"A REGIONAL STUDY OF SOUTHEASTERN VANCOUVER ISLAND, B.C."

- by -

ALBERT LEONARD FARLEY

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

- MASTER OF ARTS -

IN THE DEPARTMENT

- of -

GEOLOGY AND GEOGRAPHY

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accepted.

Sept. 6, 1949.

THE UNIVERSITY OF BRITISH COLUMBIA

August, 1949

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Vancouver Island forms one of the border ranges of the North American Cordillera, and is separated from the mainland of British Columbia by a submerged depression, the Strait of Georgia. In extent, Vancouver Island is some 280 miles long and 50 to 80 miles wide, with an estimated area of 13,000 square miles. A central, strongly dissected mountainous backbone comprises most of the Island and forms its main axis, lying in a N.W. — S.E. direction. On the east, the backbone is bordered by a relatively narrow coastal plain which slopes gently to the Strait of Georgia. Southeastern Vancouver Island as considered in this study, is that portion of the Island lying south and east of a line from the mouth of Muir Creek to the southern end of Saanich Inlet, thence following the Inlet to the northern tip of Saanich Peninsula.

Southeastern Vancouver Island presents a varied picture to the geographer. The upland topography of the west and southwest, on the one hand, is characterized by forest industry, with attendant sparse population and relatively few roads. Inland, scattered areas of suitable soils are occupied by general farms, while along the coast, the many bays and harbours are centres of fishing activity. On the other hand, extensive areas of modified glacial tills in the central and northern portions are widely developed for a variety of agricultural pursuits. Population is concentrated here and transportation routes show a dense, rectangular pattern. An urban area has developed in response to the natural harbour and its agricultural hinterland. The present day hinterland of this urban area extends far beyond the regional boundaries so that it now includes most of Vancouver Island.

Though not well endowed with metallic minerals, the region has extensive reserves of non-mettalics in the form of sands, gravels and clays. These glacial deposits are being exploited for use in local construction. Fishing is well developed along the ocean littoral and exploits several fishes of which the Pacific salmons are the most important.

The most valuable primary industries are agriculture and forestry. Agriculture is ~~well adapted to~~ favoured by the long frostless season, absence of extreme temperatures, and dry, relatively sunny summers. Berry culture, bulb and seed production are thriving operations on the glacially derived soils. Forestry utilizes the steep slopes and non-arable soils of the maturely dissected upland area in the west and southwest. Though much of the forest area has been cut over, climatic and edaphic conditions are optimum for reforestation of Douglas fir, the most valuable species.

Secondary industry in Southeastern Vancouver Island is favored by the presence of forest and soil resources and a ready source of labour, but is hindered by limited markets and energy supplies. At present, manufacturing ~~in the region~~ is restricted to simple processing.

A great variety of tertiary industries centred in the urban area of Victoria serve the large residential zone. Tourism is one of these industries which has been particularly successful, capitalizing the local climate and scenery, the recreational facilities and "British" atmosphere.

The region's greatest potential rests on its soil and forest resources. Ultimately, the cultivated land could be approximately doubled. The non-arable soils and upland areas now supporting various stages of second growth forest, are well suited to sustained yield forestry. The expansion of local population and secondary industries would probably parallel increased development of these basic industries, thereby adding considerably to the regional wealth.

Grateful acknowledgment is extended to all those who have helped the writer in the preparation of this thesis. Special recognition is due to Dr. J. L. Robinson and Mr. J. Chapman of the Department of Geology and Geography at the University of British Columbia for their constructive criticism of the manuscript. The writer is also indebted to the many Provincial Government staff members who have aided him in securing information.

CONTENTS

PREFACE

The object of this thesis is to present a picture of the geographic pattern in Southeastern Vancouver Island, British Columbia, with a view to understanding its present development and its future possibilities. In some respects it is a pioneer study, since very little has yet been done toward a geographic analysis of any part of the province.

There is a pressing need for geographic studies in British Columbia, in order that suitable long-term measures concerning the utilization of resources may be formulated. Up to the present, the general programme of industry in the province has been one of rapid exploitation of resources rather than planning on a permanent basis. Industry has not only been largely exploitative but has shown a lack of integration of resources - most of our wealth is based upon the export of raw or semi-processed materials from forest, mine and sea. Further processing of these raw materials, through the development of secondary and associated tertiary industries within British Columbia , will make more work and income available to the provincial population. The establishment of these industries and the necessary long-term planning regarding the use of resources are not simple matters. Amount and availability of raw materials, energy sources, labour and markets all must be considered. Land use studies involving the suitability of land for permanent forest, agriculture, recreation or commercial development will be necessary.

While the scope of this thesis is limited, it

is hoped that it will convey a fairly complete regional picture of Southeastern Vancouver Island - the physical background, the resources, present utilization of these resources and some suggestion as to their future use. The material has been organized with this view in mind, the first section dealing primarily with the physical side of the region, the second with the cultural side, and wherever possible, the relationships between these two phases have been indicated.

Since little geographic work has been done in British Columbia, most of the source material was gleaned from works in other fields. Geological reports, notably those of C. H. Clapp and M. A. Peacock were found very helpful, while H. S. Bostock's recent work on the Canadian Cordillera was also useful. Certain sections in the geographic study of the Pacific Northwest edited by O. P. Freeman and H. H. Martin formed general reference material and aided organization of the thesis. In the climatic section, A. J. Connor's "Frost -Free Season in British Columbia" was widely used, while his sequence of maps and graphs in "The Climate of Manitoba" was often referred to. Most of the other source material was in the form of numerous Dominion and Provincial Government publications and maps. In addition to the published material, several unpublished manuscripts and reports from government sources were consulted. Among these, R. H. Spilsbury's soil survey of eastern Vancouver Island was particularly valuable. In addition to consulting written material, extensive field work was carried out in the region, checking data and adding new material wherever possible.

I

"A REGIONAL STUDY OF SOUTHEASTERN VANCOUVER ISLAND, B.C."

INTRODUCTION:

Vancouver Island lies close to the mainland of Southwestern British Columbia, between latitudes 48°N. and 51°N. and longitudes 123° W. and 129°W. The Island forms one of the border ranges of the North American Cordillera, and is separated from the mainland by a submerged depression, the Strait of Georgia. In extent, Vancouver Island is some 280 miles long and 50 to 80 miles wide, with an estimated area of 13,000 square miles. A central, strongly dissected, mountainous backbone comprises most of the Island and forms its main axis, lying in a N.W.-S.E. direction. This backbone is flanked on the west by a rugged and deeply fiorded coast bordering the Pacific Ocean. On the east, the backbone is bordered by a long and relatively narrow coastal plain which slopes gently to the Strait of Georgia. This Strait, in turn, is bordered to the east, by the steep, rugged, west flank of the Coast Range of British Columbia.

Southeastern Vancouver Island, as considered in this study, is that portion of the Island lying south and east of a line from the mouth of Muir Creek to the southern end of Saanich Inlet, thence continuing northward along the eastern shore of the Inlet, as far as the northern tip of Saanich Peninsula. Thus, in a broad sense, the region consists of Sooke Basin and the Saanich Peninsula. The map

showing land recording districts on Vancouver Island,[1] reveals that the region chosen coincides with the area lying southeast of the Esquimalt and Nanaimo Railway land grant. However, the regional boundary is physical as well as political. In first determining the western boundary of the region, it was decided to follow the southern edge of the Vancouver Island Range, but since this range is very much dissected in the southeast, its southern extremity is difficult to trace. A close inspection of a topographic map of the area,[2] shows that a ridge of high land extends between the mouth of Muir Creek and the southern end of Saanich Arm, but this ridge expands in an eastward curving arc which has a very indefinite boundary north and northeast of Sooke Basin. In addition, the ridge is deeply indented by the valleys of Sooke and Goldstream rivers, making the natural boundary between lowland and upland more difficult to define.

