not exceed 75 degrees on this coast (e.g., Burgeo, 68 degrees; Cape Race, 73 degrees), which is more likely to experience a chilly fog than a hot sun. The Avalon Peninsula is also unlikely to experience great heat, but the railway belt, and especially the deep valleys in the western mountains, are sure to experience several spells of really high temperatures every summer. Corner Brook, for example, on Humber Arm, has a July mean monthly maximum of 88 degrees (cf. Montreal, 89 degrees; Toronto, 91 degrees), and has experienced temperatures of well over 90 degrees in each of the 3 summer months. Buchans, in the Exploits Valley near Red Indian Lake, has a corresponding figure of 87 degrees.

An unpleasant feature of summer, especially June and July, is the raw cold experienced in east and northeast winds off the Labrador current. *Maximum* day temperatures below 55 degrees (sometimes below 50 degrees) often occur at stations near the east coast in such winds. They accompany near-saturation humidities, overcast skies, drizzle, and often fog. Gander airport or St. John's are miserable places on such days. Quite often this weather spreads across all the interior plateaux, but is broken up by the descent of the air into the western valleys and coastal zone.

AUTUMN (SEPTEMBER-NOVEMBER)

Autumn is a season of rapidly declining temperatures in which the characteristics of winter soon overwhelm those of summer. Temperatures fall more rapidly in the north than in the south, so that a temperature gradient is established from south to north, ending the anomalous distribution typical of summer.

A special characteristic of the autumn is the very low mean daily range of temperature. Along the coast in November this value averages about 10 degrees, and rarely exceeds 13 degrees even inland.

THE LONG PENINSULA

The Long Peninsula has received only passing notice in the preceding section. Actually this little-settled area presents a remarkable gradation in climate. At its southern end, where it joins the mainland, temperatures on the few areas of low ground must closely resemble those at Corner Brook and Deer Lake. It will be shown later that these stations, among the most favoured in Newfoundland, have a climate almost capable of sustaining a high mixed forest of a kind similar to that of the Lake St. John basin.

Yet the shores of Belle Isle Strait, at the northern end of the peninsula, have a near-Arctic climate in which forest patches can cling to the hillsides only in semi-prostrate form. This extreme contrast results from the constant presence on both sides of the northern half of the peninsula of Labrador current water, often ice-laden well into July. Summer is hence a season of cool, drab weather, often accompanied by widespread fog or low stratus cloud. Belle Isle itself has a July mean temperature of only 49 degrees, in spite of its latitude (52 degrees—that of London, England), and Cape Norman and St. Anthony on the mainland are little warmer. Nowhere else on earth does the Arctic verge drive so far south into middle latitudes.

THE ANNUAL CYCLE OF FROST AND THAW

The variation of mean temperature over the whole of eastern Canada is such that the year is divided into seasons of frost and thaw, which are of about equal duration along a line from southern James Bay to the Strait of Belle Isle. Actually one can distinguish two distinct "thaw" periods. First there is the summer period in which temperature is continuously above 32 degrees, even at night. This is, of course, the frost-free period, extending from the mean date of the last spring frost to the mean date of the first autumn frost. Of great interest ecologically, this period is discussed later in the paper. The second period is that in which the annual course of mean daily temperature is above 32 degrees. This is best defined as the season of persistent thaw, and is highly correlated with the annual cycle of river- and sea-ice and snow-cover. Though temperature often drops well below freezing both early and late in the period, *on the average* temperature is above freezing more than 50 per cent of the day throughout.

We are concerned in this section with the season of persistent thaw and its winter analogue, the season of persistent frost. Their relationship to the freeze-up and break-up of river and harbour ice will also be discussed.

Figure 9 shows the date in spring when mean daily temperature rises above 32 degrees. Almost everywhere April is the month of thaw.

The thaw comes early in the Avalon and Burin Peninsulas, chiefly because temperatures here do not fall far below the freezing point even in mid-winter. It is noteworthy that Cape Race is a week later than St. John's, as is St. Pierre. Farther west on the south coast, the date is later (Channel, on April 17, being 14 days after St. John's). Earlier thaw is experienced in the deep valleys and embayments in the west, though even here conditions are a week after St. John's. Over most of the plateaux of the interior thaw comes between April 15 and April 20. Similar dates apply in White and Notre Dame Bays, but progressively later dates are found as one travels north along the Long Peninsula. Finally, the thaw attains the Strait of Belle Isle at about May 5 (Belle Isle itself, May 9). In short, it takes a month for the thaw to cross the island from Avalon to Belle Isle.

In the autumn, the same is true in reverse. The frost begins in the Belle Isle vicinity about November 1 (*See* Figure 10) and travels south to arrive over the Avalon and Burin peninsulas about December 5. The southward progress is more rapid inland than along the coasts. Thus at Fogo, off the north coast, persistent frost begins on November 26, whereas at Buchans, far in the interior, it comes on November 15.

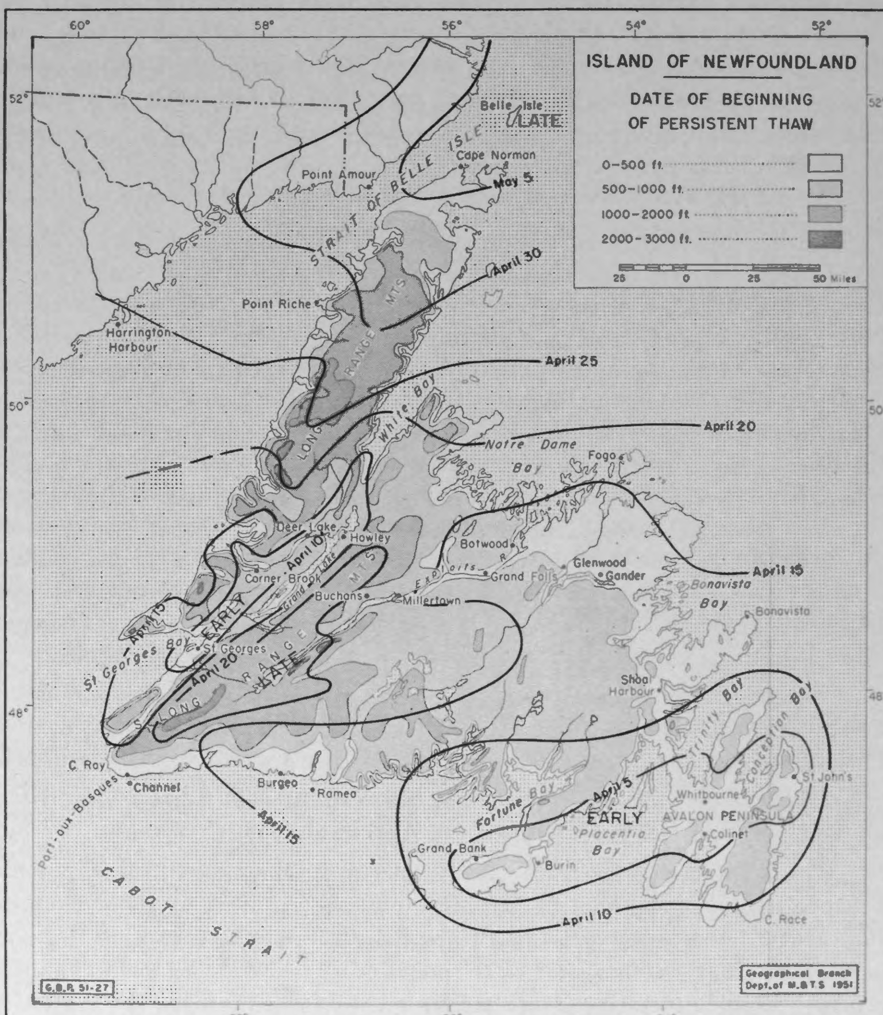


Figure 9. Date on which season of persistent thaw begins (i.e., mean air temperature rises above 32°F.).

The third map in this series (Figure 11) provides the integration of the other two by showing the duration in days of the season of persistent thaw. Values range from 175 days at Belle Isle to 253 at Grand Bank in the Burin Peninsula.

THE FREEZE-UP AND BREAK-UP OF HARBOURS

This correlates highly with the mean air temperature. A detailed list of the critical dates is given in the *Ice Atlas of the Northern Hemisphere*[1], and the following broad generalizations can be made about the climatic relations of the ice-cycle in harbours.

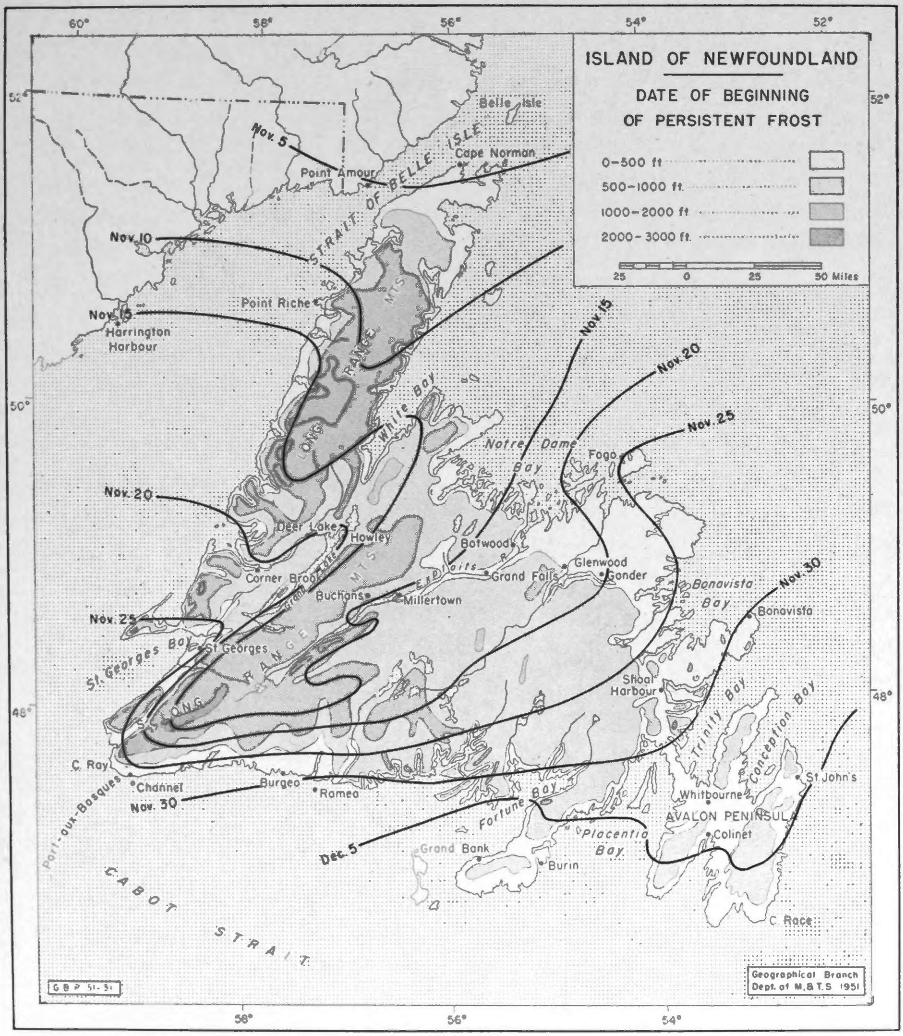


Figure 10. Date on which season of persistent frost begins (i.e., mean air temperature falls below 32°F.).

(i) The south and east coasts between Cape Bonavista and Cape Ray do not experience prolonged freeze-up of the harbours in normal winters. At St. John's, for example, the longest freeze-ups rarely exceed 1 week.

[1] Ice Atlas of the Northern Hemisphere; United States Navy Department, Hydrographic Office, Washington, 1946.

Coastwise navigation can be maintained throughout the winter, though drifting Labrador pack offshore may impede it, especially near exposed headlands like Cape Race. Such navigation also enters Bonavista Bay, but harbour ice is extensive, and entry is only possible for skilled local pilots. The absence of prolonged freeze-ups in these southern harbours is due to the

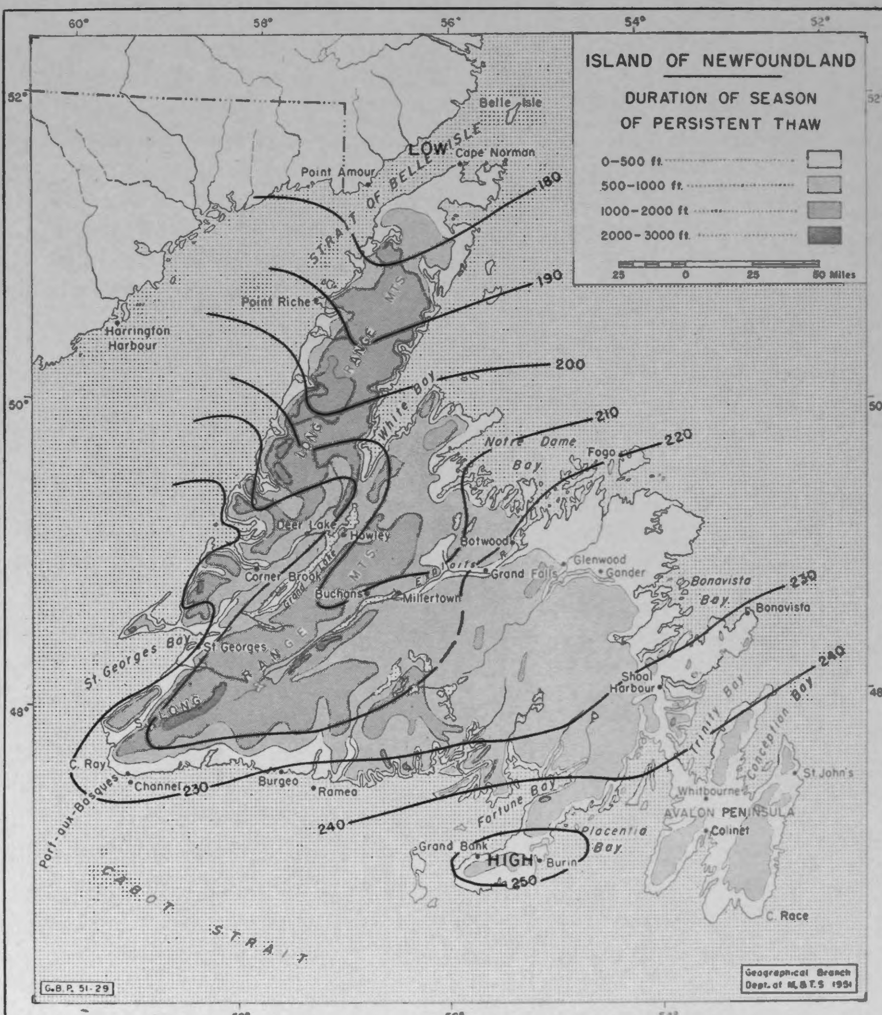


Figure 11. Duration of season of persistent thaw (mean air temperature above 32°F.).

shortness of the frost season, and to the stormy and exposed character of the coasts. In general, harbours having less than about 135 days (4 months) of freezing temperatures escape prolonged freeze-ups.

(ii) Along the north coast from Belle Isle to Cape Bonavista, a period of harbour-closure because of locally formed ice is general. The harbours of the northernmost Long Peninsula close about December 15, those of

White Bay about December 25, at Notre Dame Bay January 1–5, and of Bonavista Bay about January 10–15, *all these figures being generalizations from which large deviations may occur in individual years.* These dates come some 40 days after mean air temperature falls below the 32-degree threshold in the north, and about 45 to 50 days in the south. There is a considerable interval between the beginning of freezing temperatures (for fresh water) and the close of the harbours. This interval is far longer in Newfoundland than in the high Arctic, where closure comes in some 30 days.

(iii) The west coast shows a similar regime. The freeze-up averages about December 15 as far south as Point Riche, but comes between January 5 and 10 in Bonne Bay and the Bay of Islands. The farthest south the regular freeze-up extends is St. Georges Bay (which is reached about January 15). These dates are from 35 days in the north to 45 days in the south *later* than the date on which mean air temperature falls below 32 degrees.

(iv) On all coasts the break-up of harbour ice is also highly correlated with mean air temperature rise above 32 degrees. Everywhere the break-up is from 5 to 10 days after mean air temperature reaches this figure. Thus in Bonavista Bay it begins between April 25 and 30, but is deferred until May 15 to 25 at Belle Isle. On the west coast St. Georges Bay averages April 15, the Bay of Islands April 30, and Belle Isle Strait May 15.

These tentative correlations of the ice-cycle in harbours makes it possible to use Figures 9 and 10 with caution to assess the dates of freeze-up and break-up in harbours from which there is little information. It should be stressed, however, that tidal and other currents, as well as shelter from heavy sea and swells, can cause large local variations in the dates, and that in individual years there are often very large deviations from both normal dates.

HUMIDITY

Surface humidity is an element little subject to local variations. The moisture contained in the air is evaporated into it during a prolonged travel across either sea, fresh water, or green plant cover (the latter being almost as effective as open water in the early growing season). Local water bodies, even when as large as the Great Lakes, have an entirely minor significance, unless they differ strikingly from the air in temperature. Thus warm, unfrozen lakes and seas very rapidly raise the humidity of colder air crossing them. On the other hand, a cold lake or sea may actually *lower* the humidity by producing condensation. Where water and air are at nearly the same temperature, local water bodies can be virtually forgotten.

In climatological work it is desirable to use an absolute measure of humidity, such as the *mixing ratio*, which is the ratio of water vapour to dry air in the atmosphere, usually expressed in grams of water vapour per kilogram of dry air (hereafter written gm./kgm.). Relative humidity, the common unit, conveys little, and has very little value in application to physical problems. Its undiscriminating use can also lead to absurd misconceptions, well illustrated by the fact that mean midday relative humidity in July is 6 per cent *higher* at Edmonton than at humid Montreal.

Throughout the year mean mixing ratio increases from northwest to southeast across the island, though the differences are comparatively small. Gander airport, being roughly midway between Belle Isle and Cape Race, can well serve as a typical site. Figure 12 shows the annual variation of mean mixing ratio and mean relative humidity. Also shown are the extreme highest values of mixing ratio for each month.