Considering these difficulties in delineating the topographic boundary in the western part of the region, one wonders if the area has geographic continuity. From the standpoint of economics, transportation pattern, sequent occupance and land utilization, the western and southwestern portions of the region are closely knit with the remainder. Climatically too, there are definite similarities between the western and eastern parts, though differences do exist,

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1. See B.C. Dept. of Lands, Map 2 A, 1938, scale 4 miles per inch.

2. See: Dominion Dept. of Mines and Resources, National Topographic Series, Sheets 92NW and 92SW (parts of), 1941, scale 2 mi. per inch. or: Geographical Section, General Staff, Dept. of National Defence, 1935, Sooke Bay (1180), Goldstream (3286), and Metchosin (2971) sheets, scale 1:25,000.

as shown in a detailed analysis. The climatic factors, in turn, are reflected in the soils of the region, but particularly in the western portion, soils are more closely tied to topography than to climate, and hence they are of little use in an exact determination of the western regional boundary. Geologically, neither structure nor superficial deposits are related closely enough to the other geographic factors to aid in determining the boundary.

Considering all the geographic factors together, it is apparent that though the region as a whole has definite unity, the exact delineation of its western boundary is somewhat arbitrary. Thus it was decided to choose as the regional boundary, the political division laid down by the Esquimalt and Nanaimo Railway Land Grant. This boundary, except for the portion between Sooke and Goldstream rivers, closely corresponds with the topographic boundary. In that portion between the two rivers, it is arbitrary only because the geographic boundary itself is here difficult to determine.

The remaining boundaries of the region of Southeastern Vancouver Island are easily defined, since they consist of the waters of Saanich Inlet on the northwest, Satellite Channel on the north, Haro Strait on the east and Juan de Fuca Strait on the south and southeast. Referring to the map showing land recording districts, it can be seen that the region consists of the districts of Otter, Sooke, Metchosin, Goldstream, Esquimalt, Highland, Victoria, Lake, South Saanich and North Saanich. Those of Victoria, Lake and South Saanich together form the area of greater Victoria,

the urban centre for the region, and the Provincial capital.

1. AREA AND LOCATION

Geomatic Location and Extent.

The region of Southeastern Vancouver Island lies between the latitudes of 48°18'N. and 48°42'N., and between 123°16'W. and 123°52'W. Very irregular in outline, the region is some 28 miles in north-south extent and it averages 8 miles wide. The approximate total area is 200 square miles, forming only a small portion of the 13,000 square mile area of Vancouver Island.

Geographic Position in B.C.

Geographically, the region lies in the "populated" portion of British Columbia, forming a significant part of that southwest corner which is the geographic heart of the province. One of the reasons for the significant role which Southeastern Vancouver Island plays in the economy of B.C., is that the greater part of this region forms an important portion of the east coast lowland of Vancouver Island. This east coast lowland, together with the neighboring Fraser River Valley, forms one of the few extensive lowland areas in the province. Not only topographically, but also from the point of view of climate, the region forms one of the most favorable parts of British Columbia. The mild winters, moderate precipitation, and long frost free period, in contrast to climatic features throughout most of B.C., are conducive to the development of agriculture, particularly when combined with the suitable soils which the area possesses. Even within the limited area of Vancouver Island, its southeastern

portion displays a longer frostless season, warmer summers and a greater total sunshine than most of the remainder.

The economic importance of the region is reflected in the concentration of population within it. Approximately 100,000[1] people, or ten percent of British Columbia's one million population, live in this southeast tip of the Island. The concentration of population indicates a similar concentration of industry. Not only agriculture, the basic local industry, but also the processing of forest products, fishing and the associated tertiary industries, make up an important share of the wealth of the region, as well as a significant part of the wealth of B.C. The position of Southeastern Vancouver Island has been a determining factor in the establishment of these industries, particularly the commercial, forest and fishing industries. Located as it is, Vancouver Island provides a barrier between the ports of Puget Sound and the lower B.C. coast, and the open waters of the Pacific. Its southeastern tip, therefore, is in a sheltered position, protected from storms by the bulk of the Island, but at the same time tapping both coastwise and deep sea shipping lanes. With the exception of Port Alberni, Victoria is closer to the Pacific Ocean shipping routes than is any other major port on the lower B.C. coast and Puget Sound. In addition to deep sea trade, the region is important in providing an operating centre for small craft engaged in fishing or rafting logs, or coastal trade in the area of Juan de Fuca Strait, Haro

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1 "Vital Statistics of the Province of British Columbia", 75th report, for the year 1946, Provincial Board of Health, King's Printer, Victoria, 1948.

Strait and the southern part of Georgia Strait.

Geographic Position in Canada.

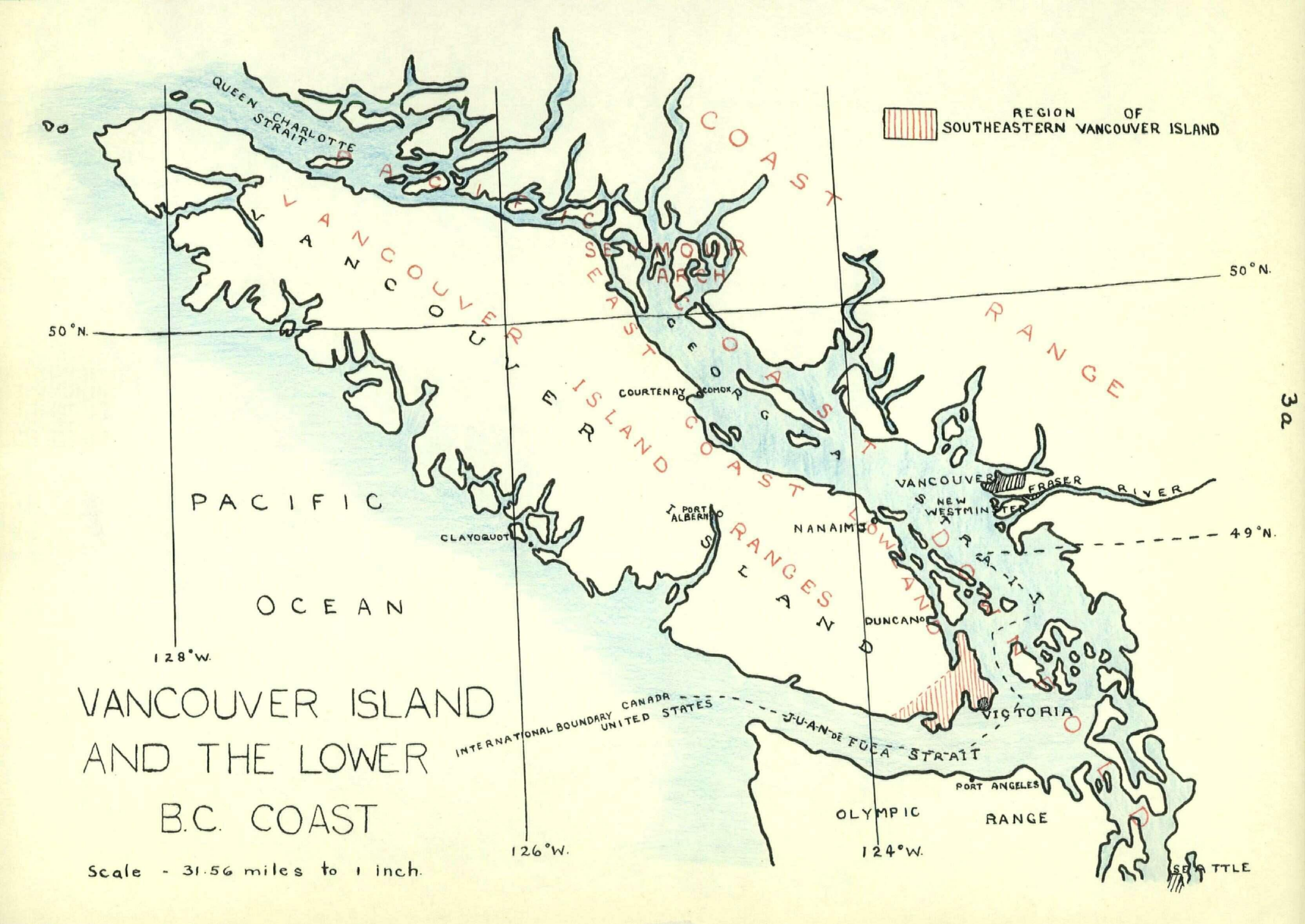
Located well to the south of the 49th parallel, this region lies roughly equidistant from Vancouver and Seattle. Consequently Victoria is a natural port of call for northbound shipping into western Canadian waters, and also is easily accessible to American tourists. This accessibility, combined with the favorable climate which the region possesses, makes tourism an important industry. The fact that Victoria has the largest per capita tourist trade of any Canadian city[1] serves to illustrate the latter statement. The geographic factors have also combined to make the region one of Canada's centres of early vegetable, small fruit and seed production.

2: GEOLOGICAL BACKGROUND

Geologic History

Southeastern Vancouver Island is made up of a narrow coastal plain and the southeastern edge of the Vancouver Island Ranges, the mountains which constitute the bulk of the Island. Bordered on the west by the Vancouver Island Ranges, and on the east by the Straits of Juan de Fuca and Georgia, the region largely represents an emerged portion of the Pacific Coast Downfold. This Downfold extends from the Gulf of California north into Alaska, and while above sea level in California, Oregon and Washington, it is submerged at its northern and southern ends. It is flanked on either side by great mountain ranges, those of B.C. being the Coast Range to

1 "Facts About Victoria", Victoria and Island Publicity Bureau, Colonist Presses, Victoria, B.C. p.2.



VANCOUVER ISLAND AND THE LOWER B.C. COAST

Scale - 31.56 miles to 1 inch.

the east, and Vancouver Island and Queen Charlotte Island ranges to the west.

Geologically, Southeastern Vancouver Island is part of a young, fold mountain area. The following inferred development of the coastland of British Columbia is based upon considerable geological evidence and embodies the research of such men as G.M.Dawson, C.H.Clapp, J.A.Bancroft, S.J.Schofield and others. The accompanying map of physical divisions will serve to illustrate the argument as it applies to the region under discussion.

During the end of the Jurassic or the beginning of the Cretaceous Period, the western belt of the present Cordilleran region was folded by pressure from the northeast, and intruded by dioritic type magmas. The region was thus bent into an outward curving arc with a pronounced longitudinal grain. At the same time, a system of tension and shear fractures developed. A great downfold or valley was also produced, dividing the present "Island Ranges" from those of the mainland. Bostock refers to this as the Coastal Trough.[1] Near the 49th parallel a smaller transverse valley was also produced, now occupied by the Strait of Juan de Fuca. By the end of the Mesozoic, the region had been subdued by erosion, and was again folded in the early Cenozoic. The compression caused a new set of shear fractures obliquely to the former set. Again, prolonged stream erosion following the folding in the early Cenozoic, reduced the surface to one of maturity at the end of the Miocene. In Southeastern

1 Bostock, H.S., Physiography of the Canadian Cordillera, Geol. Survey of Canada, Mem. 247, 1948., p.88.

Vancouver Island, this Tertiary erosion surface was peneplained,[1] and only a few, rounded hills remained above the general level. Following this, an unequal regional uplift of 3,000 to 5,000 feet occurred in the Pliocene.[2] This upwarp was greater in the central portion of Vancouver Island than it was in the south, where, according to Clapp[3] the Tertiary peneplain is now less than 1,500 feet at the coast. The uplifted surface caused rejuvenation of the advanced preceding erosion cycle, and the general pattern of the present drainage is believed to have been established at this time. Transverse rivers with large subsequent tributaries maturely dissected the uplifted surface, and along the eastern shore of southern Vancouver Island, the underlying sedimentary rocks were even further reduced, producing a new peneplain several hundred feet below the Tertiary peneplain. This surface is now some two to three hundred feet above sea level[4] and is surmounted by small rounded monadnocks. Also, off the west coast of SouthernVancouver Island, a coastal plain, which had been built in Tertiary time and later uplifted with the rest of the Island, was eroded almost to baselevel in this pre-glacial cycle. This erosion exposed the mountainous slope against which the sediments had been deposited, and the marine

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1 Clapp, C.H., Southern Vancouver Island, Geol. Survey of Canada, Memoir 13, 1912, p.16

2 Peacock, M.A., The Fiordland of British Columbia, G.S.A. Bull. 46, 1935, p.687.

3 Clapp, C.H., Southern Vancouver Island, Geol. Survey of Canada, Memoir 13, 1912, p.17.

4 Ibid., p. 19.

platform so produced now exists, as with the southeastern section, some 200 feet[1] above the sea.

Clapp[2] states that at some time following mature dissection of the uplifted peneplain, part of southern Vancouver Island was depressed, forming the drowned coastline of that part of the Island. The amount of subsidence is not stated, though judging from his account of the formation of the southeastern and southwestern coastal plains, (See foot-note 4, p.5, footnote 1, p.6) it was not great. If this is the case, it would seem difficult to reconcile with Peacock's account involving a late Pleistocene or early post-glacial regional subsidence of about 1,600 feet.[3]

Deposits and glacial striae indicate that a Pleistocene ice sheet crossed the Coast Range, formed large piedmont glaciers, and filled the Gulf of Georgia with an ice stream. Glaciers also flowed laterally away from the higher elevations of the Vancouver Island ranges, which at this time, were covered by ice up to an altitude of about 4,000 feet.[4] The Seymour Arch, (at the widest part of Vancouver Island), appears to have formed a divide which deflected the ice to Queen Charlotte Strait on the northwest, and the Straits of Georgia and Juan de Fuca on the southeast. This glaciation smoothed and rounded all the mountains under 4,000 feet high, and left a mantle of drift deposits of varied

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1 Clapp, Southern Vancouver Island, p.24.

2 Ibid., p.18.

3 Peacock, M.A., The Fiordland of British Columbia, G.S.A. Bull.46, 1935, p.692.

4 Clapp, loc. cit.

thicknesses. On retreat of the first, and largest glaciers, the land stood some 200 - 400 feet lower than at present,[1] and on the pre-glacial peneplain, sediments, both marine and glacio-fluvial, were laid down. Following retreat of the first widespread ice sheet, a period of intense valley glaciation set in, during which the ice strictly followed existing drainage channels.[2] Thus many of the westward flowing valleys were converted into fiords and several of the interior valleys were deepened into large lake basins. In addition, the drift deposited by the first glaciation was partially eroded.

Soon after, or possibly before, retreat of the second glaciation, an uplift of some 250 feet[3] caused a partial recovery from the former depression. With this uplift, the present marine erosion cycle commenced. The drift deposits have been retrograded to form steep cliffs about 250 feet high, while the unmantled portions of the coast present the initial irregularities of the drowned surface. The southwestern coastline of the Island also exhibits the result of strong wave erosion. The remnants of the west coast lowland, formed in the pre-glacial cycle have been cut back so that they now present smooth shorelines between forelands of more resistant rocks.