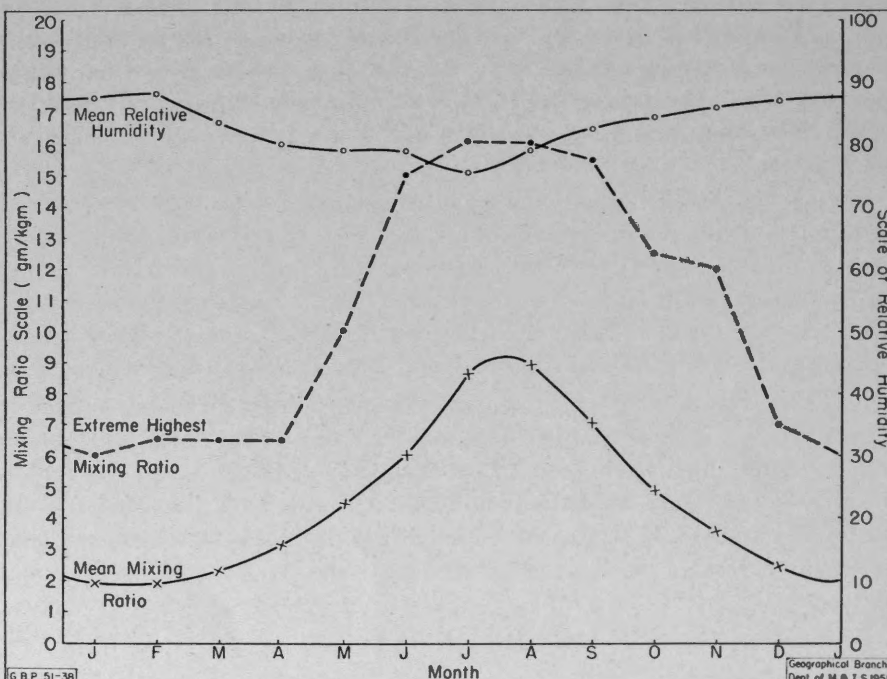


Figure 12. The annual humidity regime at Gander.

In mid-winter, humidity is very low, though relative humidity, misleading as usual, is at its annual peak, averaging over 85 per cent at all stations. In January, actual values of mean mixing ratio range from 1·4 gm./kgm. at Belle Isle to 2·4 gm./kgm. at St. John's (Torbay). These values are comparable with those for peninsular southern Ontario. Extreme highest values for January at Gander are from 6·0 to 6·5 gm./kgm., a value exceeding the normal even for Vancouver Island.

Spring is a season of rapidly rising humidities, which attain their maximum in July and August over the whole island. As true humidity rises, relative humidity falls, reaching its annual minimum in June at all stations (76 per cent at Gander). Actually, both in spring and summer Newfoundland is rather less humid than inland districts in the same latitude; the chilly seas surrounding the island tend to rob the air of moisture by creating condensation. In July, for example, mixing ratios vary from 8·0 at Belle Isle to about 9·4 at Port-aux-Basques; these are values comparable with those experienced in western Alberta, and are considerably lower than those of Saskatchewan and Manitoba. Newfoundland's reputation for summer dampness is thus far from deserved.

Like all other parts of eastern Canada, the island is periodically visited in summer and early autumn by very humid tropical air from the southwest. In such air, humidity mixing ratio has risen to above 15 gm./kgm. at Gander in each month from June to September inclusive, and has reached 17 gm./kgm. at St. John's (Torbay) in both July and August. Mean mixing ratios at Singapore are about 18 gm./kgm. throughout the year, so that these summer humid spells in Newfoundland come close to emulating equatorial dampness. Fortunately, they are of brief duration.

In autumn, true humidity declines rapidly, whereas relative humidity rises once again. From time to time in October and November, humidities above the ordinary levels of summer return to Newfoundland in the warm sectors of Atlantic coast cyclones.

PRECIPITATION

The whole island has abundant, well-distributed precipitation, which falls chiefly from the fronts of numerous cyclones approaching from southwest or west. Over considerable parts of the hilly districts total annual falls exceed 50 inches, and the greater part of the island can be reckoned perhumid according to the Thornthwaite climatic classification. Both rain and snow are abundant, the latter being of greater importance in the hilly southwest than elsewhere.

DISTRIBUTION

Figure 13 shows the mean annual precipitation over the island. As the precipitation is evenly distributed over the year, this map indicates patterns that persist through all four seasons.

The outstanding characteristic is the wetness of the south coast. From Cape Ray to St. John's the mean annual fall exceeds 50 inches (cf. Montreal, 41 inches; Vancouver, 58 inches). There are few rainfall records from inland stations on the higher parts of the plateau, but it is quite certain that falls of well over 50 inches occur in the southwest. A short record at Corner Brook Lake, some 900 feet above nearby Corner Brook (46 inches), produced a mean fall of 56 inches. It is impossible even to guess how much higher falls may be at, for example, the 2,000-foot contour.

The wetness of the south coast is readily comprehensible. Most of the precipitation falls from southerly or southwesterly streams of warm, moist air, usually when they are overrunning cooler air along the warm fronts of cyclones. Since such frontal activity is commoner over the Newfoundland area than over any other part of eastern North America, precipitation is frequent and prolonged. Moreover, the hilly character of the coast and the southwestern part of the interior intensifies the precipitation as the front approaches the coast.

The northern part of the interior is a little drier, falls in the railway zone averaging about 40 inches. Certain areas of well-enclosed lowlands have even lower falls. Thus, Deer Lake, largely surrounded by high hills, has only a little over 30 inches. The Strait of Belle Isle, protected on the south by the hilly Long Peninsula, has less than 30 inches along its entire

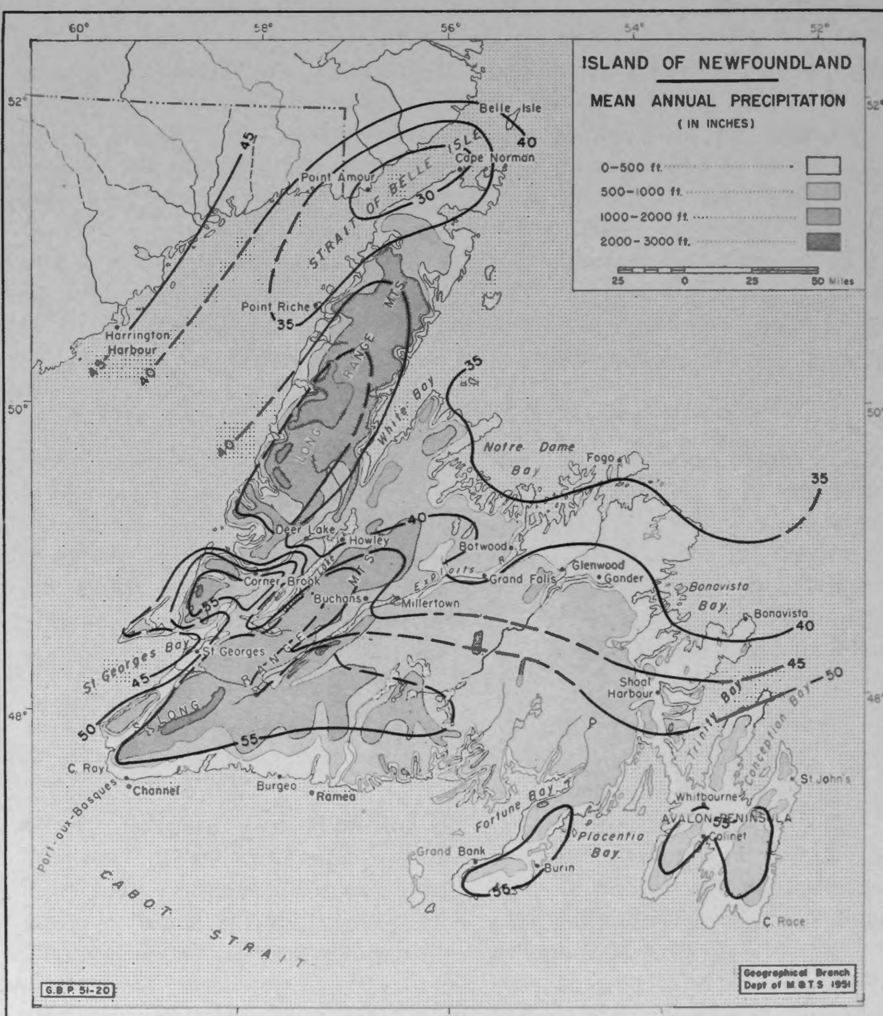


Figure 13.

length (Cape Norman, 28·4 inches; Point Amour, 24·7 inches). Similar rain shadow areas must occur in all the deeper, enclosed basins, though records are lacking from most of them.

The comparative dryness of the north coast comes as a surprise to many who had assumed that the east and northeast winds from the Atlantic were important sources of moisture. Heavy rain often falls from southerly air streams through a shallow layer of surface easterlies, which have thus assumed a reputation for wetness that they do not deserve. Only rarely do such air streams yield widespread rain or snow; more proper to them is a clinging drizzle falling from layers of low stratus cloud.

SEASONAL VARIATION

The even distribution of the precipitation between the seasons has already been stressed. Nowhere in the island is there a station having a month with less than a twenty-fifth of the annual fall. Nevertheless, a significant seasonal variation can be detected.

(i) The autumn (September to November) is a season of rising precipitation, November being the wettest month in most places. These heavy falls are explained by the high moisture content of the warmer air masses associated with cycloric activity at this season. In some parts of the south and east the maximum is delayed still later (e.g., December at Gander; January at Channel and Fogo).

(ii) Precipitation declines progressively as winter passes, and spring is the driest season almost everywhere, April being the driest month. In the extreme southeast (chiefly the Avalon Peninsula) the relative drought is prolonged until June or July, probably due to the stabilizing influence of the cold Labrador currrent offshore.

(iii) In summer (June to August) precipitation begins its rise towards the autumn maximum. Summer is the season of least frequent precipitation, measurable rain falling on only 10 to 12 days in a typical month. Thunderstorms are not uncommon inland, and there is a general tendency towards heavier rains of shorter duration than is typical of the rest of the year.

SNOWFALL

Winter snowfall is heavy in most districts. Figure 14 shows the mean annual fall. More than 100 inches are experienced everywhere except along the southernmost coasts. Heaviest falls are in the hilly southwest. There is no accurate information from the high-level areas, but Corner Brook Lake (about 900 feet) had an average fall of 218 inches over a 4-year period. There is little doubt that comparable falls must occur over most of the high plateaux of the southwest.

In the railway zone, falls vary from about 100 to 125 inches in most places. Heavier falls (157 inches) occur near Corner Brook and the west coast. Deer Lake, in its deeply sheltered valley, gets only 69 inches. In general, however, the snowfall of the more thickly settled districts resembles that of Montreal and Quebec City both in quantity and manner of occurrence.

Small amounts of snow occur in October. The first heavy falls normally come in middle or late November, and snow-cover becomes permanent in most districts early in December. Rain begins to exceed snow in April, when the snow-cover usually melts, but appreciable snowfall may occur even in May. In eastern districts light falls are sometimes reported as late as early June.

There is no reliable information about the depth and characteristics of the snow-cover. In most areas it must attain 3 to 4 feet in mid-winter, especially in forested districts; the frequent winter thaws and rains create

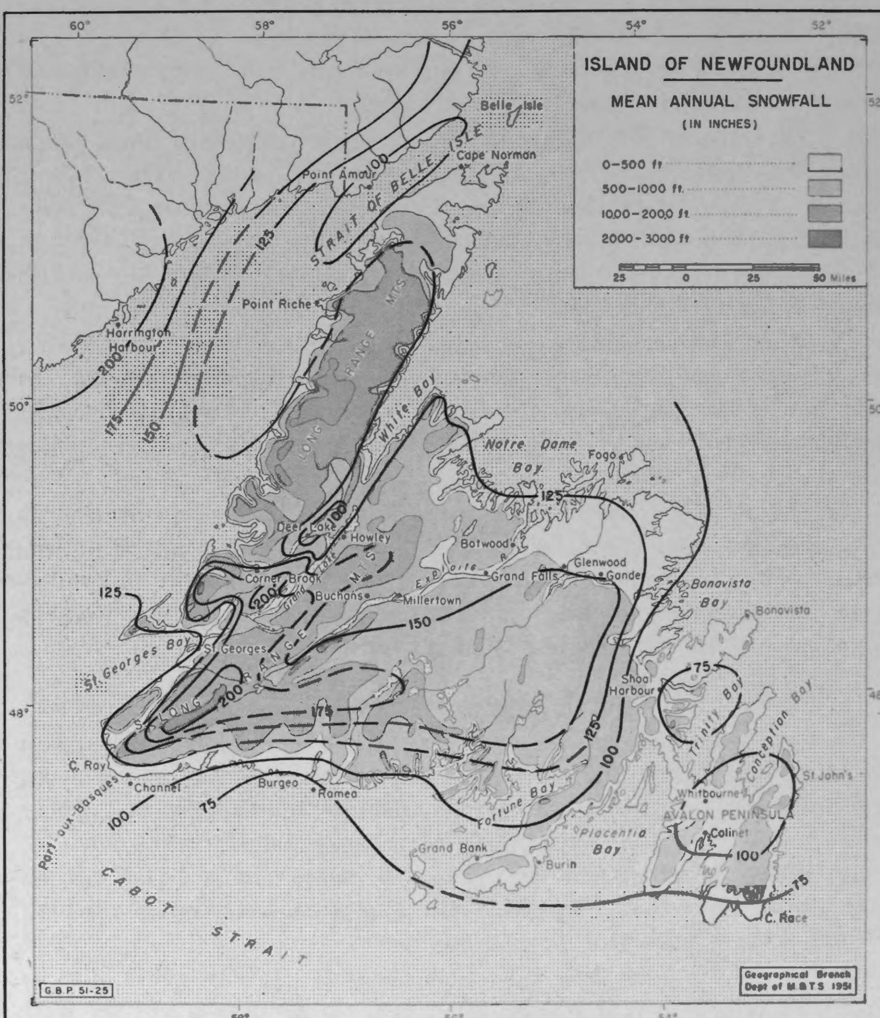


Figure 14.

numerous crusts within the snow-cover, just as they do in southern Ontario and Quebec. This is particularly true of the Avalon and Burin Peninsulas, where fully half the precipitation of midwinter falls as rain. Snow-cover in these districts is hence very uncertain, and cannot be described as permanent along the coasts.

VARIABILITY OF PRECIPITATION

The precipitation of Newfoundland is unusually reliable; the odds are strongly against a large deviation from normal of either monthly or annual falls. Table I shows how St. John's, Newfoundland, compares with other stations in eastern Canada in this respect.

TABLE I

Deviations of Monthly and Annual Precipitation from long-term Normals at certain Stations

Station	Years of record	Mean deviation as % of mean precipitation			Wettest year (inches)	Driest year (inches)
		Jan.	July	Year		
St. John's, Nfld.	46	28	29	11	67·9	42·7
Father Point, Que.	44	35	40	12	47·3	19·1
Chicoutimi, Que.	35	49	42	18	35·7	11·7

These figures show that the mean deviations from normal of both annual and monthly precipitation are smaller at St. John's than at points in the St. Lawrence basin to the west. The same reliability can certainly be claimed for the other parts of Newfoundland. The island derives its precipitation from a considerable variety of circulation types; a deficiency in one source is usually made partly or entirely good from another.

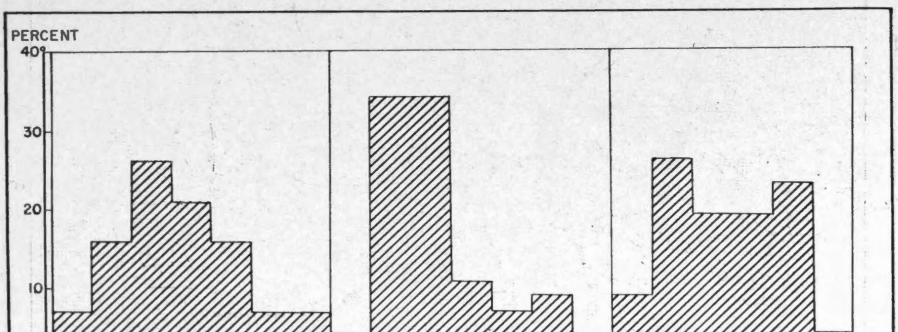


Figure 15.

Though precipitation is frequent, excessive daily or monthly falls are uncommon. Figure 15 shows the distribution of monthly and annual totals at St. John's; obviously very large deviations are exceptional. The heaviest falls on record in a single month are of the order of magnitude of 13 inches (e.g., St. John's, December, 14·1 inches; Burin, January, 13·1 inches; Cape Race, November, 11·6 inches).

Falls of 1 inch of rain in a day are commonplace at all stations, but 2 inches in a day is a rarity. The heaviest fall in one day known to the author was of 4·2 inches at Grand Bank. Cape Race has recorded 4·1 inches in 24 hours in August. Many of the heavier single-day falls have occurred in late summer or autumn, when Atlantic hurricanes have crossed the island. On the whole, however, the island is less prone to excessive daily falls than its wetness would suggest.

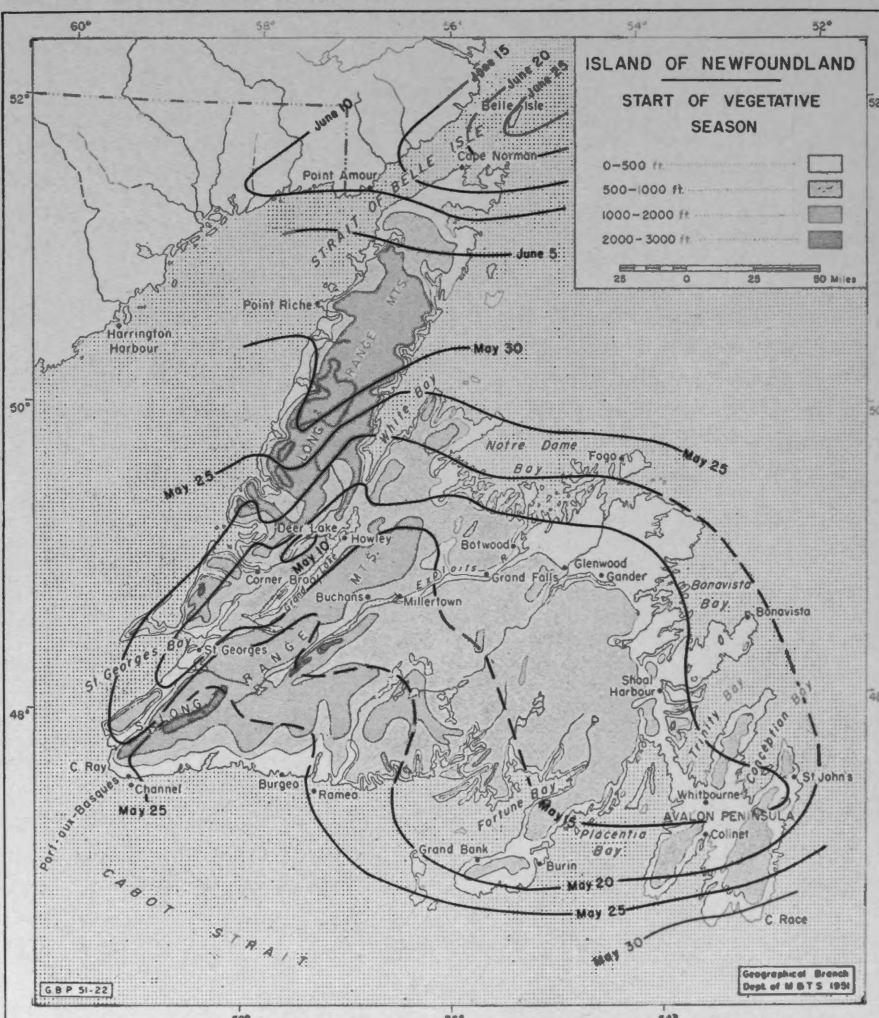


Figure 16. The vegetative season: date in spring when mean air temperature rises above 43°F.