Areal Geology

Structurally, Vancouver Island, in contrast to

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1 Clapp, Southern Vancouver Island, p.151

2 Peacock, The Fiordland of British Columbia, p.681.

3 Clapp, C.H., Victoria and Saanich Map Areas, Geol. Survey of Canada, Memoir 36, 1913, p.9.

the Coast Range of British Columbia, is largely composed of older, deformed sedimentary and metamorphic rocks, rather than younger intrusives. Thus the Vancouver Island ranges are similar in nature and related to the Olympic Range and the Coast Ranges of Oregon and Washington. The ancient sedimentaries and volcanics were invaded ~~and replaced,~~ in the late Jurassic and early Cretaceous, by irregular bodies of granitic rocks; while both coasts of the Island are fringed with fragmental sediments resting on the older rocks. Covering the hard rocks to various depths is a mantle of partially stratified glacial detritus.

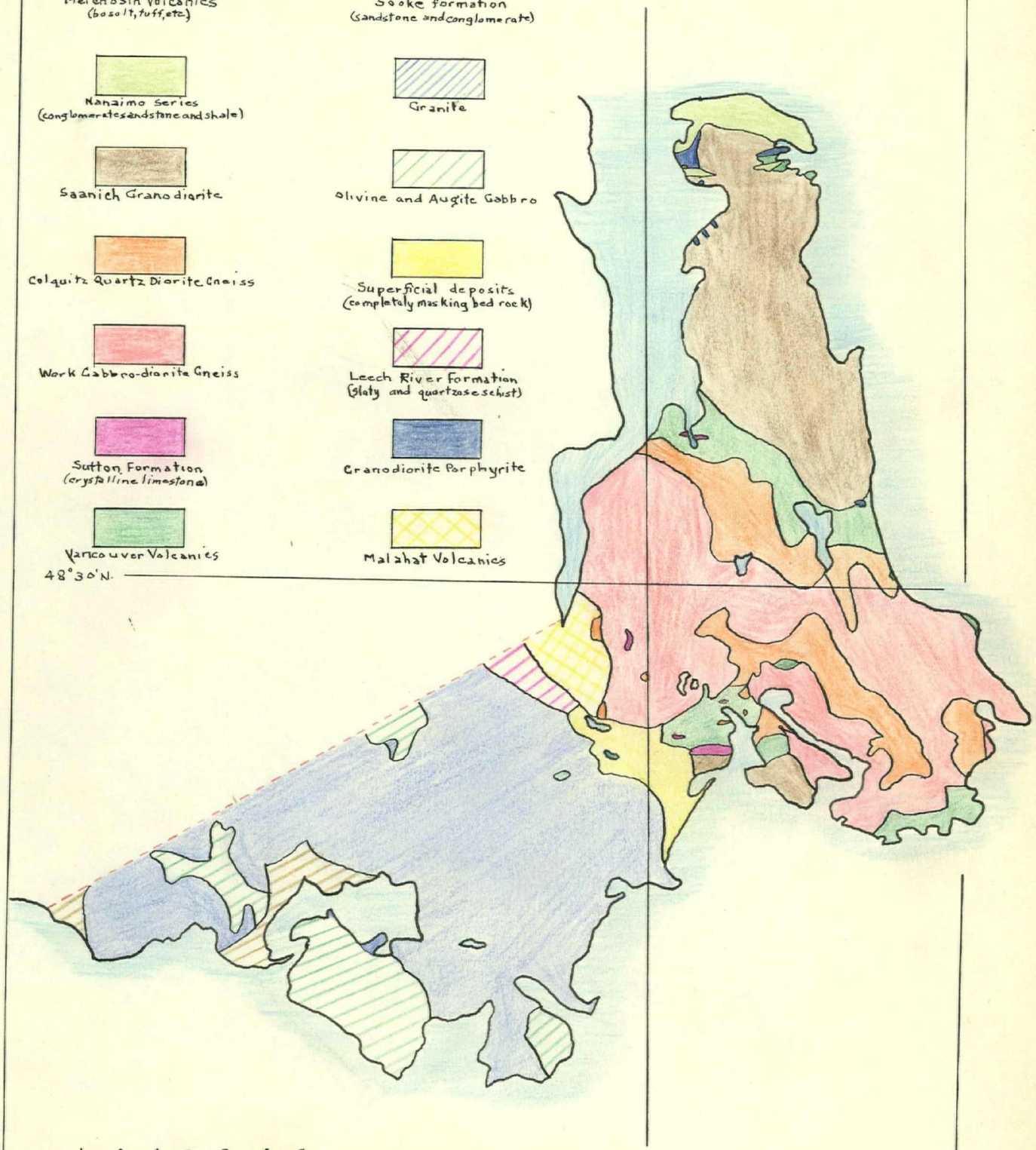
Though the detailed geology of the region of Southeastern Vancouver Island is complicated, the present distribution of the various rock types can be seen from the accompanying map. In the northeast, a narrow belt of sedimentary rocks of upper Cretaceous age, conglomerate sandstone and shale, forms the tip of Saanich Peninsula. Bordering this to the south, is an extensive area of acidic intrusive rocks, chiefly granodiorite and quartz diorite, and termed by Clapp[1], the Saanich Granodiorites. On the south, these upper Jurassic rocks border on a narrow band of upper Triassic sedimentaries and volcanics, the Vancouver Volcanics, stretching from the area of Tod Inlet to Cordova Bay. Another narrow strip, similar to the Saanich Granodiorites, but named by Clapp, the Colquitz Quartz Diorite Gneiss, parallels the Vancouver Volcanics. The Colquitz rocks border on the south,

1 Clapp, C.H., Victoria and Saanich Map Areas, Geol. Survey of Canada, Memoir 36, 1913.

AREAL GEOLOGY

LEGEND

- Metchosin Volcanics (basalt, tuff, etc.)
- Nanaimo Series (conglomerate sandstone and shale)
- Saanich Granodiorite
- Colquitz Quartz Diorite Gneiss
- Work Gabbro-diorite Gneiss
- Sutton Formation (crystalline limestone)
- Vancouver Volcanics
- Sooke formation (sandstone and conglomerate)
- Granite
- Olivine and Augite Gabbro
- Superficial deposits (completely masking bed rock)
- Leech River Formation (slaty and quartzose schist)
- Granodiorite Porphyrite
- Malahat Volcanics



1 0 1 2 3 4 5

scale - 4 miles to 1 inch.

a large and rather irregular mass of basic rocks. These basic rocks are largely intrusives of upper Jurassic age and are chiefly gabbros and diorites. In the east central part of this basic mass are smaller areas of the Colquitz type. Stretching from Oak Bay to the Beacon Hill area is a small arc of Vancouver Volcanics, (upper Triassic), while another area of the same type rocks forms the periphery of Esquimalt Harbour. Around and to the south of the end of Saanich Inlet, a zone of Carboniferous and later sedimentary and volcanic rocks, extends as far south as the Colwood delta. This delta is an heavily drift-covered, roughly triangular area which extends inland from a base lying between Albert Head and the mouth of Esquimalt Harbour. Most of the remaining area of Southeastern Vancouver Island is made up of Eocene volcanics. These are the Metchosin Volcanics, made up of basalts, tuffs and the like. Smaller zones of intrusives and sedimentaries make up the remainder -- in the west central, southwest, Sooke Peninsula and Rocky Point areas, are basic rocks of Tertiary age, largely intrusive; while bordering the western shore of Sooke Harbour and in the extreme southwestern corner of the region, are Eocene or later sedimentary rocks.

Superficial Geology

The superficial geology of Southeastern Vancouver Island illustrates some of the important effects which glaciation has had upon topography, economic geology, soils, and drainage. The ice scoured the upland and removed the soil from the lowland. By quarrying the belts of weaker rocks and scouring some of the existing valleys, lake basins, fiords

and harbours were produced. The drift mantle left after glaciation disrupted drainage, formed valuable non-metallic deposits, and in many instances, has weathered to fertile soils. Though the effects of glaciation have been of paramount importance in man's occupation of the area, the overall picture of the region is one of subdued, drowned relief, developed in the pre-glacial cycle.

The till left by glaciation is varied in character. That left by the first glacier is largely unmodified in the upland areas, though sliding and rain wash on the steeper slopes have caused some change. During retreat of the first, (Admiralty), glaciers, the Admiralty till in the larger valleys and on the coastal lowlands, was reworked by the agencies of rivers, lakes and oceans, causing strati -fication. These stratified deposits are of two main types --those formed in estuaries and lakes, and those formed in rivers and deltas.

Since the land at this time was considerably lower than at present, (as proven by marine fossils), many estuaries existed. In the comparatively still waters of the estuaries, finer sediments were deposited. These have been called the Maywood clays, and consist largely of stratified clay,sand and gravel, with irregularly distributed boulders, (believed dropped from melting ice floes). Since most of these deposits contain marine fossils, their mode of origin is ascertained, though some similar deposits, lacking marine fossils, are believed to have formed in post-glacial lakes.

The stratified deposits formed in rivers and

1. Cut bank in the Cordova sands and gravels, near Cordova Bay. Lenses of sand can be seen interspersed in the gravels. Stratification of these reworked Admiralty tills is apparent. A superincumbent layer, (3 to 4 feet thick), of largely unstratified Vashon till can be discerned above the sands and gravels.

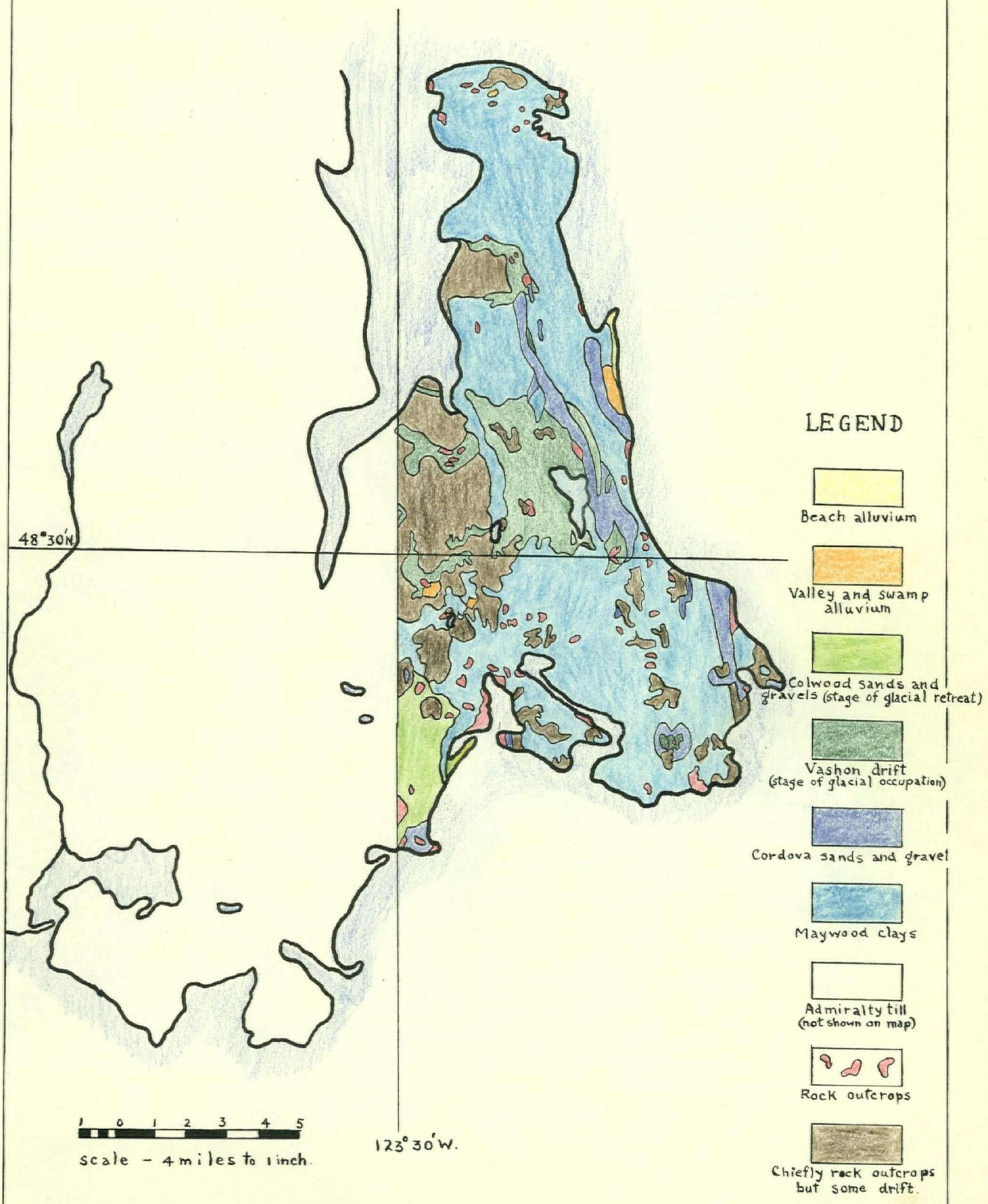
2. Truck farm near Mt. Douglas. The tree-covered, esker-like ridge of Cordova sands and gravels which extends south from the monadnock, forms the background.

deltas during the Puyallup interglacial are of coarser material than the estuarine and lake deposits. They are made up mostly of stratified sand and gravel, and it is believed that either shallower water prevailed or else the rivers and streams issuing from the ice front were more heavily loaded with coarser detritus. These deposits are known as the Cordova sands and gravels.

The Puyallup interglacial ended with the Vashon glacial epoch, and the Vashon drift was deposited at this time. Coincident with, or immediately after this glaciation, the previously mentioned 200 to 400 foot uplift occurred. Most of the Vashon drift was deposited through the agency of ice alone, but some of it is slightly stratified, indicating the work of streams flowing under the glacier, or issuing from it. As mentioned, this second period of glaciation was less intense than that of the Admiralty epoch, for its drift deposits, in the lowlands at least, always rest on those originating from the Admiralty till, and do not rest on bedrock. However, the Vashon glaciers eroded portions of the former deposits, chiefly the Cordova sands and gravels, leaving considerable areas of flat land underlain by the Maywood clays. In some places, the sands and gravels were protected by monadnocks, and thus formed esker-like ridges behind the latter.

It is believed that the recession of the Vashon glaciers was rapid, because of the absence of distinctive features such as moraines and eskers, formed of Vashon drift. However, a large delta, the Colwood plain or delta, was formed at this time in front of the receding ice. Apparently it was

SUPERFICIAL GEOLOGY OF THE VICTORIA — SAANICH AREA



laid down at least partly in salt water, by a heavily loaded stream flowing from a large valley glacier occupying the Goldstream-Leech river valley. These deposits have been called the Colwood sands and gravels.

In post-glacial times delta and river deposits have been left by rivers existing to-day, while several smaller lakes, sloughs and ponds have become filled with alluviums.

The accompanying map of superficial geology indicates the preponderance of Maywood clays in the drift deposits[1].