Heavy snowfalls in a single month or day are not uncommon. There are several authentic records of falls of over 100 inches in a single month (e.g., at St. John's, Fogo, and Burin), and 50 inches is an ordinary event.

The heaviest single-day falls known to the author are of 21 and 22 inches, both at St. John's. Ordinarily the heaviest individual snowstorm of winter leaves about 15 inches of snow behind it in most districts, though much greater falls probably occur in the hills.

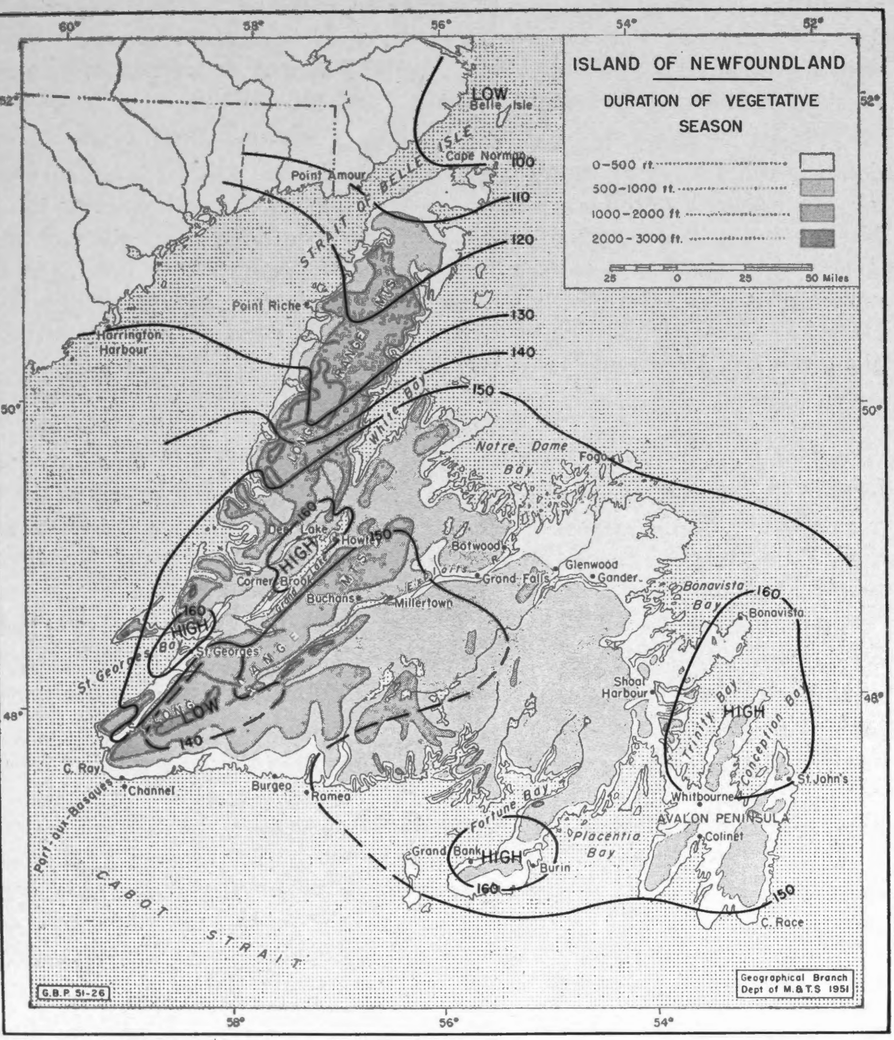


Figure 17. Duration in days of vegetative season (with mean temperature above 43°F.).

ECOLOGICAL CLIMATOLOGY

It is now possible to review the climate as it affects natural vegetation and agriculture. The evidence is presented cartographically or in tabular form and the ensuing account is hence brief.

THE VEGETATIVE SEASON

Though opinions differ among ecologists as to their value, much use has been made in the past of so-called "threshold dates", which are the dates on which mean air temperature passes a standard temperature, at which it is assumed that growth begins in crops or natural vegetation. The chief value of such dates is that they enable us to compare one region with another. The threshold date adopted here is 43 degrees, which is reached in Montreal and Ottawa about April 10.

Figure 16 shows the date of beginning of the vegetative season as so defined, and Figure 17 shows its duration in days. The striking features are the lateness of the start in all areas, some 30 to 50 days later than Montreal, and the comparatively favourable conditions along the railway zone, which has a season of over 160 days near St. Georges, Deer Lake, and in northern Avalon. The Burin Peninsula has the longest season, though the Deer Lake basin is earliest to start. The rapid deterioration northward along the Long Peninsula should be noted.

THE FROST-FREE SEASON

This season is the period between the last spring and first autumn frosts. It varies quickly from point to point, and a map has hence not been attempted. Average dates of the latest and earliest frost, and the mean duration of the period, are given for all available stations in Table II. The following generalizations can be made with reasonable confidence:

(i) Along the south coast, the period is from 140 to 150 days, the last spring frost coming on the average between May 20 and 25, and the first of autumn between October 10 and 15. The Burin Peninsula is the most favoured area.

(ii) In the railway zone, there are about 110 days, extending from June 5 to 10 until late September or early October. Frosts may occasionally occur late in June or early September. Moreover, the average period is much shorter in certain areas in which topography favours local frost drainage (e.g., Colinet, 94 days; Glenwood, 75 days—cf. Gander, 123 days; Millertown, 78 days). On the whole, the frost regime resembles that of the better parts of the wheat-growing land in the Prairie Provinces (cf. Winnipeg, 110 days; Calgary, 98 days; Medicine Hat, 120 days).

CLIMATIC CLASSIFICATION AND NATURAL VEGETATION

The whole island lies in the microthermal (D) province in Köppen's scheme, actually falling within the Dfc sub-province, regarded by Köppen as sub-Arctic. Belle Isle lies on the verge of the ekistothermal (ET) or tundra climates. As might be expected from these facts, the island is largely covered by spruce-fir associations of the Boreal Forest formation. Certain non-Boreal elements enter the associations in places, and there are large areas of so-called "moss-barrens", in many ways resembling the treeless Arctic tundra.

TABLE II

Duration of Frost-free Period at Stations in Newfoundland

Station	Years	Between	Mean dates			Extreme dates			
			Last spring frost	First autumn frost	Duration of frost-free period (days)	Earliest last spring frost	Latest last spring frost	Earliest first autumn frost	Latest first autumn frost
Belle Isle	50–53	1884–1946	June 20	Sept. 25	97	May 18	July 15	July 18	Oct. 23
Buchans	15	1932–1946	June 4	Sept. 22	110	May 16	June 19	Aug. 31	Oct. 10
Burgeo	8–9	1938–1946	May 21	Oct. 8	140	May 7	June 3	Sept. 20	Oct. 25
Burin	20–22	1909–1931	May 21	Oct. 17	149	Mar. 31	June 17	Oct. 3	Nov. 24
Cape Race	26	1921–1946	June 3	Oct. 9	128	May 15	June 21	Sept. 20	Nov. 17
Channel	66	1877–1946	May 23	Oct. 12	142	May 1	June 8	Sept. 9	Nov. 1
Colinet	8	1938–1946	June 15	Sept. 17	94	June 4	June 27	Aug. 31	Oct. 6
Corner Brook	12–13	1933–1946	June 7	Sept. 26	111	May 9	June 28	Aug. 31	Oct. 30
Deer Lake	14	1933–1946	June 7	Sept. 18	103	May 15	June 30	Aug. 22	Oct 10
Fogo	27	1919–1946	June 11	Oct. 11	122	May 13	July 9	Aug. 21	Nov. 6
Gander	10	1937–1946	June 4	Oct. 5	123	May 15	June 20	Aug. 26	Oct. 18
Glenwood	10	1937–1946	June 25	Sept. 8	75	June 3	July 13	Aug. 26	Oct. 10
Grand Bank	12	1935–1946	May 25	Oct. 15	143	May 5	June 13	Oct. 6	Nov. 2
Grand Falls	13	1934–1946	June 7	Sept. 28	113	May 15	June 30	Sept. 1	Oct. 17
Howley	8	1937–1944	June 4	Sept. 22	110	May 15	June 30	Sept. 6	Oct. 16
Millertown	12	1935–1946	June 23	Sept. 9	78	June 8	July 12	Aug 13	Sept. 30
Port-aux-Basques	21	1909–1929	May 26	Oct. 17	144	May 8	June 9	Sept. 26	Nov. 6
St. Georges	48–50	1895–1944	May 25	Oct. 12	140	April 11	June 30	Sept. 19	Nov. 7
St. John's	58–60	1877–1942	June 2	Oct. 10	130	April 28	June 30	Sept. 4	Nov. 11

In all cases "frost" refers to a minimum temperature at or below 32·0° F. in the thermometer screen.

Figure 18 shows the distribution of potential evapotranspiration following Thornthwaite.[1] Potential evapotranspiration defines what has been described as the "water need" of the landscape; it comprises the combined annual water loss by soil evaporation and transpiration under optimum soil moisture conditions. Purely a computed variable, it has

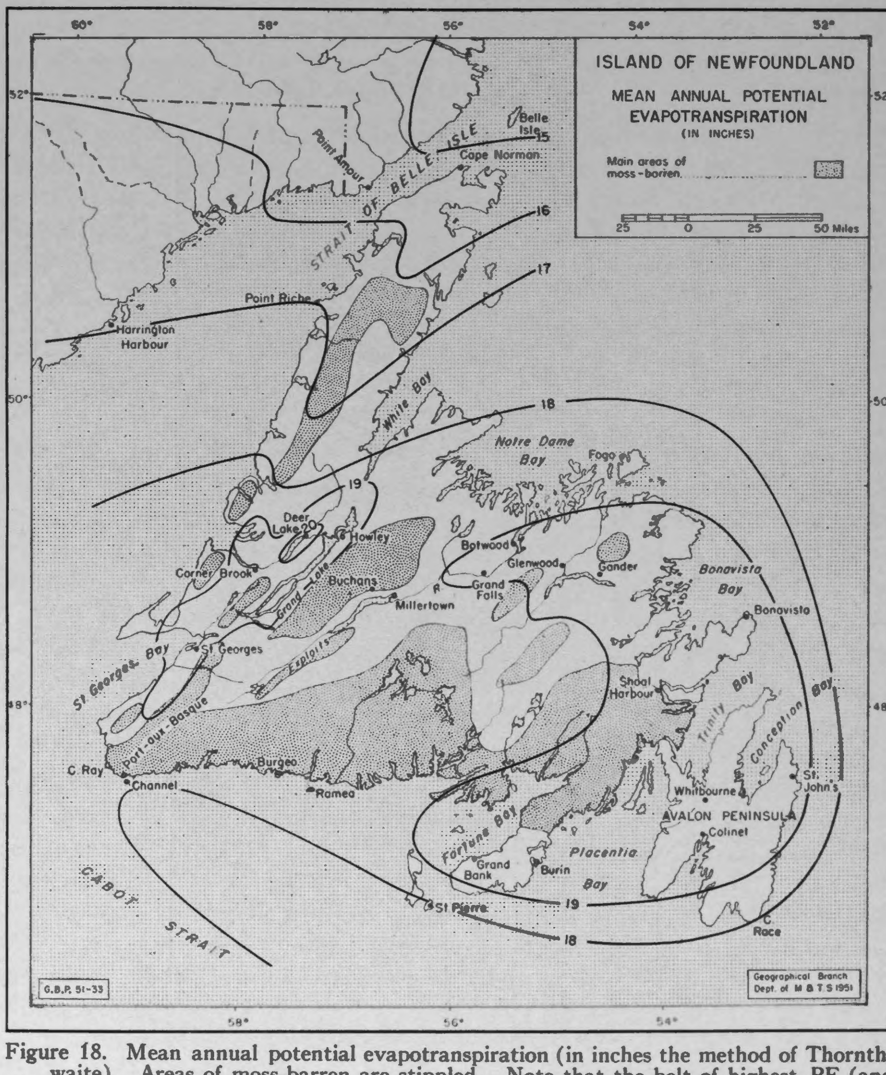


Figure 18. Mean annual potential evapotranspiration (in inches the method of Thornthwaite). Areas of moss-barren are stippled. Note that the belt of highest PE (and hence thermal efficiency) occurs on either side of the railway belt.

been shown to fit observations in many parts of Canada[2]. As it is an accumulating function of air temperature, Thornthwaite also regards it as a measure of "thermal efficiency" or growth potential for vegetation. Henceforth it will be referred to as PE in this paper.

[1] Thornthwaite, C. W.: An Approach towards a Rational Classification of Climate; Geog. Review. vol. 38, No. 1, pp. 55–94 (January 1948).

[2] Sanderson, M.: The Climates of Canada according to the new Thornthwaite Classification; Scientific Agriculture, vol. 28 No. 22, pp. 501–517 (1948).

Highest values of PE occur in the north and northeast, in a crescentic belt more or less astride the railway route. Values of 19 to 20 inches occur from St. Georges Bay to the Avalon and Burin Peninsulas. The best station is Deer Lake (20·0 inches). In southern Avalon and on the south coast west of Fortune Bay, PE is from 18 to 19 inches, distinctly lower than

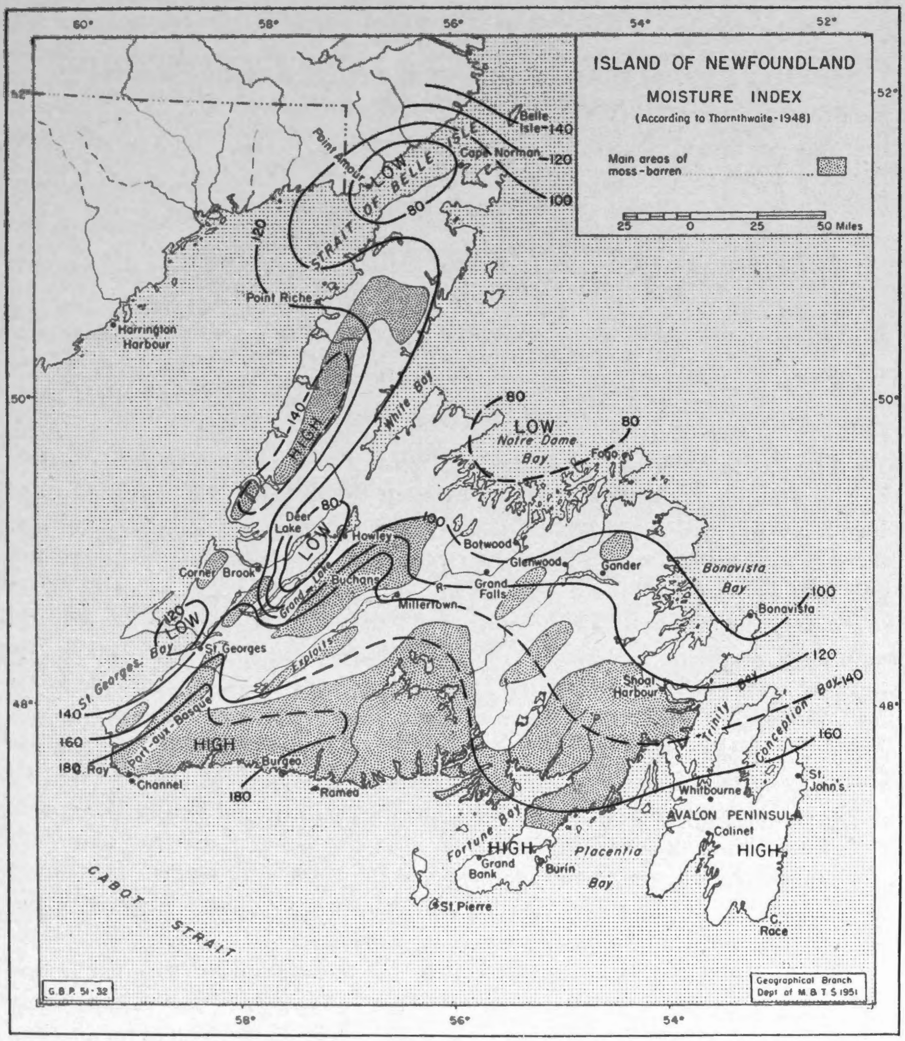


Figure 19. Moisture index (according to Thornthwaite, 1948). The following terms apply to various ranges of the moisture index: 60-80, third order humid (B_3); 80-100, fourth order humid (B_4); over 100, perhumid (A). Moss-barrens shown stippled.

in the north. Northwards along the Long Peninsula, PE declines rapidly from 19 inches to below 15 inches at Cape Bauld. This is a transition that in Quebec is spread over the distance from La Tuque on the St. Maurice to Fort McKenzie in northern Ungava—a distance of nearly 700 miles.

These values of PE refer the greater part of Newfoundland to the warm microthermal province (C'_2), the northern two-thirds of the Long Peninsula alone falling into the cool microthermal provinces (C'). The present writer has shown[1] that there is a high correlation between annual PE values and the structure of the Boreal Forest formation in Quebec and Labrador. Broadly speaking, the correlation established was as in Table III.

TABLE III

Forest Types Typical of Various Ranges of Annual Potential Evapotranspiration, Quebec and Labrador

Value of PE (inches)	*Forest Type*
12·0–12·5	
	Tundra and thin woodland intermingled
14·0–14·5	
	Open woodland (chiefly spruce): lichen floor
16·5–17·0	
	Close forest, with spruce-fir associations
18·5–19·0	
	Ditto, with occasional admixture of white and red pines, yellow birch, and sugar maple
20·0	
	Great Lakes-St. Lawrence mixed forest, with white and red pines, yellow birch, and sugar maple as dominants

The forest cover of Newfoundland follows this correlation very closely. On the mainland, especially in the railway zone, there is a good stand of close forest, in which the chief association is white spruce-balsam fir (*Picea glauca-Abies balsamea*). There is an extensive admixture of white and red pine (*Pinus strobus*; *P. resinosa*). Two other species typical of the Great Lakes-St. Lawrence forest also occur, yellow birch (*Betula lutea*) and mountain maple (*Acer spicatum*). Other hardwood species typical of the southern forests occur, but with a local distribution; thus sugar maple (*Acer saccharum*) and white elm (*Ulmus americanus*) occur in the St. Georges district, together with red maple (*Acer rubrum*), which also occurs in Avalon. These southern species nowhere achieve dominance, so that the forests of the mainland fall essentially into the main Boreal Forest formation, but contain numerous individuals typical of the Great Lakes-St. Lawrence formation. As PE on the lower ground is everywhere between 18·0 and 20·0 inches, it is clear that this distribution is in close accordance with the climatic relations tabulated above.

Along the Long Peninsula, close forest yields rapidly to open lichen woodland, with black spruce (*Picea mariana*) growing scattered in a sea of lichen (chiefly *Cladonia*). In the far north, this in turn gives way to a landscape in which tundra covers all but the lowest ground—the so-called "forest tundra". This again parallels precisely the zonation seen in Quebec-Labrador in a similar range of climates. Many of the higher plateau surfaces of the mainland also support a black spruce lichen woodland. This is unquestionably the effect of altitude, which reduces the PE below values shown on Figure 18 (drawn for the lower ground).

[1] Hare, F. K.: Climate and Zonal Divisions of the Boreal Forest Formation in Eastern Canada; Geog. Review, vol. XL, No. 4, pp. 615–635 (October 1950).

The "moss-barrens" that are so extensively developed (*See* Figures 18 and 19) in Newfoundland present many problems. In many cases this treeless, mossy and sedgy vegetation occurs on highlands, where the climate is truly Arctic, and in such cases the barrens form a true Alpine tundra. But quite often the barrens extend down to very low levels, being well developed on the south coast and in Avalon at sea-level, in spite of the fact that the thermal efficiency is adequate for close forest.

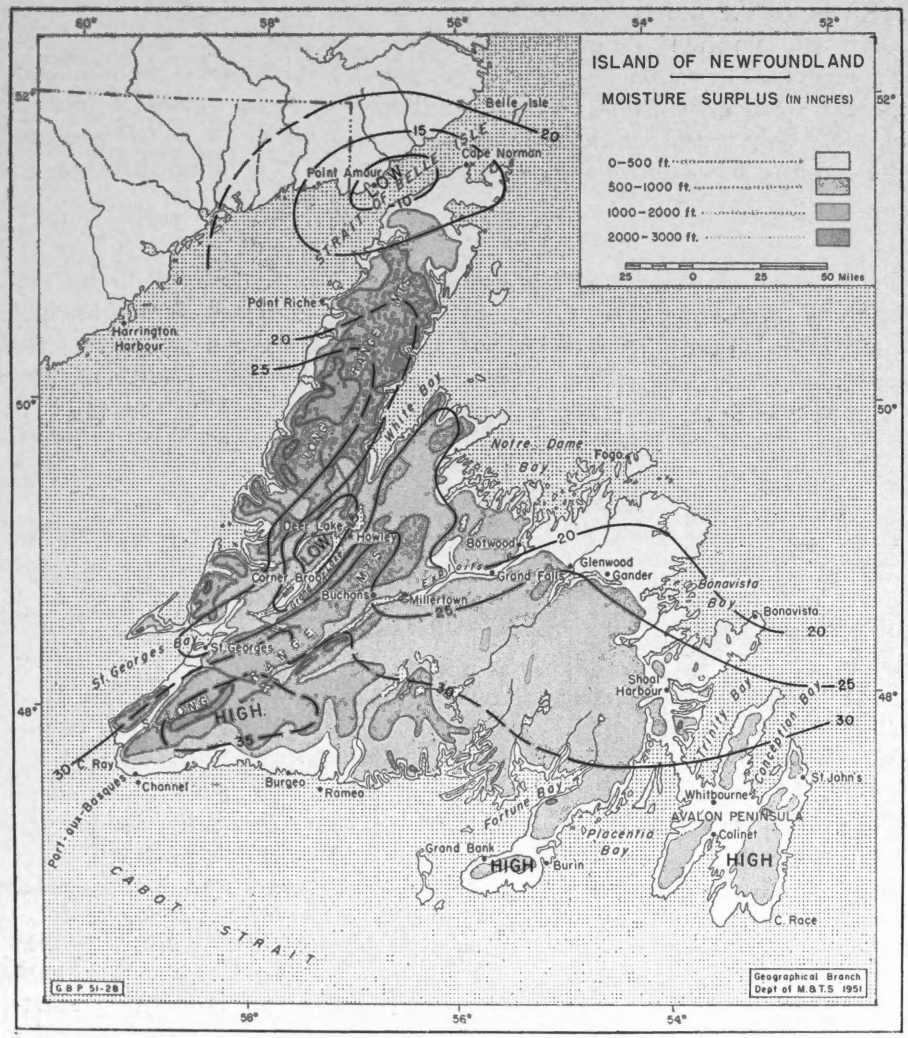


Figure 20. Moisture surplus, approximately the amount of precipitation available for run-off on flat, well-drained ground.

It is possible that the lack of trees in these areas is due to the excessive wetness of the climate. Though almost the whole island has a perhumid climate, according to Thornthwaite's scale of moisture efficiency, the moisture index is highest near the south coast. Figure 19 shows this index, as well as the barrens, after Gutsell.[1] It is clear that the moss-barrens are most widely distributed in the south, where moisture indices generally exceed 150, and where PE on the low ground is below 19·0 inches. The forest cover is most continuous in the north, with moisture indices 60 to 120 and PE above 19·0 inches.

The wetness of the island is further emphasized by Figure 20, which shows the annual moisture surplus, again following Thornthwaite. This map shows the number of inches whereby annual precipitation exceeds water consumption by evapotranspiration; in general it indicates the amount of water available for run-off or percolation from flat, well-drained ground. Along the whole of the south coast the surplus exceeds 30 inches, and it is easy to see how level areas in this region may be waterlogged to the point at which forest growth is impossible at these temperatures.

ACCESS BY AIR

Climate materially affects ease of access to Newfoundland by air. Many of its weather types are inimical to flying, and each of the principal airfields is periodically closed down for some hours. This is true, for example, of Gander, an important trans-Atlantic refuelling station. The chief land airfields are tabulated below:

TABLE IV

Land Airfields of Newfoundland[2]

Airfield	Lat.		Long.		Altitude	Official "minimum" safe daylight landing conditions (Overcast sky)	
						Cloud base (ft.)	Visibility (mls.)
	°	′	°	′			
Argentia	47	19	53	39	46	500	1
Buchans	48	51	56	50	927	900	3
Gander	48	57	54	34	493	400	3/4
St. John's (Torbay)	47	37	52	44	484	700	1
Stephenville	48	32	58	33	22	800	1

The elements that affect the safety of flight are principally visibility, cloud height, and ice accretion. The first two affect safety during take-off and landing. Minimum safe landing conditions are defined by the Department of Transport for all airfields. Those cited in the preceding table refer to daylight landing conditions with overcast skies, and show the values of cloud height and visibility below which landing is regarded as unsafe. They make possible a rough and ready estimate of the relative difficulty of approach of all the fields.

[1] Gutsell, B. V.: op. cit.
[2] Canada Air Pilot; Canada, Dept. of Transport.

VISIBILITY

Proneness to fog and other forms of bad visibility accounts for much of the loss of operational time at the airfields. Except for Buchans, all the above fields are on or near the coast, and are hence liable to be affected severely by sea fog. Blowing snow is another source of reduced visibility.

Accurate visibility statistics have only been available since 1944 for Newfoundland stations. Since then hourly summaries have been published for the 4 years 1944–47 for four stations, Buchans, Gander, Torbay, and St. Andrews (the latter being similar in site to Stephenville). Table V shows the frequency of all fog and thick or dense fog.

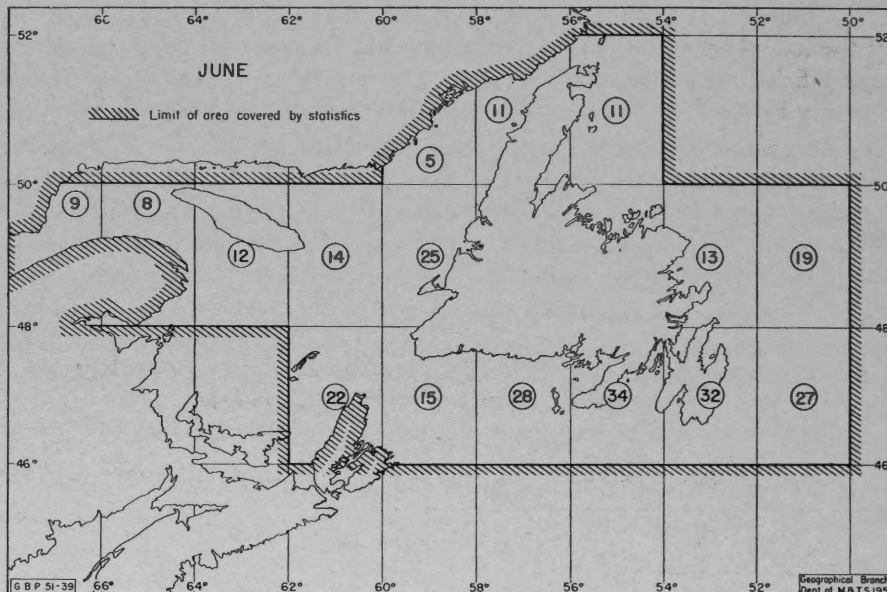
TABLE V

Frequency of Fog at Certain Stations, Expressed as a Percentage Fraction of all Hourly Observations, 1944–47

Station	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Fog of all densities (vis. below 6 miles)											
Buchans	7·6	5·3	2·5	11·5	12·6	9·8	7·0	8·0	7·8	10·3	8·3	5·0
Gander	9·6	14·2	11·6	16·4	9·6	15·9	12·7	12·1	14·3	12·8	23·6	6·6
Goose Bay	0·2	1·4	0·7	0·7	3·3	3·1	2·9	3·1	3·9	3·3	2·0	0·4
St. Andrews	3·4	4·8	2·5	4·7	6·1	9·0	7·6	6·2	8·1	3·9	4·1	2·3
Torbay	19·9	21·8	23·0	30·7	30·4	36·3	28·7	28·4	24·8	20·6	33·2	13·8
	Thick or dense fog (vis. below 55 yards)											
Buchans	1·5	1·1	0·2	3·9	2·7	0·5	0·6	0·9	1·1	0·8	0·7	1.2
Gander	2·8	4·2	1·9	6·9	1·7	3·7	3·2	1·4	2·7	1·4	4·0	1·3
Goose Bay	0·0	0·5	0·1	0·1	0·9	0·0	0·0	0·4	0·0	0·4	0·1	0·1
St. Andrews	0·0	0·5	0·5	0·6	0·9	2·2	1·4	0·7	2·1	0·2	0·0	0·0
Torbay	8·3	8·6	9·3	16·7	14·2	18·0	13·6	9·8	6·6	6·6	12·8	7·0

These figures show that fog is common throughout the year both on the coast and inland. By far the worst station is Torbay, which has the poorest fitness of all airfields known to the author. Thick or dense fog occurs frequently there in all months, being most common in April and November, when mean temperature is just above 32 degrees; and in summer, June being the foggiest month. Most of the fog affecting this station comes off the sea from the celebrated Grand Banks fog area. The high frequency of fog in spring and autumn when temperatures are near 32 degrees is characteristic of many parts of eastern Canada.

Gander has a similar type of distribution, but fog is much less common. Gander is farther from the sea (20 miles), and sea fog has a chance to lift before it reaches the airport. Radiation fog, however, is a little more common. Once again fog is common in April and November, when thawing snow covers the ground, but summer fog is less significant than at Torbay. Actually there is little to choose between summer and winter. Gander has a distinctly poor record for a trans-Atlantic base. It compares very unfavourably with Goose Bay *(See* Table V).



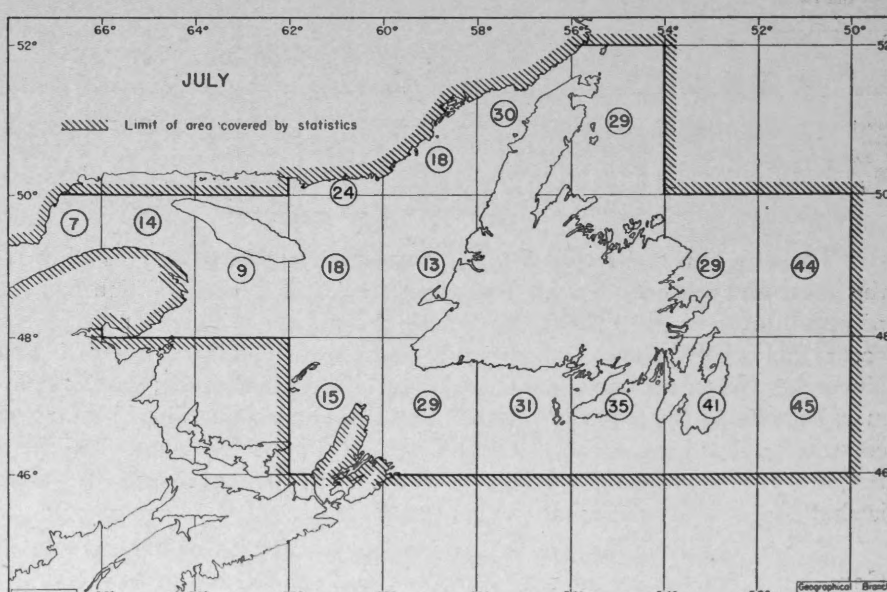
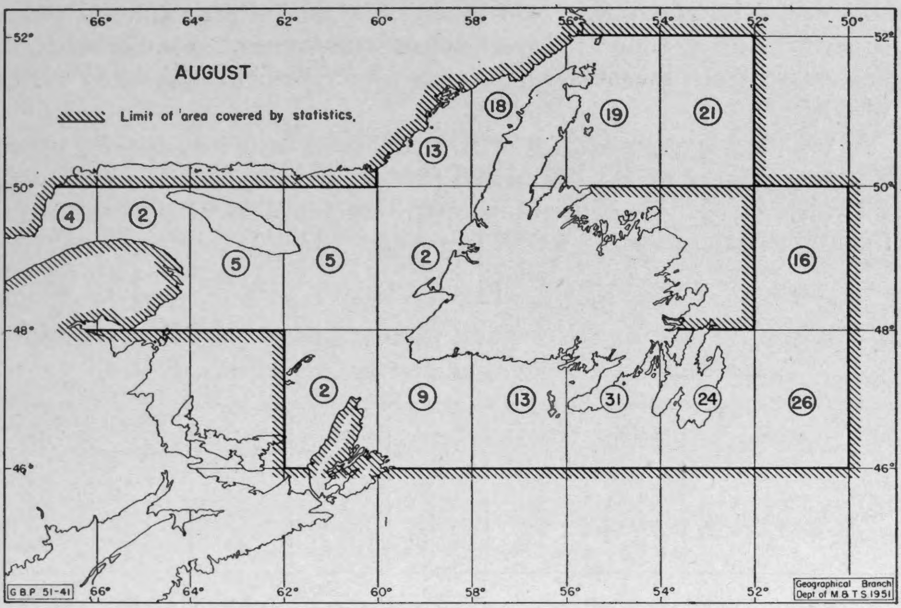
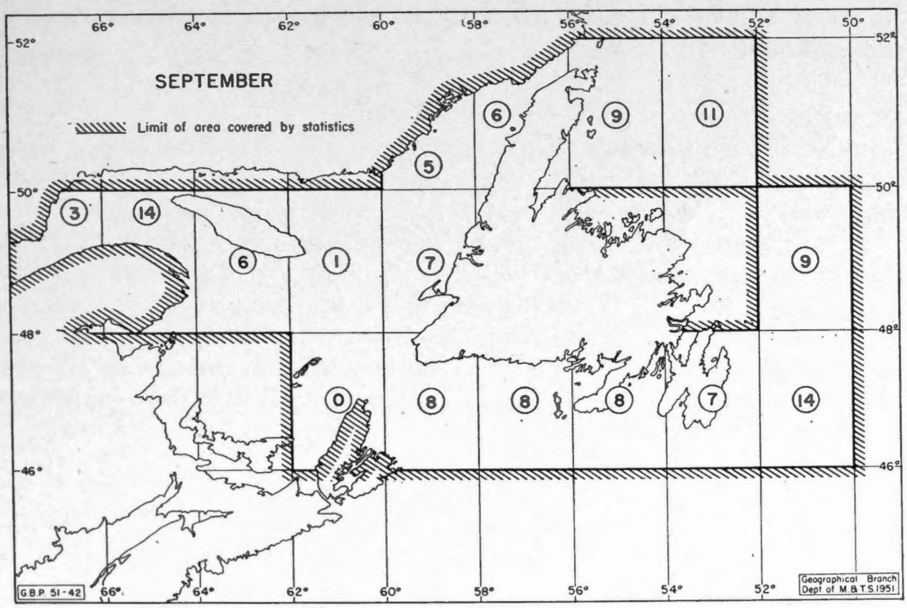


Figure 21. The frequency of fog over the marine approaches to Newfoundland, expressed as percentage of all observations. Thus "34" means that fog was present on 34 per cent of the recorded observations. Figures refer to the 2-degrees square in which each is roughly centred. Periods 1883–99 and 1921–38. Data supplied by Marine Superintendent, Meteorological Office, London.