3. GEOMORPHOLOGY

The general map, (Plate II), and the accompanying small scale topographic map will aid in locating the physical features mentioned in this chapter.

Present Landforms and Drainage

The greater part of Southeastern Vancouver Island consists of the lowland surface developed during the pre-glacial cycle. This lowland, now averaging 200 feet in elevation, is surmounted by numerous, but relatively small, rounded monadnocks, one of the most prominent of which, Mt. Newton, is 1,025 feet above the sea. In the west and southwest, the lowland grades into a maturely dissected upland area, referred to in the section under geologic history as a portion of the

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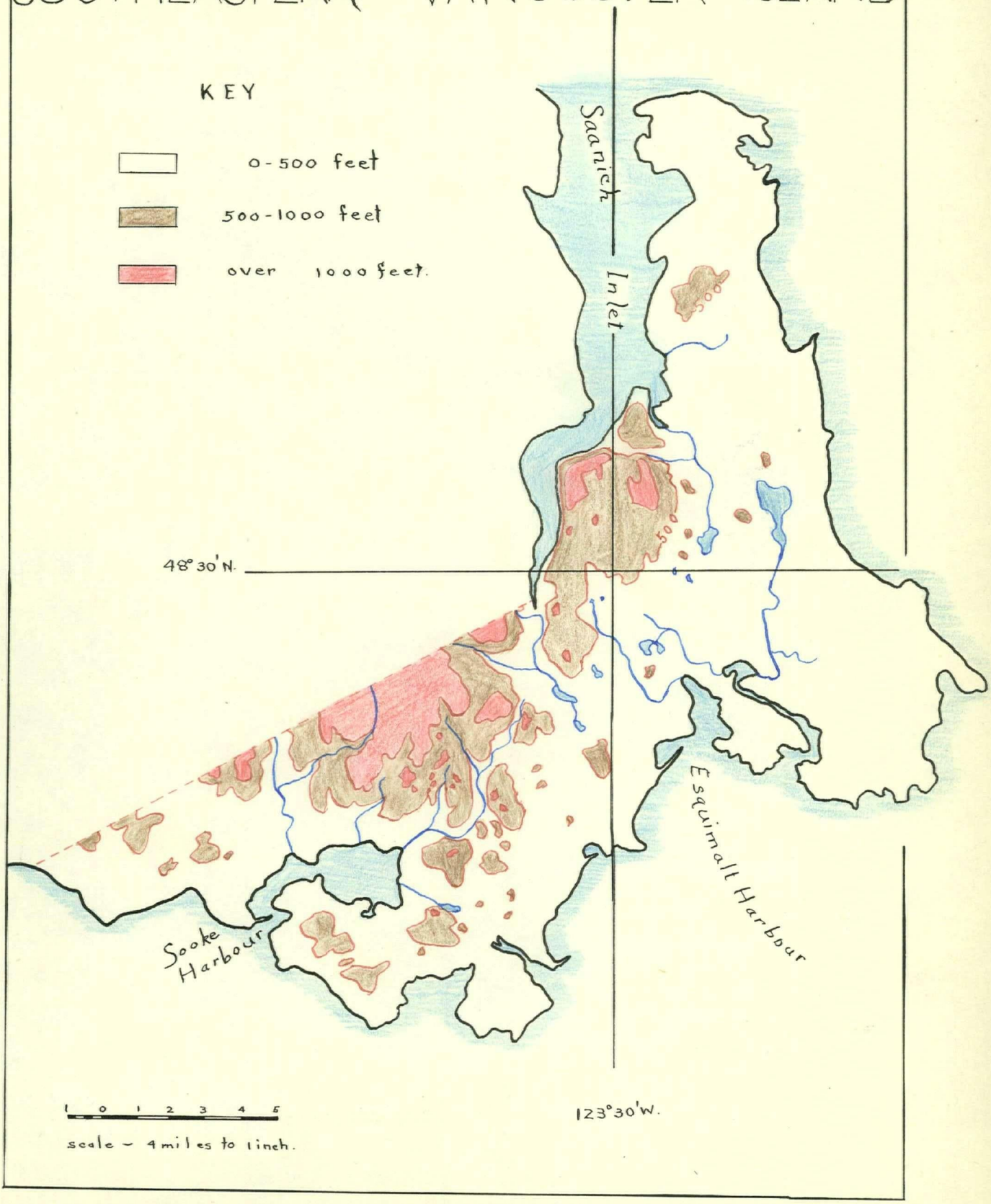
1 Map adapted from map contained in Clapp's report on the Victoria and Saanich areas. The boundaries of each type of deposit are approximate. They have been drawn only where the deposit concerned reaches an appreciable thickness and is easily recognized. No map of superficial geology for the southwestern part of the region is at present available.

TOPOGRAPHY OF SOUTHEASTERN VANCOUVER ISLAND



uplifted Tertiary peneplain. This upland is actually a part of the Vancouver Island ranges, and since it has been glaciated, the elevations have smooth, rounded outlines. The scouring action of the glaciers is also evidenced in a small fiord forming part of Saanich Inlet, and in the drowned, glaciated valleys forming the harbours of Victoria, Esquimalt and Sooke.

The lowland surface is not flat, but in the areas where there is little or no drift mantle, many small, irregular valleys exist, which follow zones of weaker rocks. Numerous hollows in the mantle of the drift covered areas have given rise to shallow lakes, such as Elk Lake, North of Victoria and Langford Lake in the Colwood area. Others, however, were formed in deepend rock basins as exemplified by Prospect Lake, west of Elk Lake, and Thetis Lake, near Esquimalt Harbour. Elk Lake, the largest within the region, was the former centre of water supply for Victoria city. Some of the monadnocks, notably Mt. Douglas and Mt. Tolmie, both near Victoria, have presented bulwarks to erosion by the Vashon glaciers, and hence drift trains extend south from them. That of Mount Douglas or, as it is sometimes called, Cedar Hill, is nearly a mile long and about 90 feet high. The drift mantle forms a wide flat plain in the central part of the region, known as Colwood plain or delta. This flat area forms the mouth of a wide valley which extends for many miles across southern Vancouver Island in a roughly east-west direction. Relatively few streams traverse the lowland in the northeastern portion of the region, and

those which do are largely discontinuous. Colquitz River, draining from Elk Lake into Portage Inlet, is a notable exception.

The upland in the northern half of the region is almost wholly restricted to the area south of Tod Inlet, north of Langford Lake, and west of Thetis and Prospect Lakes. Thus it forms a large block northwest of Victoria, and is known as the Highland District. This section of the southern upland of Vancouver Island has been maturely dissected by several small streams, so that it is characterized by numerous hills. The highest of these is Mt. Work, with an elevation of 1,400 feet. The streams are adjusted to the zones of weaker rocks, and as a result, the valleys have a general north-south trend. The glacial movement having been generally in a north-south direction, has considerably deepened the valleys; and in scoured rock basins, many small lakes were formed, such as Prospect Lake in the east, and Fizzle Lake in the central section. It would appear that the six small lakes skirting the base of Mt.Work, Durrance, Heal, Killarney, Fork, Third and Pease lakes, were formed as a result of scouring by a glacier deflected by that monadnock. In addition to scouring action of the glaciers, scattered drift deposits were laid down in the valleys. Another evidence of glaciation is the small inlet - Tod Inlet - which is somewhat fiord-like in character. The sheltered waters of this inlet, combined with the adjacent deposit of Sutton limestone, were the chief determining factors in the establishment of a former cement manufacturing plant here. The western boundary of the upland is a typical fiord forming the southern part of

Saanich Inlet and comprised of Squally Reach and Finlayson Arm.