AUGUST
Limit of area covered by statistics.
66° 64° 62° 60° 58° 56° 54° 52° 50°
52° 50° 48° 46°
18
19
21
13
4
2
5
5
2
16
2
9
13
31
24
26
G.B.P. 51-41
Geographical Branch Dept of M.&T.S.1951


SEPTEMBER
Limit of area covered by statistics
66° 64° 62° 60° 58° 56° 54° 52° 50°
52° 50° 48° 46°
6
9
11
5
3
14
6
1
7
9
0
8
8
8
7
14
G.B.P. 51-42
Geographical Branch Dept of M.&T.S.1951

(Figure 21)

At Buchans, fog is much less frequent. Thick fog is of importance only during the spring thaw. St. Andrews, typical of the southwest coast, shows little fog in winter but has a considerable amount between May and September, much the greater part being sea fog brought onshore by southwest winds.

Visibility is often reduced at airfields during winter by blowing snow. The windiness of the Newfoundland climate, and the heavy and frequent snowfalls, ensure that this will be a nuisance. Table VI summarizes its frequency at the stations used in Table V.

TABLE VI

Frequency of Blowing and Drifting Snow at Certain Stations, Expressed as a Percentage Fraction of all Hourly Observations, 1944–47

Station	November	December	January	February	March	April	May
Buchans	1·0	11·5	17·6	11·4	9·1	4·3	0·3
Gander	0·2	5·4	8·1	6·7	5·9	1·4	0·4
Goose Bay	2·5	1·9	1·8	2·6	0·1	1·0	0·4
St. Andrews	0·1	3·9	10·0	6·3	1·5	0·2	0·0
Torbay	0·8	4·6	11·6	9·3	5·5	0·8	0·6

Proneness to blowing snow depends very much on local site. Thus, Buchans, on the edge of an extensive barren, suffers badly: Gander, set in forest, is relatively protected. All the Newfoundland stations compare unfavourably with Goose Bay.

ICE ACCRETION

No precise statistics of the frequency of ice accretion exist. With modern de-icing equipment, most forms of accretion have diminished significance. The one form that retains much of its danger, especially for low altitude local flying, results from freezing rain or freezing drizzle, in which unfrozen rain or drizzle from warm air aloft falls to the ground through a layer of air below the freezing point. Aircraft flying in such a layer may suffer severe and rapid accretion. Another form of icing still not to be disregarded is the heavy rime that may accumulate on aircraft flying through thunderstorm cloud. The frequency of both these conditions can be given for Gander airport.

TABLE VII

Frequency of Freezing Rain or Drizzle at Gander, Expressed as a Percentage Fraction of all Observations, 1944–47. Also Thunderstorms, in Hours per Month

——	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Freezing rain or drizzle	3·8	6·3	5·2	3·1	1·6	0·4	—	—	—	0·2	2·6	4·8
Thunderstorms	—	—	Tr.	0·3	0·3	0·3	2	4	3	0·3	—	—

It is clear that thunderstorms are very infrequent. They are, moreover, even less frequent on the coasts. Freezing rain and drizzle, however, are significant elements in mid-winter.

OVERALL FITNESS

In view of the obvious defects of the Newfoundland climate as a medium for flying, it becomes of interest to compare the fitness of the chief airfields with others in eastern Canada. Table VIII compares the frequency of "closed" conditions at Gander and Stephenville with the frequency at Goose Bay, Dorval, and Rockcliffe (Ottawa) airports. The standard used is the percentage of time when cloud base was below 500 feet and/or visibility was below 1 mile.

TABLE VIII

Percentage of Time when Cloud Base Was below 500 feet and/or Visibility Was below 1 Mile, based on Hourly Observations 1944–47

Station	December-February	March-May	June-August	September-November
Gander..................	18·0	16·4	12·4	13·2
Stephenville..............	10·6	4·7	5·9	2·9
Goose Bay...............	5·7	4·1	2·4	3·5
Dorval..................	9·6	4·5	2·0	6·2
Rockcliffe...............	7·4	5·3	2·5	6·2

Table VIII makes it very clear that Stephenville, the most generally serviceable field from the weather standpoint, compares unfavourably with all three mainland airports except in autumn. Gander has a thoroughly unsatisfactory record, being unfit from two to four times as long as the mainland fields. It is particularly obvious that Gander is a far less satisfactory field than Goose Bay, its competitor as a trans-Atlantic base. Torbay is, of course, far worse than Gander.

ACCESS BY SEA

The influence of climate on navigation at sea works through three chief processes: (i) the formation of ice, already discussed; (ii) the occurrence of sea fog, especially significant near island-studded coasts and in ice-infested waters; and (iii) the incidence of strong winds, leading to heavy seas. The last two processes remain to be discussed.

FOG AT SEA

The Newfoundland coasts and the waters offshore have a well-merited reputation for fogginess. These fogs result from the flow of warm, humid air across the cold waters of the Labrador current and the Gulf of St. Lawrence. They are at their worst at the beginning of the navigation season, when icebergs are plentiful off eastern Newfoundland. Though much has been done to reduce the delay and danger caused by the fog, chiefly by the use of marine radar and the provision of shore-based radio aids, the Newfoundland waters remain one of the most difficult parts of the North Atlantic to navigate.

Figure 21 shows the incidence of fog at sea during the 4 months of the navigation season during which it constitutes a major hazard. The figures show the percentage frequency of fog in all observations by British ships in the periods 1883–99 and 1921–38.[1] Though the figures are presented for 2-degree squares, they naturally refer chiefly to the main shipping lanes.

Off southwest Newfoundland (Gulf of St. Lawrence shore) fog is frequent in May, June, and July, but decreases in frequency very rapidly late in July as the Labrador current water warms up. In August and September fog is uncommon, but in October and November is apt to increase slightly. It is added to in the autumn by frequent blizzards, which reduce visibility quite badly.

The Strait of Belle Isle is open only from June until December. Fog increases rapidly in frequency in June to a maximum in July (over 30 per cent of all observations in the strait itself) both over the strait and its two approaches. Though a little less foggy than the Grand Banks waters, the Belle Isle route is quite difficult at this season. An improvement takes place in August (18–21 per cent), which continues throughout the autumn. At no time, however, does the fog risk fall below 5 per cent.

The south and east coasts of Newfoundland border the world's foggiest seas. Sea fog is a menace throughout the season of navigation, the worst area being south and east of the Avalon Peninsula. July is the worst month, when over 40 per cent of observations over a large area have fog. Cape Race once recorded 193 consecutive hours of fog in July. This is, in fact, the special mark of Grand Banks fogs, their density and long duration. June and August fall only a little short of July, but a marked improvement begins in September, November being the clearest month, with frequencies of well below 10 per cent in all areas.

This discussion has said little about the problem of harbour approaches. Statistics of fog from harbours are apt to be misleading, and are omitted here. Thus, St. John's harbour is almost free of fog after early June, whereas the approaches beyond the sheltering headlands are blanketed for long periods throughout summer. It is impossible in this brief report to attempt a review of all the harbours, each of which presents a separate problem.

Middleton[2] has analysed the records of Belle Isle, Cape Race, and Bird Rocks, and has shown that there is a marked diurnal variation in frequency of "thick weather", most of which is fog. At Cape Race, for example, poor conditions are most frequent in the early morning and least frequent

[1] Data supplied by Marine Branch, Meteorological Office, Air Ministry, London, England.
[2] Middleton, W. E. K.: The Climate of the Gulf of St. Lawrence and Surrounding Regions, as it affects Aviation; Meteorological Memoirs No. 1, Canada, Department of Transport, Toronto, 1935.

between 1400 and 1800 hours. In the Strait of Belle Isle the same rule holds, though the rhythm is even more strongly marked. In July, for example, the frequency at 1700 hours is only 58 per cent of the frequency at 0600 hours. It is not known to what extent the same is true over the open sea.

Unfortunately, a reliable discussion of the period January-May along the lines of the above is not possible. At these times navigation in Newfoundland is confined to coastal movements in the extreme south and southeast, and to fishing vessels making their way out from harbours. Neither type of navigation leaves much record.

Some indication of the relative frequency of fog off the southeast coast can be derived from the record of thick weather at Cape Race, given as Table IX.

TABLE IX

Frequency of Thick Weather at Cape Race, Expressed as a Percentage Fraction of Hourly Observations 1920–29[1]

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
22·1	21·4	15·4	21·5	41·4	39·9	57·6	34·4	25·8	20·1	16·1	16·8

Table IX shows that the winter months are comparable with those of late autumn in frequency of "thick weather", and are much better than those of summer. Bad weather remains common, however.

GALES

Strong winds or gales are common over the Newfoundland region, and often cause serious difficulties in navigation. Table X shows the frequency of such winds at Cape Race and Belle Isle during the navigation season.

TABLE X

Frequency of Gales (Winds over 28 knots, 33 m.p.)[2]
(Days per month)

Station	Years	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Belle Isle...........	15	6	5	3	3	6	7	8	9
Cape Race..........	11	3	1	1	1	2	4	5	10

This table shows that gales become increasingly frequent as autumn progresses. In the Strait of Belle Isle gales are not infrequent even in midsummer. The strait has a well deserved reputation for storminess that is in some measure a result of canalization of winds along it.

[1] Middleton, W. E. K.: op. cit.
[2] Newfoundland and Labrador Pilot, Vol II.

APPENDIX

LIST OF CLIMATOLOGICAL STATIONS AND CLIMATOLOGICAL TABLES

The following list of stations includes all those to whose detailed records access was obtained. The dates given do not necessarily indicate the complete period of records. They only show the years used by the author in the statistical analysis. The international index numbers of telegraphic reporting stations are taken from Department of Transport Circular 1521, Jan. 1, 1949. "B" under period indicates a broken record.

Climatological tables for the stations marked * follow. In these tables a precipitation day is one with 0·01 inch of rain or melted snow or more. A snow day is one on which 0·1 inch or more snow fell.

Station	Index No.	Lat.	Long.	Height	Period
		° ′	° ′	(feet)	
Belle Isle*	809	51 53	55 22	426	1874–1948
Bonavista	—	48 38	53 05	—	1934–1938 B
Botwood	808	49 09	55 21	31	1938–1948 B
Buchans*	804	48 51	56 50	894	1934–1948
Cape Race*	800	46 39	53 04	99	1920–1948
Channel*	—	47 37	59 09	50	1893–1948 B
Colinet	—	47 11	53 35	—	1938–1948 B
Corner Brook*	—	48 57	57 57	40	1933–1948
Corner Brook Lake	—	48 46	57 45	926	4 years
Daniels Harbour	185	50 14	57 35	49	1946–1948
Deer Lake*	—	49 06	57 29	185	1933–1948
Fogo*	806	49 43	54 17	25	1910–1948 B
Gander*	803	48 57	54 34	482	1937–1948
Glenwood	—	48 59	54 52	93	1936–1948
Grand Bank*	802	47 06	55 46	19	1934–1948
Grand Falls*	—	48 55	55 40	200	1913–1948 B
Howley	—	49 11	57 06	384	1934–1948 B
Millertown	—	49 00	56 21	692	1934–1946
Point Amour	—	51 28	56 51	—	Not known
Point Riche	—	50 42	57 25	35	Not known
Ramea-Burgeo*	—	47 32	57 31	—	1934–1948 B
St. Andrews	197	47 46	59 20	35	1944–1948
St. Anthony	819	51 25	55 30	45	1944–1948 B
St. Georges*	—	48 28	58 25	10	1902–1945 B
St. John's*	—	47 34	52 42	125	1875–1948
Stephenville	815	48 32	58 33	44	1943–1948
Torbay	801	47 37	52 44	463	1942–1948

Station: Belle Isle Index No. 809 Lat. 51° 53′ Long. 55° 22′ Ht. above S.L. 426′ Years 1874 to 1948

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	11	18	4	14	34	−15	40	−30	1·8	0·4	15	13	1	12	5·8	7·4	7·3	6·4
February	12	18	6	12	35	−11	40	−30	2·1	0·3	18	13	2	12				
March	19	24	14	10	34	− 5	45	−20	3·2	1·1	21	14	3	13				
April	27	32	23	9	38	8	56	−10	2·8	1·5	14	13	4	9	7·3	7·2	7·5	6·6
May	34	38	29	9	49	20	59	9	2·8	2·4	3	13	10	5				
June	41	47	35	12	58	28	69	19	4·6	4·6	<0·5	15	14	1				
July	48	54	42	12	66	37	72	25	4·6	4·6	<0·5	15	15	—	7·3	7·9	7·1	7·3
August	50	56	45	11	65	38	71	29	5·0	5·0	<0·5	15	15	—				
September	46	51	41	10	61	33	69	27	4·9	4·8	1	15	15	1				
October	37	41	33	8	50	21	58	12	5·2	4·9	3	14	13	3	6·8	7·5	7·2	6·7
November	28	33	23	10	45	9	52	−6	3·7	2·7	10	13	8	7				
December	18	24	13	11	32	−1	40	−30	3·0	0·9	21	14	2	13				
Annual	31						72	−30	43·7	33·2	106	167	102	74				
Years of observation	75	75	75	75	10	10	75	75	75	75	75	10	10	10	5–6	7–8	5–6	7–8

Station: BUCHANS Index No. 804 Lat. 48° 51′ Long. 56° 50′ Ht. above S.L. 894′ Years 1934 to 1948

MONTH	AIR TEMPERATURE (°F) at station level								PRECIPITATION (inches)						CLOUDINESS			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	15	23	7	16	40	−10	44	−13	3·5	0·7	29			17				
February	15	23	6	17	41	−14	46	−18	3·0	0·7	23			14				
March	20	28	11	17	41	−6	54	−19	2·5	0·7	18			14				
April	31	40	23	17	54	8	67	−2	2·9	1·9	10			7				
May	43	53	34	19	70	22	72	18	3·2	3·0	2			1				
June	52	63	42	19	82	32	88	30	3·3	3·3	<0·5			—				
July	62	73	51	22	87	40	91	34	3·4	3·4	—			—				
August	60	70	51	19	85	39	87	30	4·0	4·0	—			—				
September	52	61	43	18	76	31	81	28	4·2	4·2	—			—				
October	41	48	34	16	65	22	68	18	4·2	3·9	4			2				
November	32	38	25	13	55	9	65	−3	4·7	3·3	14			10				
December	22	29	16	13	44	3	51	−8	3·2	1·4	18			10				
Annual	37				89	−18	91	−19	42·2	30·5	118			75				
Years of observation	11–13	11–13	11–13	11–13	4–6	4–6	8–10	8–10	11–13	11–13	11–13			5				

Station: Cape Race   Index No. 800   Lat. 46° 39′   Long. 53° 04′   Ht. above S.L. 99′   Years 1920 to 1948

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths) of 2–3 obs. daily			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days				
January	25	33	18	15	43	−1	51	−12	5·0	3·4	16	17		8	5·0			
February	23	30	16	14	40	−1	44	−15	4·6	2·7	19	16		9	6·0			
March	28	34	22	12	42	7	48	−5	4·3	2·8	14	15		7	5·4			
April	33	39	28	11	48	16	60	7	4·4	3·9	5	14		3	6·6			
May	40	46	33	13	58	26	68	15	4·5	4·5	<0·5	15		1	6·8			
June	47	54	40	14	68	32	78	21	4·3	4·3	—	14		—	6·6			
July	55	62	48	14	73	40	80	35	3·8	3·8	—	15		—	7·0			
August	57	64	50	13	73	42	78	33	4·5	4·5	—	14		—	6·1			
September	54	60	47	13	70	34	76	30	4·1	4·1	—	13		—	5·8			
October	46	53	40	13	62	26	72	14	4·5	4·5	<0·5	14		—	4·9			
November	38	45	32	13	53	16	58	7	5·3	5·2	1	17		1	6·6			
December	30	37	23	13	47	7	54	−6	5·3	4·3	10	17		7	6·7			
Annual	39				75	−4	80	−15	54·5	48·0	66	181		36	6·1			
Years of observation	19	19	19	19	19	20	20	20	19	19	19	19		19	4			

Station: Channel (Port-aux-Basques) Index No. — Lat. 47° 37′ Long. 59° 09′ Ht. above S.L. 50′
Years 1893 to 1948 (Broken)

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths) of 2–3 obs. daily			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days				
January	21	27	16	11	41	2			5·5	2·3	32	24		21	8·5			
February	19	25	13	12	38	1			3·4	0·9	25	19		17	8·0			
March	25	30	19	11	42	3			3·7	1·6	21	19		15	7·3			
April	33	38	28	10	47	17			3·7	2·8	9	16		8	7·5			
May	41	47	35	12	60	27			3·8	3·7	1	11		1	7·1			
June	49	55	43	12	66	35			3·8	3·8	—	15		—	7·3			
July	56	62	51	11	73	44			4·7	4·7	—	15		—	7·8			
August	59	64	53	11	73	44			4·3	4·3	—	15		—	6·8			
September	52	58	47	11	67	36			4·4	4·4	—	15		—	6·5			
October	44	49	40	9	58	30			5·2	5·1	1	19		2	7·4			
November	36	40	31	9	50	19			4·9	4·4	5	20		9	8·3			
December	28	33	23	10	44	11			4·6	2·6	20	23		18	8·9			
Annual	39				75	−3			51·9	40·4	115	211		91				
Years of observation	42	42	42	42	20	20			35	35	35	20		20	10			

Station: CORNER BROOK   Index No. —   Lat. 48° 57′   Long. 57° 57′   Ht. above S.L. 40′   Years 1933 to 1948

MONTH	AIR TEMPERATURE (°F) at station level								PRECIPITATION (inches)						CLOUDINESS			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	18	26	11	15	44	−8	51	−25	4·0	0·8	33	18						
February	17	25	8	17	43	−13	55	−25	3·3	0·2	31	16						
March	25	34	17	17	50	−7	66	−21	3·0	0·7	23	18						
April	35	43	27	16	60	12	66	8	2·5	1·1	14	14						
May	43	53	33	20	69	23	74	19	3·1	2·9	2	14						
June	54	66	42	24	84	32	92	24	3·5	3·5	—	14						
July	63	74	52	22	88	39	94	34	3·5	3·5	—	11						
August	62	73	51	22	88	36	94	32	3·8	3·8	—	12						
September	54	64	44	20	80	32	88	28	3·8	3·8	—	17						
October	44	52	35	17	73	24	76	18	5·0	4·8	2	17						
November	34	41	27	14	61	13	67	3	5·4	3·1	23	20						
December	25	31	19	12	50	7	57	−1	4·5	1·6	29	20						
Annual	39				89	−20	94	−25	45·5	29·8	157	191						
Years of observation	8–10	8–10	8–10	8–10	6–8	6–8	8–10	8–10	7–8	7–8	6–8	6–8						

Station: DEER LAKE Index No. — Lat. 49° 06′ Long. 57° 29′ Ht. above S.L. 185′ Years 1933 to 1948

MONTH	AIR TEMPERATURE (°F) at station level								PRECIPITATION (inches)						CLOUDINESS			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	17	26	8	18	46	−17			1·6	0·5	10	11		11				
February	15	25	6	19	43	−21			1·5	0·4	12	11		10				
March	23	33	14	19	49	−14			1·4	0·4	10	10		8				
April	35	43	27	16	60	7			2·1	1·1	9	10		7				
May	44	53	34	19	70	25			2·7	2·6	1	13		1				
June	55	65	44	21	81	33			3·2	3·2	—	13		—				
July	62	73	51	22	85	37			3·7	3·7	—	12		—				
August	61	71	51	20	85	36			3·3	3·3	—	12		—				
September	54	64	44	20	77	32			3·5	3·5	—	16		—				
October	44	52	36	16	70	23			3·8	3·5	3	15		2				
November	34	40	27	13	60	9			3·2	2·2	10	16		9				
December	24	31	17	14	48	−1			2·0	0·7	13	12		9				
Annual	39				86	−23			31·9	25·0	69	151		57				
Years of observation	10	10	10	10	7–8	7–8			10	10	10	7–8		6–8				

Station: Fogo Index No. 806 Lat. 49° 43′ Long. 54° 17′ Ht. above S.L. 25′ Years 1910 to 1948 (Broken)

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths) of 2–3 obs. daily			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days				
January	20	26	14	12	42	−1	52	−10	3·5	0·6	29	18		17	7·1			
February	18	25	12	13	40	−7	54	−18	3·2	0·5	27	15		13	6·9			
March	24	30	18	12	44	1	56	−15	3·1	1·0	21	18		13	6·8			
April	32	38	27	11	52	14	62	5	2·2	1·2	10	15		8	7·6			
May	41	48	34	14	66	25	80	10	2·4	2·2	2	14		2	6·6			
June	50	58	42	16	76	27	82	20	2·4	2·4	—	13		—	6·7			
July	60	68	51	17	80	41	86	30	2·5	2·5	—	13		—	6·4			
August	58	65	52	13	77	41	86	32	2·7	2·7	—	13		—	6·4			
September	53	59	46	13	73	32	81	23	2·7	2·7	—	14		—	6·3			
October	44	50	38	12	62	29	73	10	3·3	3·3	<0·5	16		1	6·9			
November	35	40	30	10	55	19	64	8	3·0	2·2	8	16		6	8·1			
December	27	31	22	9	47	10	60	−4	3·3	1·4	19	17		13	7·8			
Annual	39				81	−8	86	−18	34·2	22·8	114	182		73	7·0			
Years of observation	20–25	20–25	20–25	20–25	20	20	25	25	20	20	20	20		18	3			

Station: GANDER Index No. 803 Lat. 48° 57′ Long. 54° 34′ Ht. above S.L. 482′ Years 1937 to 1948

MONTH	AIR TEMPERATURE (°F) at station level								PRECIPITATION (inches)						CLOUDINESS			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	19	26	12	14	40	−6	50	−13	2·8	0·6	22	17		16	7·3	7·9	8·2	6·9
February	19	27	11	16	42	−10	53	−15	3·5	0·8	27	18		18				
March	24	32	17	15	43	−3	53	−14	2·5	0·8	17	20		17				
April	33	40	26	14	54	12	71	4	2·3	1·0	13	18		12	7·3	7·9	8·1	7·6
May	44	53	35	18	71	24	77	22	2·4	1·9	5	14		4				
June	52	62	43	19	82	34	87	28	3·1	3·0	1	15		1				
July	62	72	52	20	84	41	91	36	3·7	3·7	—	13		—	6·5	7·6	7·5	7·3
August	61	70	52	18	86	39	89	38	3·6	3·5	—	16		—				
September	55	63	47	16	79	38	83	32	3·3	3·2	<0·5	16		—				
October	44	51	37	14	70	24	76	23	4·3	3·9	4	18		4	6·1	7·3	7·8	6·4
November	34	40	28	12	57	13	67	6	4·5	3·4	11	20		11				
December	25	31	19	12	44	3	50	−5	3·8	1·3	25	20		14				
Annual	39						91	−15	39·7	27·1	127	204		97				
Years of observation	10	10	10	10	5	5	11	11	11	11	11	5		5	7–9	7–9	7–9	7–9

Station: GRAND BANK Index No. 802 Lat. 47° 06′ Long. 55° 46′ Ht. above S.L. 19′ Years 1934 to 1948

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
		Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths) of 4 obs. daily			
	Mean daily	Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days				
January	26	32	21	11	44	5	51	−4	4·6	2·2	24	19		15	7·8			
February	26	31	20	11	42	5	48	−2	4·3	2·2	21	18		14	7·8			
March	28	33	23	10	42	8	50	−1	4·4	2·7	17	17		12	7·6			
April	35	40	29	11	50	19	60	15	3·6	2·8	8	14		6	7·4			
May	43	49	36	13	64	27	67	22	4·1	4·0	1	13		1	7·2			
June	54	57	42	15	68	33	74	31	4·0	4·0	—	13		—	7·7			
July	59	66	51	15	75	40	79	38	3·5	3·5	—	11		—	6·8			
August	61	67	54	13	77	42	82	35	3·4	3·4	—	11		—	7·1			
September	56	62	50	12	73	38	76	33	3·9	3·9	—	12		—	6·9			
October	47	53	41	12	64	29	69	25	5·8	5·8	<0·5	15		1	6·7			
November	39	44	33	11	58	21	65	16	6·4	6·0	4	17		4	8·1			
December	31	36	26	10	49	17	54	9	6·0	4·1	19	20		13	8·0			
Annual	42						82	−4	54·0	44·6	94	180		66	7·4			
Years of observation	14	11	11	11	10	10	14	14	14	14	14	14		14	4			

Station: Grand Falls Index No. — Lat. 48° 55′ Long. 55° 40′ Ht. above S.L. 200′ Years 1913 to 1948 (Broken)

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	16	26	7	19	45	−15			2·8	0·5	23	14						
February	13	24	4	20	42	−17			3·2	0·8	24	12						
March	23	31	14	17	46	−6			3·3	0·5	28	13						
April	34	42	27	15	57	11			2·5	1·5	10	14						
May	43	52	35	17	69	26			2·8	2·5	3	14						
June	54	64	43	21	81	32			3·3	3·3	—	10						
July	61	72	51	21	80	39			3·6	3·6	—	12						
August	61	71	51	20	81	39			3·4	3·4	—	13						
September	53	62	45	17	77	32			3·4	3·4	<0·5	16						
October	44	51	36	15	68	25			4·1	4·0	1	16						
November	33	40	27	13	57	12			3·8	2·8	10	18						
December	24	31	17	14	47	−3			3·9	1·3	26	14						
Annual	28				86	−21			40·1	27·6	125	166						
Years of observation	20	20	20	20	20	20			20	20	20	4–6						

95256—8

Station: RAMEA-BURGEO Index No. — Lat. 47° 32′ Long. 57° 31′ Ht. above S.L. — Years 1934 to 1948 (Broken)

MONTH	AIR TEMPERATURE (°F) at station level								PRECIPITATION (inches)						CLOUDINESS			
		Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths)			
	Mean daily	Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	0130 hrs.	0730 hrs.	1330 hrs.	1930 hrs.
January	23	28	18	10	39	4			4·0	2·4	17							
February	21	27	15	12	38	1			3·3	1·8	15							
March	26	31	21	10	41	4			3·3	1·8	15							
April	33	38	28	10	44	18			3·5	2·9	7							
May	40	45	35	10	54	30			3·9	3·9	<0·5							
June	48	54	43	11	64	34			3·6	3·6	—							
July	55	60	50	10	68	43			4·2	4·2	—							
August	58	64	53	11	73	44			3·3	3·3	—							
September	53	59	47	12	66	39			5·3	5·3	—							
October	44	50	39	11	61	31			5·7	5·7	—							
November	35	41	30	11	53	17			5·3	5·1	1							
December	29	34	24	10	47	13			4·9	3·7	13							
Annual	39				73	−6			50·4	43·7	68							
Years of observation	7–8	7–8	7–8	7–8	4–6	3–5			7–8	7–8	7–8							

Station: St. Georges Index No. — Lat. 48° 28′ Long. 58°25′ Ht. above S.L. 10′ Years 1902 to 1945 (Broken)

Month	Air Temperature (°F) at station level: Mean daily	Mean of daily: Maximum	Mean of daily: Minimum	Mean of daily: Range	Mean monthly: Maximum	Mean monthly: Minimum	Absolute: Maximum	Absolute: Minimum	Precipitation (inches), Mean of monthly: Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days	Cloudiness, Mean (tenths) of 2–3 obs. daily			
January	21	27	14	13	45	−4	56	−25	4·5	1·1	34	20		16	7·6			
February	17	25	9	16	41	−9	52	−24	3·6	0·4	32	15		12	6·2			
March	25	33	17	16	48	−2	63	−21	2·7	0·9	18	14		9	6·2			
April	35	42	27	15	56	12	70	−9	2·0	1·6	4	12		5	5·8			
May	44	51	36	15	63	27	77	20	2·5	2·5	1	12		1	5·5			
June	52	60	44	16	73	33	83	23	2·7	2·7	—	13		—	5·7			
July	60	67	53	14	77	44	87	37	3·8	3·8	—	13		—	5·0			
August	61	68	53	15	77	43	86	33	3·9	3·9	—	12		—	5·4			
September	54	61	47	14	72	36	81	27	4·5	4·5	—	14		—	5·7			
October	45	52	38	14	65	28	74	20	4·1	3·9	2	15		1	6·1			
November	36	42	30	12	56	19	68	6	5·1	3·8	14	17		7	7·5			
December	28	34	22	12	48	10	58	−4	3·6	1·5	21	19		13	8·0			
Annual	40				79	−12	87	−25	43·1	30·6	124	176		64	6·2			
Years of observation	30–35	30–35	30–35	30–35	30	30	35	35	8–10	8–10	8–10	10		20	4			

95256—8½

Station: St. John's Index No. — Lat. 47° 34′ Long. 52° 42′ Ht. above S.L. 125′ Years 1875 to 1948 (Broken)

Month	Air Temperature (°F) at station level								Precipitation (inches)						Cloudiness			
	Mean daily	Mean of daily			Mean monthly		Absolute		Mean of monthly						Mean (tenths) of 2–3 obs. daily			
		Maximum	Minimum	Range	Maximum	Minimum	Maximum	Minimum	Precip.	Rainfall	Snowfall	Precip., days	Rain, days	Snow, days				
January	23	31	16	15	48	0	59	−19	5·3	2·8	25	17		12	7·1			
February	22	29	15	14	44	−2	56	−21	4·9	2·3	26	15		11	7·1			
March	28	34	21	13	48	5	67	−10	4·6	2·9	17	16		8	6·6			
April	35	41	29	12	47	18	72	−1	4·2	3·4	8	16		4	7·0			
May	43	51	35	16	70	27	81	20	3·6	3·4	2	15		1	6·7			
June	51	61	42	19	72	33	87	28	3·5	3·5	—	13		—	6·1			
July	59	68	50	18	81	41	90	34	3·5	3·5	—	13		—	6·1			
August	59	68	52	16	79	42	92	32	3·7	3·7	—	13		—	5·7			
September	54	61	46	15	75	35	84	29	3·8	3·8	—	15		—	5·9			
October	45	52	39	13	68	28	77	22	5·3	5·3	<0·5	17		—	6·6			
November	37	43	31	12	59	19	66	6	5·9	5·5	4	17		3	7·4			
December	29	35	23	12	50	8	60	−4	5·5	3·6	19	18		10	7·2			
Annual	41				83	−5	92	−21	53·8	43·7	101	185		49	6·6			
Years of observation	50	50	50	50	50	50	50	60	60	60	23	23		20	15			

RÉSUMÉ

Cette étude sur le climat de l'île de Terre-Neuve intéresse plus le géographe que le météorologiste; en fait, elle est écrite pour lui, car l'auteur met en relief les principaux éléments du climat, comme la température, les précipitations et l'humidité, et il explique les effets du climat sur la végétation et les transports.

En décrivant le milieu physique, on attire l'attention sur l'influence de la mer sur le climat de l'île, par la présence du courant froid du Labrador qui l'encercle presque complètement, du courant de Gaspé et la formation de glaces, en hiver, sur les eaux avoisinantes.

Beaucoup de gens croient que les températures annuelles enregistrées à Terre-Neuve sont froides et inclémentes. L'analyse détaillée des températures saisonnières démontre que le climat de l'île ressemble à celui de Montréal, en hiver, et qu'il se compare favorablement à celui d'Edmonton, en été.

On étudie ensuite le cycle annuel du gel et du dégel; on définit la période de dégel comme la période de l'année pendant laquelle la température moyenne reste constamment au-dessus de 32 degrés, et la période de gel comme la période correspondante ayant une température moyenne au-dessous de 32 degrés. Le dégel s'effectue en avril et le gel se forme en novembre. On souligne les conséquences de la période sans gelée sur la végétation et l'agriculture, et celles de la période de gelée sur les transports d'hiver et la fermeture des ports locaux. L'humidité est analysée d'après le rapport entre la vapeur d'eau et l'air sec de l'atmosphère, le minimum d'humitidé est enregistré en hiver, et le maximum en été. Les précipitations sont abondantes et bien réparties toute l'année; on note cependant, des variations saisonnières; la moyenne des précipitations est de 50 pouces sur la côte et de 40 pouces dans l'intérieur. Il tombe plus de 100 pouces de neige par année.

La saison agricole est tardive et plus courte que celle des environs de Montréal et des basses-terres du Saint-Laurant, elle s'étend de la fin de mai et du début de juin à la fin de septembre et au début d'octobre. Ensuite on classe les types de climats en relations avec la végétation naturelle, en particulier avec les essences forestières.

On décrit, dans les dernières pages, les effets climatiques sur l'accessibilité de Terre-Neuve par air et par mer. Dans le premier cas, on analyse les conditions de visibilité, la hauteur des nuages, le dégagement du ciel et l'accroissement de la glace, dans le deuxième cas, on traite de la formation de la glace sur les eaux environnantes, la présence de la brume et la vélocité et périodicité des vents.

En appendice, on trouve une liste des stations météorologiques avec tableaux statistiques sur la température, les précipitations, etc., pour plusieurs stations.

MAP NOTES

Selected Maps Published by Federal Mapping Agencies

Canada. 1:50,000 Series.

Canada, Department of National Defence, Army Survey Establishment, Ottawa, 1949.

The 1:50,000 series is being published by the Department of National Defence in a mapping program that includes the production of new sheets, and the conversion of 1-inch sheets to the new scale. The original sheet lines of the 1-inch series are being used, but for southern Canada each new sheet covers half the area of the 1-inch sheets, and northwards of 61° 00′ N. the new sheets will cover the same areas as the 1-inch series. Conversion is already completed for sheets covering British Columbia, southern Ontario, and parts of the Maritime Provinces; new sheets are being produced for Yukon Territory. Eventually the 1:50,000 series may replace the 1-inch topographic series.

The maps are printed in five colours. Water features are shown in a blue tint outlined with dark blue; names of water features in blue oblique lettering. Glaciers and snowfields are also shown in blue.

Contours are in brown, with contour intervals of 25 feet, 50 feet, or 100 feet according to the ruggedness of the region. Wooded areas are shown in solid green for heavy wooded areas and hatched green for light wooded areas. Roads are graded into six categories according to road surface and the number of traffic lanes. The top four categories are filled in with red, and lower grade and private roads unfilled. Railways are represented by thin black lines and show three categories and abandoned lines. Cultural features are represented by a well-chosen variety of symbols.

The sheets are gridded with a 1,000-metre grid constructed on a Transverse Mercator Universal Projection. Latitude and longitude are given for each sheet corner, the half-sheets covering 15′ latitude and 15′ longitude.

Marginal information includes a detailed reference legend, index to adjoining sheets, magnetic declination, conversion scale for elevations (metres and feet), and scales for miles, metres, and yards.

Canada. 1:250,000 National Topographic Series.

Canada, Department of National Defence, Army Survey Establishment, Ottawa, 1950.

This series will eventually replace the 4-mile to 1-inch topographic series, and existing sheets at this scale are now being converted to a scale of 1:250,000. New sheets in the topographic series are being produced on the new scale, using the established sheet lines of the 4-mile series. The projection is Universal Transverse Mercator and sheets are gridded with a 10,000-metre grid. Latitude and longitude are given for each sheet corner.

The Surveys and Mapping Branch of the Department of Mines and Technical Surveys is also engaged in this conversion program, and is at present converting the 3-mile series covering the Prairie Provinces.

Preliminary sheets in the 1:250,000 series published by the Department of National Defence are printed in black with water features in solid blue. The first sheet to be issued fully coloured is Sheet 31 C "Kingston" (2nd edition 1950–51) replacing the "Belleville-Kingston" sheet (1935). It has been recompiled from new and revised 1-mile maps of the National Topographic Series and shows a number of changes in style and presentation. The sheet extends over one degree of latitude and two degrees of longitude (44° 00′ N. to 45° 00′ N. and 76° 00′ W. to 78° 00′ W.). The southern extension on the original sheet to include Prince Edward county has been deleted.

The new style is bold and clear, and whereas there is a general simplification in the reference, it has also been amplified to show additional information. Contours have been redrawn and replace form lines on the first edition for heights above 700 feet. The contour interval has been changed from 100 to 200 feet. This tends to reduce relief detail but is counterbalanced by the detail in which the new contouring is drawn, particularly apparent in the areas of Shield topography. Relief layering is now omitted.

The road classification has been extended from a 3-grade to a 4-grade representation, with grades according to surface and number of traffic lanes. They are represented by a double black line filled in with red for all weather roads and unfilled for lowest category roads with loose surface and less than two traffic lanes. Many minor roads are now omitted—a feature noticeably apparent in the deletion of the concession roads.

Another major change is in the representation of settlement. Cities and towns are now shown by symbols that replace the detailed work in the original edition showing the street layouts of the larger centres and a differentiation in size in the smaller towns and villages. In the second edition the larger centres are represented by blocked out areas drawn in accordance with the built-up area. These areas are printed in red stipple with main roads overprinted in red. Smaller towns and villages are shown by a single symbol—a small open circle that does not show differentation in the size of the communities.