The coastline of the northern part of the region is quite irregular in outline --the result of depression of the reduced surface, glaciation, and partial recovery. The main irregularities, Saanich Inlet, Esquimalt Harbour and Victoria Harbour, have been mentioned as drowned, glaciated valleys. That of Victoria Harbour extends northwesterly and forms a peculiarly shaped body of water known as Portage Inlet, joined to Victoria's outer harbour by Victoria Arm, Selkirk Water, Inner Harbour and the mouth of James Bay. The eastern shoreline of the region dips under the waters of Haro Strait. Numerous ridges representing resistant protrusions, (monadnocks), on the Pacific Coast Downfold, appear offshore as islands. At least two of the off-lying islands, however, represent wholly or in part, ridges of glacial drift. These are James and Sidney islands. Moderate marine erosion has retrograded the drift deposits which overly most of the northern part of the region, forming steep sea cliffs, and in some places, sand spits and boulder beaches. These features are particularly evidenced in the areas of Saanichton Bay and at the seaward edge of Colwood delta, where a long spit, Coburg Peninsula, almost isolates Esquimalt Lagoon. A large portion of the coast, however, presents resistant rocks to the sea, forming a youthful shoreline in contrast to those of the retrograded areas. Here, the initial irregularities of the glaciated, depressed surface have survived, and minor features such as coves and wave chasms, have developed in the weaker rocks.

Looking north along Coburg Peninsula. Esquimalt Lagoon is visible on the left, and the entrance to Esquimalt Harbour is in the right background. The monadnock of Mt. Douglas can be seen above the entrance to the harbour. Coburg Peninsula is believed to have been built by northward setting longshore currents carrying eroded materials from the Colwood delta.

Often, the hard rocks form headlands between areas of retrograded drift deposits.

In the southern half of Southeastern Vancouver Island, the lowland areas are much more limited and scattered, largely confined to the narrow coastal plain and the river valleys. The lowland of the southwest coast forms the remnants of the once extensive west coast lowland. In this area, wave action has been strong, and the sediments deposited against the crystalline rocks, together with the overlying drift, have been largely removed, leaving scattered remnants of the plain between protecting headlands of the crystalline rocks. These remnants are of no great extent, being only one to five miles long and one quarter to three miles wide, as shown by those existing between the headlands of East Sooke Peninsula, Otter Point, and Sheringham Point. The lowland is drift covered and for the most part, presents little relief. In the Metchosin and Esquimalt Districts, the coastal lowland is more extensive, though strictly speaking, it might be considered as part of the east rather than west, coast lowland. Part of the reason for its greater extent in the east, is that it has not undergone the severe wave erosion that is experienced along the coast of Sooke and Otter Districts. The eastern half of the peninsula south of Pedder Inlet forms a fairly extensive part of the coastal lowland. North of this, from the area of Parry Bay to that of Langford Lake, the lowland is broken by only two significant elevations --Mount Metchosin and Triangular Mountain.

In its western part, the lowland is drained by southward flowing streams, and since it has been uplifted, the streams have been rejuvenated and have cut relatively narrow gorges to the coast. Tugwell Creek, in the extreme western part of the region is typical of these. Sooke River is the largest stream crossing the lowland, and is the largest stream in the region. With its southern most tributary, DeMamiel Creek, it drains a fairly extensive part of the lowland north of Sooke Harbour. Being of considerable volume, Sooke River has cut the sediments of the lowland to grade, so that in its southern course, it meanders over a flood plain. This flood plain, along with the overlying glacial drift, has been terraced. In addition the river has extended a delta which now almost separates Sooke Harbour from the larger Sooke Basin.

The upland areas in the southern half of the region represent, as in the Highland District, the mature dissection of the uplifted Tertiary peneplain. The dissection has been accomplished by a number of small, generally southward flowing streams, adjusted to the weaker rocks, and like the Highland District, the valleys trend generally north - south. Nearly all these valleys have been strongly glaciated, producing smooth sides and fairly wide, usually drift covered, floors. This is particularly true of the larger valleys, notably that of Sooke River. In some cases the valleys have been deepened to form small lake basins, such as that of Lake Matheson, southeast of Sooke Basin. More usually, the valleys are drift filled, and small hollows in these drift deposits give rise to small lakes and ponds. In the central part of the region, a

Looking upstream from the mouth of Sooke River. The river has terraced its flood plain in the lower reaches. The terrace on the right is planted to potatoes. Hydro-electric transmission lines bringing power from the Jordan River plant to Victoria, appear in the centre of the photograph.

valley now partially occupied by Goldstream River, has been filled with drift which widens eastward into Colwood delta. Shallow hollows in the drift are occupied by Florence, Glen and Langford lakes. These drain northward into Goldstream River, which in turn flows north into Saanich Inlet. This river, which forms a part of the present water supply system for Victoria, has cut a narrow gorge through the glacial deposits to the underlying bedrock. The hills of the upland area south of Goldstream River, increase in height from the coast inland. Thus near the coast, Mt. Metchosin, Mt. Blinkhorn and Garibaldi Hill, rise to elevations of from 600 to 800 feet, while to the northwest, Mt. McDonald, Mt. Helmcken, Mt. Redflag, Mt.Matheson and Broom Hill reach from 900 to 1400 feet above the sea. Along the boundary with the main portion of the Vancouver Island ranges, Mt. Shepherd (also named Mt. Manuel Quimper), Ragged Mountain and Braden Mountain range from 1,500 to nearly 1,900 feet high.

The shoreline of the southwestern part of the region is, like that of the Victoria--Esquimalt area, formed by the drowning of wide, but rather shallow valleys in the greatly reduced surface. Thus broad, shallow bays separated by wide, low headlands, with offlying rocky islands characterize the coast from Albert Head to Sooke Harbour. The drowning of this area has been so complete, that a partially inundated glaciated valley extending from Roche Cove in Sooke Basin, through Matheson Lake to Pedder Inlet, very nearly separates the east Sooke and South Metchosin areas from the mainland of Vancouver Island.

The shoreline is largely composed of resistant rocks, and weaker areas within them, such as shear zones and joints, have been eroded forming small coves and wave chasms. On the other hand, parts of the coast particularly along Parry Bay and the north shore of Sooke Harbour have been cut in glacial deposits, producing cliffs similar to those of east Saanich and Colwood delta. In the northern part of Parry Bay, long-shore currents have built a spit composed of the eroded till, and this spit all but isolates Metchosin Lagoon from the rest of the Bay. Another, similarly built spit, Whiffin Spit, nearly closes the entrance to Sooke Harbour. West of Sooke Harbour, the shore line is fairly regular, and as previously referred to, presents crescent shaped bays between protecting headlands of crystalline rock. Between these promontories, the sedimentary rocks together with any overlying drift, have been cut back to form steep cliffs, dissected by southward flowing streams, and skirted on the seaward side by narrow boulder beaches.

Broad Effects of Physiography on Land Use in the Region

The effect which physiography has had upon the utilization of the region is apparent in several ways. The farm lands in Southeastern Vancouver Island are concentrated in the eastern portion, particularly in the northeast, for here the land is comparatively level in contrast to that of the west and southwest. In addition, glacial deposition has resulted in the formation of good agricultural soils, again, particularly in the northeast. Thus, from the suburbs of

Looking east along the shores of Sooke Bay near Otter Point, showing resistant forelands of Sooke gabbros between crescent-shaped gravel and boulder beaches of eroded superficial deposits. The superficial deposits overlie scattered remnants of the west coast lowland, built of Tertiary sedimentary rocks.