Wooded areas are represented by a light green tint without symbols to represent coniferous or deciduous trees. An additional symbol in the legend represents land and water aerodromes.

Canada. National Topographic Series 1:126,720. Sheet 41 1/SW.—Espanola.

Canada, Department of National Defence, Army Survey Establishment, Ottawa, 1949.

This is a new sheet in the 2-mile to 1-inch series and covers the area 46° 00′ N. to 46° 30′ N. and 81° 00′ W. to 82° 00′ W., showing Sudbury in the northeast corner of the sheet and stretching westward to include Espanola and southward to North Channel (Lake Huron). The sheet is similar in style to the new 1:250,000 series and has a similar reference. It was compiled from information and aerial photographs taken in 1946 and supplied by the Department of Lands and Forests, Province of Ontario. Previously, there was no modern topographic cover for this area apart from the 8-mile sheet and a 1-inch geological survey base map compiled from surveys 1916–1926 and published by the Geological Survey in 1930. This sheet entitled "Panache Sheet" covers the southeast quadrant of the present 2-mile map.

Canada. 1:4,055,040 (64 miles to 1 inch). NW. and NE. Extensions.

Canada, Department of Mines and Resources, Surveys and Mapping Bureau, Ottawa, 1949.

The 64-mile map of Canada, originally published in 1947 and revised in 1949, shows the country northwards to approximately the 75th parallel. The map has now been completed by the publication of NW. and NE. extensions and extends to the North Pole. The two extensions have been designed with an outside border on two sides only so that the sheets join with the map sheet to give a full sheet 54½ x 55 inches.

Water Powers of the Dominion of Canada. 1:6,336,000 or 100 miles to 1 inch.

Canada, Department of Resources and Development, Engineering and Water Resources Branch, Ottawa, 1951.

The map shows in graphic form the distribution of water-power sites and is published in the form of a blue line print. The outline base shows the principal rivers and lakes and also the boundaries of the geological regions of Canada. Developed and undeveloped water-power sites are shown by circles in proportion to the horsepower capacity of the sites, graded from "1,000 h.p. or under" to "above 2,000,000 h.p.". The 1951 edition of this map shows the new developments in the Ottawa Valley and in British Columbia.

Alberta, Showing Oil and Gas Fields and Potential Gas Areas. 1:1,267,000 or 1 inch to 20 miles.

Canada, Department of Mines and Technical Surveys, Geological Survey of Canada, Ottawa, 1951.

This map has been prepared to accompany the geological report "Natural Gas Reserves of Prairie Provinces" by G S. Hume and A. Ignatieff. It is printed in three colours using a black base, with oil and gas developments shown in colour. The base is an outline and was recompiled from a map of the same scale entitled "Province of Alberta" issued by the Geological Survey in 1949. Oilfields, drillings, and the oil pipe-line are shown in green, with the locations of refineries also indicated in this colour. Gasfields, drillings, and gas pipelines are shown in red. The extent of the Athabasca bituminous sands are also indicated.

The map shows oil and gas developments up to the end of 1950, and reveals a marked concentration in the southeast quadrant of the province, with main centres of activity in the vicinity of Edmonton and Calgary. The extensive Viking-Kinsella-Fabyan gasfield, southeast of Edmonton, is shown, and also the smaller fields at Medicine Hat and southeast of Lethbridge near Pakowki Lake.

[B.V.G.]

BOOK NOTES

Recent Government Publications of Geographical Interest

The Physiography of Southern Ontario. By L. J. Chapman and D. F. Putnam. Published for the Ontario Research Foundation by the University of Toronto Press. Toronto, 1951, xxi, 284 pp., maps, diagms., illus. Price $4.

This report, based on 16 years work, consists of the systematic and topographic description of the physiography of southern Ontario. It is the major study so far completed of this region.

The first chapter, on the bedrock, describes the origin and succession of the sedimentary rocks in southern Ontario, their warping in the Algonquin-Frontenac region and their faulting in the Ottawa Valley. The broad division by the Frontenac axis separates eastern from central and western Ontario. In eastern Ontario alternate strips of good and poor land are related to fault scarps and the filled-in depressions between them.

Central and western Ontario form a cuesta and vale topography, the vales of western and central Ontario, floored with shale, being divided by the Niagara cuesta of dolomitic limestone. The cuesta is arched in the centre, in continuation of the Cincinnati arch farther south, and has a height of 1,800 feet near Collingwood. Re-entrants notch the scarp to control routes across it, to provide water power, or sheltered sites for farming.

The second chapter in the book reconstructs the glaciation of the region and describes its effects.

The ice-sheets had both an erosional and depositional phase. Erosion deepened the vales underlying Lakes Ontario, Huron, and Superior until they were lowered beneath sea-level. Erosion also broadened the re-entrants and scraped the scarps in the cuestaform landscape.

Eighty-four per cent of the region is covered by deposits of glacial till of the Wisconsin glaciation. Pre-Wisconsin till is not in evidence at the surface and is not important to the physiography. However, the interbeds between older and younger till are vital factors in well-water supply throughout the region.

The depth of till varies; it is very shallow over the escarpments and fairly shallow in eastern Ontario and over parts of the Niagara Peninsula.

A description of the types of glacial remains is given, including moraines, spillways, drumlins, eskers, and glacial-lake features. This is followed by a summary of the recession of the Wisconsin glacier as it affected the geographical distribution of these remains.. The first land to be uncovered by the receding glacier was the series of moraines between Orangeville and London. From this position a lobe of ice to the south retreated to the Ingersoll and Paris moraines, while a lobe to the north uncovered drumlinized terrain. Readvances of Georgian Bay and Lake Huron ice left moraines at Milverton and Mitchell northwest of London. Gradually the uplands of southwestern Ontario emerged to form a little island in the expanse of ice and meltwater. Further moraines were deposited around the margins of this island, including the Port Huron moraine, which formed a morainic system shaped like a horseshoe from Port Huron to Brantford. The retreat of the ice-front from these moraines uncovered drumlin fields around the fringes of Lake Ontario and Georgian Bay. Later the lobe of ice in the basin of Lake Ontario parted from that in the basin of Lake Simcoe along the central Ontario interlobate moraine referred to as the Dale Ridge. Further retreat uncovered large drumlin fields in eastern Ontario.

The invasion of the area by glacial lakes partly buried and smoothed out the morainic and drumlinized terrain of southwestern Ontario. The beach-ridges and lake-shore deltas formed at the margins of the various stages of glacial-lake transgression are described. Many are sites of settlements and routes, as along the Lake Iroquois shoreline, and of intensive agriculture. Sheets of lacustrine deposits between frequent outcrops of rock in the eastern and northern parts of the region are important for settlement.

Excellent maps illustrate the precise geographical distributions of the moraines, drumlins, eskers, and glacial-lake features that make up the bulk of the surface physiography of southern Ontario.

The third chapter in the report describes the individual surface features of southern Ontario. The great morainic complexes of the Horseshoe System in southwestern Ontario and of the Interlobate System in central Ontario are discussed in detail in thirty subsections; the drumlin fields of the Lake Ontario ice-lobe, the Georgian Bay ice-sheet, the Simcoe and Kawartha Lakes ice-sheet, and in eastern Ontario are analysed and depicted; the eskers of southwestern and of central Ontario are detailed; and the lacustrine sediments and strand lines of Lake Maumee, Lake Whittlesey, Lake Arkona, Lake Warren, Lake Algonquin, Lake Nipissing, Lake Iroquois, and the Champlain Sea are outlined.

The authors are concerned mainly with describing the physical characteristics of these various features. Nevertheless, the human significance of the terrain may be inferred from occasional references to drainage, land use, and settlement. The dry terraces on the sides of the glacial spillways and on glacial-lake beaches are generally sites for cultivation, main roads, and the nuclei of important settlements. Poorly drained lacustrine flats and the swamps impounded between moraines and drumlins remain under woodland. Drumlins are usually well drained and stand out as well-cultivated features. Moraines vary in use considerably according to their texture; where gentle and not too bouldery they have good farms, where rough and associated with a knob-and-kettle topography they are under woods or pasture.

Special attention is paid to the influence of bedrock and glacial deposits on drainage and the chief river systems of southern Ontario are discussed. The volume of the streams, their gradients, and their size and erosive power are related to different types of drift. The degree of run-off, the amount and regime of flow, the effectiveness of the drainage done, the frequency of flooding, the presence of soil erosion, if any, and the human use of the rivers are all discussed.

In the fourth chapter the total effects of bedrock, glacial erosion, glacial deposition, glacial-lake and marine transgression, and post-glacial drainage are related to each other and their geographical combinations shown in fifty-two physiographic districts.

These districts are grouped according to certain associations of physiographic factors into major regions. The larger regions are "(1) the broad half-dome that slopes from the Niagara escarpment to Lakes Huron and Erie; (2) the Niagara escarpment itself; (3) South-Central Ontario between the edge of the Canadian Shield and Lake Ontario; and (4) the lowlands between the St. Lawrence and Ottawa regions".

The first region is characterized by the structural arching in continuation of the Cincinnati anticline; fairly sharply dipping belts of limestone and shale overlain by a medium depth of till; by the morainic complex of the Horseshoe System; by the lacustrine flats of the southwestern dip-slope and by pronounced Warren, Arkona, and Whittlesey beaches. Large sandy deltas of the glacial waters into which Thames and Grand Rivers emptied form a belt of land noted for tobacco farming and specialized crops.

The Niagara escarpment mounts from a height of about 350 feet in the Niagara Peninsula to 1,800 feet near Collingwood, at the crest of an arch, and drops again to the Bruce Peninsula and Manitoulin Island. Changes in lithology affect appearance; pre-glacial drainage was responsible for large re-entrants such as the Dundas Valley; glaciation deepened and widened these re-entrants, stripped the capping surfaces, mantled the scarp face and the dip-slope with drift; and post-glacial drainage has produced a series of short, steep streams with irregular regimes.

South-central Ontario is dominated by the massive interlobate morainic system, called the Oak Ridges. A secondary scarp at the edge of the Black River Limestone, overlooking the Precambrian rocks of the Frontenac axis, is a feature to the east of the region. The Simcoe-Kawartha Lakes drumlin field provides notable relief, and the Nipissing and Algonquin beaches around Georgian Bay and Lake Simcoe together with the Iroquois beach around Lake Ontario are also significant. Areas of shallow drift on limestone are common in the north and east of the region.

Eastern Ontario comprises the edge of the Frontenac axis, the thinly covered limestone plain farther east, the drumlin fields and till of the southern part of the Ottawa Valley, and the sandy deltas and clay plains of the area of the Champlain Sea, together with the well-marked terraces cut by post-glacial rivers in the Ottawa Valley.

Again, although the emphasis is on the physical features themselves, the effect of these features on the geography of roads, railways, occupation, and settlement is frequently brought out.

Excellent photographs and diagrams illustrate the essential characteristics of each major region and of most of the minor physiographic subdivisions. Much of the land use can be read from them.

The fifth and final chapter of the book gives a summary description of the structure, glaciography, terrain, and drainage of the region; it suggests that they combine to form certain land-types, which are presented in a coloured map on the scale of 4 miles to 1 inch; attention is drawn to the chief qualities of the soil and related types of farming are indicated; and a recapitulation of the regional division of southern Ontario is made.

In conclusion, there are a short glossary of physiographic terms, a bibliography of 112 entries on the physiography of southern Ontario, and a detailed index.

Four large, folded maps are issued with the book. These comprise four sheets of a map describing the geographical occurrence of the chief land types of the region, including escarpments, till moraines, spillways, kame moraines, undrumlinized till plains, drumlinized or fluted till plains, drumlins, bevelled till plains, limestone plains, shale plains, sand plains, clay plains, eskers, beaches and shorecliffs, boulder pavements, sand dunes, bogs, and marshes. The sheets are printed in colour on top of a base map showing counties, townships, and concessions. Due to the base map it is very easy to locate any individual boundary.

[J.W.W.]

ALBERTA. Department of Economic Affairs, Industrial Development Board Economic Survey. Edmonton, 1950. February, VILLAGE OF MANVILLE, 8 pp. 1 map; March, CITY OF MEDICINE HAT, 28 pp. 2 maps; August, CITY OF EDMONTON, 105 pp. 2 maps.

These publications continue the series of economic surveys of Alberta settlements. Though primarily economic they contain much geography or material of use to the geographer. They are compiled with the assistance of local officials and others familiar with the history of development of the settlements concerned. The topics are treated alphabetically and not systematically, and range from administration, area, communications, cultural activities, fairs, geology, government offices and services, hotels, industry and business, living conditions, location, and newspapers, to population, power, professional and skilled services, rainfall, resources, soil, sports, tax structure, temperature, tourism, trading area, and water. These reports are an accurate, factual, up-to-date compendium about the geographical basis for economic development, the economic life, the administration and cultural activities of Alberta settlements.

[J.W.W.]

MOIRA VALLEY CONSERVATION REPORT. Ontario Department of Planning and Development, Toronto, 1950, XX, pp. 429, illus., dgms., maps.

This is one in a series of conservation reports on the river systems of Ontario where periodic floods and droughts and river erosion present their problems. It is prefaced by a list of the recommendations relating to conservation arising out of the report. Six parts follow. The first deals with the geographical location, the geology and physiography of the region together with the history of its development and settlement. The second part describes the soils, present land use, land economics, and land use capability of the region, together with detailed studies of soils and land use in the Zion Hill sample area.

The third part is concerned with the special problems of forestry, showing the existing forest situation, the importance of forest products to the region, forest conservation measures now in progress, and forest conservation methods required. A description of forest insects and diseases is also included. The fourth part records the water conditions in the valley, discussing the extent and causes of flooding and suggesting solutions. The fifth part deals with the former and present status of wildlife together with a consideration of improving the farm for wildlife. Detailed studies of the muskrat, meadow mouse, and types of fish are appended. The last section of the report discusses the recreation problems and possibilities of the area, related to its resources and population.

Each section is illustrated by photographs taken during the course of the field work and by diagrams and maps. A folder is issued with the report, containing a location map of the watersheds of Moira and Napanee Rivers; a coloured map of the soils, another of the present land use and a third on the recommended land use at a scale of 2 miles to 1 inch; and a sectional coloured map, in three sheets, of forest conditions in the area, on the scale of 1 mile to 19/20 inch.

[J.W.W.]

SOIL MECHANICS IN CANADA. By Robert F. Legget. Canada, National Research Council, Tech. Memo. 13, Ottawa, 1949, 3 pp.

In this paper, one of a series of seven Canadian papers presented at the second International Conference on Soil Mechanics and Foundation Engineering held at Rotterdam, 1948, Mr. Legget has outlined the growth and present status of Soil Mechanics in Canada. He describes its expansion in Canadian universities and the research being carried on by various agencies in almost every Canadian province.

Five aspects in particular are under investigation by the National Research Council, namely Track studies, which involve the inter-relationship of soil mechanics and the mobility of tracked and wheeled vehicles; Permafrost in its relationship to building problems in the Canadian northland; Muskeg, Snow and Ice, and Civilian Soil Mechanics.

The most recent Canadian development is the establishment of the Division of Building Research in the National Research Council. The services of this Division will eventually be at the disposal of Canadian construction engineers and should be a valuable aid to research due to "the unusual soil problems to be faced in Canada, the vast size of the country, and corresponding necessity for utilizing all available scientific facilities most efficiently".

[J.K.F.]

THE BATHURST INLET PATROL, R.N.W.M.P., 1917–18. By C. I. Adam. Roy. Can. Mtd. Pol. Quarterly, vol. 16 (1), July 1950, 12-25 pp., maps, illus.

In the spring of 1913, word arrived from the north, of the murder by the Eskimos of two white explorers, H. V. Radford and T. G. Street, during the previous summer. The tragedy had occurred in the almost unknown and inaccessible region around Bathurst Inlet, and due to the difficulty of obtaining food and fuel in this area, it was not until the spring of 1917 that the police were able to investigate the murders.

Starting out from Baker Lake on March 21, 1917, Inspector F. H. French and Sgt.-Major T. B. Caulkin travelled over 5,100 miles in the next 10 months. After questioning many groups of natives, the police decided that there had been strong provocation in these murders by "those who knew no better than the primitive laws of nature". Much of the time on the patrol was spent hunting caribou and seals, and on several occasions, game was obtained when the party was on the point of starvation.

This little publicized patrol has been written up by Constable Adam and excerpts from the official reports are chosen to improve the account.

[J.K.F.]

ARCTIC ICE AND THE WARMING OF THE ARCTIC. By N. N. Zubov, trans. by E. Hope. Canada, Department of National Defence, Ottawa, 1950, 73 pp., maps, illus., tbl.

This translation of Chapters VI and VII of Zubov's "In the Centre of the Arctic", published in Russian in 1948, is a valuable addition to the knowledge of Arctic conditions. The studies of the factors determining the formation and disintegration of the polar pack are clearly presented. Glaciers, icebergs, permafrost, and the drift of the polar ice form interesting sections, and Zubov has summarized most of the available data concerning the biological cycle that takes place at the edge of the melting pack ice.

In the chapter on the warming of the Arctic, the author states that "the only thing of which we can be sure is that the warming of the Arctic is caused by a general stepping up of atmospheric and hydrospheric circulation", but he adds that this only replaces one problem with another, as the cause of the increased circulation is still unknown.

[J.K.F.]

GYPSUM MINES IN CANADA and COAL MINES IN CANADA, 1949. Canada, Department of Mines and Technical Surveys, Mines Br., Ottawa, 1950.

Those interested in the geographical aspects of mining cannot help but find lists such as these useful. The list of gypsum mines includes the name, address, and location of each operator, with similar information on the milling plants, in addition to their rated daily capacity, date of first operation, and the process used. The whole list is prefaced by a short summary describing the distribution of gypsum, province by province.

The list of coal mines is similar but includes the 1948 output of the larger mines together with an alphabetical index according to the name of each mine.

[N.L.N.]

THE CLIMATE, SOILS, AND SOIL-PLANT RELATIONSHIPS OF AN AREA IN SOUTHWESTERN SASKATCHEWAN. By W. A. Hubbard. Sci. Agr., vol. 30 (8), August 1950, 327-342 pp., map, tbls., illus.

The theme of this paper is "that vegetation, if correctly interpreted, will answer many questions regarding the soil and climatic conditions of the region". This has been applied to fifty sites within a radius of 50 miles of Swift Current, Saskatchewan, so that examples could be drawn from the five different soil textural classes in the area. Composite soil samples were collected from all sites and the vegetation sampled by means of meter quadrants and the point method. The two were then correlated, having regard to the general physical and climatic characteristics of the area. Particular attention was paid to soil texture, which indirectly controls the available moisture, and some marked positive and negative correlations obtained. [N.L.N.]

A SOIL RATING AND CLASSIFICATION FOR IRRIGATION LANDS IN WESTERN CANADA. By W. E. Bowser and H. C. Moss. Sci., Agr., vol. 30 (4), April 1950, pp. 165–171, tbls.

This study is an outgrowth of "the realization that irrigated lands varied in their ability to produce and, therefore, in their ability to carry the capital cost of construction". The need to assess the land on the basis of the productive power of the soil led to the development of several rating systems, which are unified in this paper. Seven factors are considered—soil profile, parent material, soil texture, salinity, stoniness, degree of erosion, and slope. Within each of these, ratings are assigned that are multiplied together to give the final rating for a given soil. A colour scheme is suggested for mapping the soils on the basis of such ratings. The authors conclude with the recognition that certain changes may occur as the result of irrigation which "cannot be fully assessed prior to irrigation" and may call for later reclassification of problem areas. [N.L.N.]

THE FARM WOODLOT IN NOVA SCOTIA. By J. E. Lattimer. Nova Scotia, Department of Agriculture and Marketing, Extension Bull. 14, Halifax, 1949, 26 pp., mimeo.

The purpose of this study is to show the desirability and necessity for a combination of forestry and farming in which the use of the woodlot is a crucial part of the land utilization pattern. This introduces the revolutionary idea that farm woodlots can produce better timber than virgin forests and that land may be improved by maintaining trees rather than clearing. Such a combination would appear not only possible but necessary when climate, soil, topography, and various cultural conditions are all considered.

The woodlot per farm in Nova Scotia covers an acreage of two and a half times that of the cleared land. With such a large area in woodlot, it would appear that silviculture could furnish an important supplementary farm income, and along with agriculture provide the most desirable type of land utilization.

By means of statistics, tables, questionnaires, and interviews, the writer has compiled the facts on all the numerous aspects of this problem in the province of Nova Scotia.

Five statistical tables, and an extensive bibliography, are included in this study.

[M.R.D.]

A STUDY OF BIRD POPULATIONS IN THE APPLE ORCHARDS OF ANNAPOLIS VALLEY, NOVA SCOTIA. By John P. Kelsall. Canada, Department of Resources and Development, Development Services Br., Wildlife Management Bull., Ser. 2, No. 1, Ottawa, 1950, 69 pp., mimeo.

This study deals primarily with bird populations in the commercial apple orchards of the Annapolis Valley. An integral part of the study was the investigation of poisoning among bird populations due to toxic materials in the spray used in the protection of the apple trees from insects and disease, the result of which was that, "poisoned sprays, as normally applied in the commercial orchards of the Annapolis Valley, have no readily observable direct effect on the migratory bird population nesting or feeding in the orchards".

Besides a list of references, the work includes a dozen photographs showing the different types of orchards in which the study was made. [M.R.D.]

MOISTURE RELATIONSHIPS IN SOUTHERN ONTARIO. By Marie Sanderson. Sci., Agr., vol. 30 (6), June 1950, pp. 235-255, maps, tbls.

This paper presents the normals and annual variations in the moisture relationships in the climate of southern Ontario. The average water need, deficiency, surplus, and actual water loss is computed, according to Thornthwaite's method, for eighty-three weather observing stations and the results presented on maps. A boundary is established between Thornthwaite's mesothermal and microthermal climatic types and certain observations made on the moisture provinces within these types. Finally, the daily changes in four particular moisture provinces for the period 1923–1948 are examined in detail.

[N.L.N.]

SILICA IN CANADA. By A. R. MacPherson. Canada, Department of Mines and Tech. Surveys, Mines Br., Memo. Ser. No. 104, Ottawa, 1949, 22 pp., illus., tbls., mimeo.

This publication begins with the different forms in which silica occurs in nature and then deals with the principal industrial uses and specifications for silica before describing, in tabular form, the principal known silica deposits in Canada. This table gives the geographical location, the physical type, and data on chemical analyses for each of the principal occurrences, in addition to listing the operating plants. The author then goes on to discuss briefly the economics of the silica industry and plant equipment and operations, concluding with the results of the laboratory investigations made by the Mines Branch in this field. [N.L.N.]

REPORT OF THE COMMITTEE ON FORESTRY AND NATURAL RESOURCES. New Brunswick, Legislative Assembly, Fredericton, 1950, 83 pp., map, mimeo.

The Forestry and Natural Resources Committee of the New Brunswick Legislature was formed in 1947. Various briefs and papers were presented to the Committee by competent experts, both in government and in industry.

Submissions to the Committee dealt with such subjects as the possible improvement of fishing opportunities in southeastern New Brunswick, the important relationship of conservation of natural resources and the tourist trade, progress to date in the development of Fundy National Park, the steps taken by the Maritime Lumber Bureau to overcome the handicaps facing eastern Canadian timber, the aerial photographic survey of the province in 1944–45, and the use made of the photographs for forestry surveys, soil conservation, location of power transmission lines, and for map compilation. They also included the problem of land use as it applies to colonization, the duties and responsibilities of a district forester, the development of the economic aspects of handicrafts in New Brunswick, the Bay of Fundy tides as a source of power, and the influence of the various fisheries on the general economy of the province, and the handicaps it must overcome.

On the basis of the submissions made, the Committee presented its final report and recommendations to the Legislative Assembly, April 28, 1950. The recommendations noted the need for a survey of fish and game in the province, the necessity of placing colonists on farms in proven agricultural land, and a revised colonization scheme.

A sketch map shows the proposed Saint Mary's Tidal Power Development.

[M.R.D.]

INFORMATION CONCERNING THE RIVER ST. LAWRENCE SHIP CHANNEL FROM FATHER POINT TO MONTREAL, INCLUDING TIDE TABLES. MONTREAL TO LAKE ONTARIO AND THE OTTAWA RIVER. Canada, Department of Transport, Ottawa, 1950, 177 pp. Price 25 cents.

This publication deals with navigability conditions on the ship channels of the St. Lawrence and Ottawa Rivers. The type of information gathered here includes bridge clearance, tides, code of signals, instructions to pilots, marine signal service, list of buoys, international rules of the road, rules of the road for the Great Lakes, and distances between places. [P.C.]

THE DAIRY FARM BUSINESS IN MANITOBA, 1942 TO 1947. By H. L. Patterson and H. W. Trevor. Canada, Department of Agriculture, Pubn. 829, Tech. Bull. 76, King's Printer, Ottawa, 1949, 41 pp.

The object of this study was to provide factual information on the operation of Manitoba's dairy farms, a phase that confronts the dairy industry with many problems.

The paper is treated in three parts: first, the introduction, which outlines the setting of the industry, field research procedures, and a description of farms in relation to markets and natural factors. Part I, on Farm Business, is an analysis of the activities of the farm, and is presented under such headings as income and expenditures, livestock, crops, labour, capital turnover, size of business, and farming combinations. Part II is an analysis of the problems peculiar to the dairy farm as a part of the general farm business. This is discussed under regional competitiveness, organization, variation of costs and returns, production per cow, feeding and labour efficiency, and marketing and building costs.

The paper is fully illustrated with statistics, but contains no graphs, maps, or illustrations. [W.A.B.]

NAVIGATION CONDITIONS ON THE HUDSON BAY ROUTE FROM THE ATLANTIC SEABOARD TO THE PORT OF CHURCHILL, SEASON OF NAVIGATION, 1949. Canada, Department of Transport, 1950, 82 pp. Price 15 cents.

This report gives dates of opening and closing of navigation and the conditions of progress of the break-up and the starting of ice formation at various points of Hudson Bay and Strait. Information on ice conditions and navigability in these waters is extracted from the logs of ships that cruised in the area in 1949. Included in the report are particulars of ships using the port of Churchill during 1949; a list of aids to navigation such as radio, coast, and lighthouses; and meteorological data taken by the Federal ice-breaker *N. B. McLean* or recorded by stations located in the region. [P.C.]

THE GREAT LAKES-ST. LAWRENCE DEEP WATERWAY. By G. A. Lindsay. Canada, Department of Transport, Ottawa, 1949, 31 pp., illus.

This is the latest official engineering report available on the Great Lakes-St. Lawrence deep waterway. It was necessary to prepare a new report due to the economic and political developments that have occurred in connection with the project since 1945. The project is described by sections: the Great Lakes and connecting channels, including the Welland Ship Canal, the International Rapids section; the Lake St. Francis section, the Soulanges section, and Lachine section. The existing conditions, the expenditures to date, the proposed improvements, and the estimates of costs are given for each section and for the whole project. A set of twelve plates illustrate the report. [P.C.]

ALBERTA FACTS AND FIGURES. Alberta, Department of Industries and Labour. King's Printer, Edmonton, 1950, 404 pp., maps, illus.

This publication contains a compilation of information intended to be of value for industrialists, producers, and distributors, and is presented on a provincial and regional basis.

A wide range of subjects cover the province in considerable detail: physical environment, population, immigration, municipalities, agriculture, minerals, forestry, fur, fisheries, waterpower, industries, trade, education, public health and welfare, commercial services, and provincial cities.

It abounds in statistics, and includes numerous graphs, maps, and illustrations.

[W.A.B.]

FARMING IN ALBERTA. By R. E. English. Alberta, Department of Agriculture, King's Printer, Edmonton, 1950, 40 pp., maps, tbls.

The purpose of this booklet, to answer many inquiries on farming in Alberta, is achieved through a division of the subject into two parts: the basic necessities of farming and the economic aspects, including various financial, political, and social services. The first part, with a brief historical note, deals largely with climatic factors, types of farming areas, soils, and irrigation. The second section covers briefly land tenure, ways of acquiring farm land, farm investments, costs and credits, mechanization, and agricultural assistance from the Federal and Provincial Governments and Provincial University. [B.C.]

THE MAMMALS OF WATERTON LAKES NATIONAL PARKS. By A. W. F. Banfield. Canada, Department of Resources and Development, Development Services Br., Wildlife Management Bull., Ser. 1, No. 1, Ottawa, 1950, 43 pp., maps, tbls., mimeo.

The report consists basically of listings of the mammals found in the park area, with some historical data, territorial extent of species, food habits, and estimates of population. The photographs of the main species discussed are particularly useful, and there are nine maps showing the distributions of the major mammals discussed in the report and one indicating areas occupied by domestic livestock. [B.C.]

UTILIZATION OF SAWMILL WASTE IN THE SOUTHERN COAST REGION OF BRITISH COLUMBIA. By F. W. Gurnsey. Canada, Department of Mines and Resources, Dominion Forest Service. King's Printer, 1949, 34 pp., mimeo., tbls.

This short report presents much pointed information by a judicious use of clear, meaningful tables. A good example is Table 3, which shows a surprisingly high potential waste. The report includes brief descriptions of the methods used in the industry in utilizing sawmill waste and a list of the uses of the waste, which varies from domestic fuels to alcohol, wood sugar molasses, and insulation. There are references to related publications both in Canada and the United States as well as to continuing experiments in the general problem of sawmill waste utilization. [B.C.]

POTENTIAL MINERAL RESOURCES OF YUKON TERRITORY. By. H. S. Bostock. Canada, Department of Mines and Technical Surveys, Geological Survey of Canada, Paper 50-14, Ottawa, 1950, 29 pp., mimeo., maps.

The paper gives a general account of the geology and physiography of the Yukon Territory, and a short statement on the possibility of a future transportation network and the route it might follow in order to best serve existing known mineral belts.

For the remainder of the paper, the Yukon has been divided into eleven Mineral Belts and Areas and thirteen Fuel Belts and Areas, the locations of which are shown on two maps. In his description of each of the Mineral and Fuel Belts, Dr. Bostock describes the area and lists, in detail, the minerals or fuels found, as well as giving the history of any mining properties that have been worked. [B.J.G.]

THE DISTRIBUTION OF FRESH-WATER FISHES IN BRITISH COLUMBIA. By G. C. Carl. British Columbia, Department of Education, Provincial Museum of Natural History and Anthropology, Victoria, 1950, 3 pp., map.

In a brief article, rich with pertinent information, Dr. Carl links native species of fish in British Columbia with four possible routes of introduction following the Pleistocene glaciation. Only part of the fifty-one native and fourteen recent migrant or introduced species are listed, but they are sufficient to connect the present distribution with the possible routes of entry into the province. [B.C.]

ESQUISSE PHYTOGÉOGRAPHIQUE DU QUÉBEC. Par M. Raymond. Jardin Botanique de Montréal, Bull. No. 5, 1950, 147 pp.

Dans l'introduction à cette étude, l'auteur remarque que si la flore du Québec offre un caractère uniforme à l'observateur ordinaire, comme le croyait le savant d'il y a une centaine d'années, tel n'est pas le cas aujourd'hui. Les flores s'adaptent aisément, avec le temps, au milieu où elles croissent; les agents extérieurs comme le climat, l'altitude, la proximité des eaux, l'isolement et la nature du sol les modifient et les transforment. C'est ce que l'auteur démontre d'une façon méthodique dans les autres chapitres.

Le premier chapitre traite des affinités de la flore du Québec; on met en relief les espèces qui existent dans la province, sur le continent nord-américain et en Asie. On indique cette affinité spatiale soit par prolongement ininterrompu d'une zone qui s'étendrait jusqu'au nord-est de l'Asie, soit par zones isolées les unes des autres et disséminées dans le nord-ouest du continent nord-américain et le nord-est du continent asiatique. L'auteur a réuni dans un schéma les points de contact entre les flores asiatique, européenne et nord-américaine.

Il divise ensuite la flore du Québec en trois régions botaniques principales, la région arctique, sub-arctique ou hudsonienne et laurentienne. Après avoir décrit les grandes associations botaniques naturelles qui constituent les cadres de la flore québecoise, l'auteur délimite certaines frontières floristiques naturelles. A l'intérieur de ces frontières, et région après région, il étudie la flore, détermine ses différents facteurs et groupe les résultats dans des "conclusions statistiques". En terminant, il avertit le lecteur que si l'on a tracé certaines limites naturelles pour quelques espèces, les recherches qu'il reste à faire sont énormes. [P.G.]

A LIST OF THE PLACE NAMES OF THE ISLAND OF NEWFOUNDLAND WITH THEIR GEOGRAPHICAL POSITIONS. Canada, Department of Mines and Technical Surveys, Geographical Branch, Misc. Papers I, Ottawa, 1950, 59 pp., and introduction.

This alphabetical list of the geographical names of Newfoundland provides a means of locating on maps the principal populated places and geographical features of the island and its surrounding waters.

Only features shown on the 10-mile map of Newfoundland published by the Department of Natural Resources, Newfoundland, in 1941, are included, consequently, all names will not be found. The spelling of the names and the locations are as shown on the 10-mile map and alternative spellings are not listed.

[L.B.S.]

YUGOSLAVIA—A GEOGRAPHICAL APPRECIATION. Canada, Department of Mines and Technical Surveys, Geographical Branch, For. Geog. Inform. Ser. 3, Ottawa, 1950, 74 pp., maps, diags., tbls., biblio.

This study is the third in a series of country studies being prepared as part of the foreign geography research program of the Geographical Branch. As other studies in the series, it is designed to acquaint those responsible for Canadian participation in international affairs with relatively up-to-date information on the physical, social, economic, and political geography of a country of significance to Canada.

This particular report is divided into five chapters, Yugoslavia in its European Setting, Physical Geography, The People, Economic Geography, and, finally, Historical and Political Geography. It includes 15 maps and diagrams and 9 tables as well as an extensive bibliography and selected map bibliography.

[G.A.B.]

GEOGRAPHY IN CANADIAN UNIVERSITIES. By M. R. Dobson. Canada, Department of Mines and Technical Surveys, Geographical Branch, Misc. Paper 2, Ottawa, 1950, 55 pp., tbl.

This report is a factual compilation of the situation with regard to geographical training in Canadian universities. It gives brief notes on the way in which geography developed in twenty institutions, according to information supplied by the universities themselves or available in published form, and outlines the courses offered. It concludes with a more detailed presentation of the courses offered in the five universities with separate departments of geography and the two universities in which geography is a sub-department.

[N.L.N.]

FIFTEENTH ANNUAL REPORT ON ACTIVITIES UNDER THE PRAIRIE FARM REHABILITATION ACT FOR THE FISCAL YEAR ENDED MARCH 31, 1950. Canada, Department of Agriculture, Prairie Farm Rehabilitation Branch, Regina, 1950, 93 pp., maps, illus.

This is the annual report for the fiscal year 1949–50 of operations under the Prairie Farm Rehabilitation Act (1935), which was passed by Parliament to "meet the problems relating to the rehabilitation of people residing within drought areas in the provinces of Manitoba, Saskatchewan and Alberta".

The report presents two main themes, the P.F.R.A. Land Utilization Program and the P.F.R.A. Water Conservation Program, and describes applied, economic geography in the arid West. It assesses the basic factors of the environment in terms of human need. Acknowledging that man's economic demands in this area went beyond the means of the natural environment, the report describes the undertakings through which certain material gains have been realized for marginal and sub-marginal land without destroying it. It serves also to emphasize that which can be accomplished in a community by co-ordination of effort through a regional planning agency. The text is supplemented by 14 maps, some 40 photographs and 1 artist's sketch.

[G.A B.]

Canada and the United Nations, 1950. Canada, Department of External Affairs, Conf. Ser. 1950, 1, Ottawa, 1951, 190 pp., illus., chts., tbls., maps. Price 50 cents.

This report attempts to outline the various political, military, social, and economic activities of the United Nations and its Specialized Agencies during 1950 and review Canadian participation therein. It includes topics of particular concern to geographers whose special interests lie in the fields of economic, social, and political geography such as discussions on the respective situations in Korea, Formosa (Taiwan), Kashmir, Indonesia, and the former Italian colonies. It discusses technical assistance to under-developed countries, the work of various economic and demographic commissions, and reports on F.A.O., I.T.O., UNESCO, W.H.O., and W.M.O.

Throughout the report factual statements are presented in a way that provides a much needed perspective to regard world events in a realistic but objective light. Of particular interest to those with geographical training will be the maps of Korea and Kashmir that have been included in this publication.

[G.A.B.]

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
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