Victoria to the northern tip of the Saanich Peninsula, stretch most of the farm lands within the region. While the soils in the northeast are sandy loams and silt loams, those in the central and southwest vary from clays to sandy and gravelly soils. The soils of the former area have been extensively developed for the cultivation of small fruits as well as early market peas and potatoes, bulbs and seed crops. In the southwest, however, land use varies from dairying and mixed farming on the heavier textured soils, to poultry raising and sheep ranching on the gravelly and stony soils.

Physiography has also had an effect on the mineral industry in the area. Minor deposits of metallics have been discovered in the glacially scoured uplands, notably in the west central and southwestern sections. However, of far greater importance locally, are the scattered non-metallic deposits of clays and gravels of glacial origin, which, past and present, have formed an important part in the economy of the region.

The ocean littoral, in as much as it is a phase of the physiography and hydrography of the region, further illustrates the effect of physical control on industry in the region. Being surrounded by water on nearly all sides, the region is well situated to the development of a local fishing industry, the many bays and harbours providing shelter and operating centres for small craft, and the comparatively shallow adjacent waters forming feeding grounds for several species of fish. The logging industry also utilizes the numerous coastal indentations for booming grounds, while the

harbours of Victoria, Esquimalt and Sooke are important to coastwise and deepsea trade.

One of the most significant evidences of physical control is the influence of physiography upon climate. In its broader aspect, Southeastern Vancouver Island is seen to lie to the leeward of the Vancouver Island ranges, and therefore it experiences considerably less rainfall than adjacent areas of Marine West Coast type. A more detailed analysis shows further differentiation within the region--again, a physiographic control.

4. CLIMATE

Climatic Controls

The climate of Southeastern Vancouver Island has exercised a profound control over the natural vegetation, physiography, agriculture and habitability of the region. The complex of factors which make up the climate are so closely interrelated as to make their enumeration difficult, but among them are: latitude, relationships of land and water masses, ocean currents, topography, pressure systems and prevailing winds. These controls, acting through and upon each other, produce a great variety of microclimates within the broad climatic region often referred to as the Marine West Coast. The latter term implies a general location in the mid-latitudes on the western side of a continent. Marine West Coast also connotes the general climatic characteristics of mild winters, cool summers, abundant precipitation most of which falls in winter, a long growing season and a small diurnal and annual

temperature range. To serve as a background for a more detailed treatment of the region of Southeastern Vancouver Island, it might be useful to consider the broad relationships within the Marine West Coast climatic type.

Since these climates occupy mid-latitudes on the windward coasts of continents, they are greatly influenced by the maritime air masses which move in a general west to east direction. Consequently the coasts tend to assume the temperature characteristics of these air masses, which themselves reflect the temperature of the ocean over which they move. For this reason, Marine West Coast stations are warm for their latitude in winter and cool for their latitude in summer. Adding to this temperature anomaly, are the poleward moving ocean currents, which impart to the on-shore winds, some of the temperature characteristics of the warmer latitudes from which they have come. To illustrate this effect, mean January temperatures for a few scattered inland and coastal stations may be considered. Vamcouver, in latitude 49°N. has a January mean of 36°F - approximately the same as that for Venice (lat.45°N), Teheran (lat.36°N), Amarillo, Texas (lat.35°N.), and Louisville, Kentucky, (lat. 38°N).[1] July mean temperatures for the same stations in respective order are: 63°, 75°, 77°, 77°, and 79°. Another effect of the ocean on the landward moving air masses is to raise their water vapour content. This acts as a further temperature modifier, since it has the double action of reducing

1 Statistics obtained from: Climate and Man, Yearbook of Agriculture, U.S. Dept. of Agriculture, Washington, D.C., 1941.

incoming insolation, thereby retarding heat gain, and also absorbs outgoing radiation, thereby reducing heat loss. In consequence, diurnal temperature range, either winter or summer, is small.

Marine West Coast stations are found in the "zone" of Westerly winds and thus in the paths of mid-latitude depressions. Particularly in the fall and winter months, these stations are under the influence of constantly varying pressure systems, bringing associated weather variability. These depressions result from the interplay of air masses which have different characteristics. Even so, the air masses, in travelling over the ocean, regardless of trajectory, are modified by it, and the temperature contrasts between them are not as strong as, for example, those between Tropical Gulf and Polar Continental air masses. This is not to imply that the pressure systems are weak, for the resultant winds make winter gales common, but temperatures are never very low. The contrasting, rapidly converging air masses, having a relatively high moisture content, bring abundant precipitation in the form of frontal rain, while heavy cloud cover and fog are common. Occasionally in the winter months, a westward moving, stable, continental air mass will invade the west coastal area, bringing cold clear weather which may persist for several days. Usually, however, the clear weather is limited to the short periods between depressions; and with these, the temperatures, though possibly freezing, are not as cold as those experienced under the cP "cold spells".

In marked contrast to the winters, summers at Marine West Coast stations are relatively sunny, and dry, particularly on the equatorward margin of the climatic type. However, these marine climates have cloudy summers in comparison to other temperate climates. The reason for the seasonal change is the poleward migration of the Pacific High in the summer months. Accordingly, mid-latitude depressions are weak or lacking and the stable atmospheric conditions give these stations their most favorable season.

Topography, as would be expected, alters the general pattern of Marine West Coast climate. Not only local topography, producing a variety of micro-climates within small areas, but also larger features limit the area and modify the expression of this climatic type. Where mountains rise directly behind the coast, as in British Columbia, the marine climate is limited to a narrow strip along it. While the mountains provide a barrier to the extension of the marine climate eastward, they also tend to prevent continental air masses from flowing westward. Particularly in winter, a broad effect of topography on the coastal climates is illustrated. During winter, cold air from the mountain valleys moves westward, providing a cold, upslope surface over which the landward moving maritime air mass glides, thereby cooling and precipitating most of its moisture.

Detailed Climate of the Region

The climate of Southeastern Vancouver Island is considerably different from adjacent areas of Marine West Coast

type. Lying to leeward of a large part of the Vancouver Island ranges, it experiences less precipitation than areas on the windward side of them, and also less precipitation than neighboring areas on the mainland. This "rain shadow" effect has further implications in that the Victoria--Saanich area has some of the highest values for recorded sunshine in Canada. The sheltered position of the region--Olympic Mts. to the south and southwest, Vancouver Island ranges to the west and northwest, and Coast Range to the north and east--also has an effect in reducing wind velocities particularly those from the north and north west. The sheltered position is also insular. Consequently, while the region is largely protected from the violent winter storms which are experienced on the "west coast", sea breezes from Juan de Fuca Strait during the summer months, ensure protection from the hot weather so commonly experienced at interior stations. The insular position of Southeastern Vancouver Island also reduces incidence of frost during the winter months, well illustrated by Victoria's average frost free period of 254 days, one of the longest in Canada.[1] In addition, the position of the region, separated from the mainland by Georgia Strait, appears to affect the amount of Cordilleran air which spreads to the area in the winter months. This insular position, in combination with the local topography of the region, strongly affects wind direction.

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1 This value, obtained from a table of Temperature, Precipitation and Sunshine at Selected Stations in Canada, Met. Division, Dept. of Transport, Canada; is based upon the number of days experiencing a minimum temp. above 32°F recorded in a screen 4½ feet above the ground.

Thus, while the frequency of easterly winds at Victoria in the months October to March inclusive, averages 13 percent, and southeasterly winds average 10 percent, northeasterly, northerly, westerly and southwesterly winds for the same period, average 14, 27, 15 and 10 percent respectively. Vancouver, for the same period, has easterly winds in 35 percent frequency, southeasterly 17 percent, northeasterly 17 percent, northerly 2 percent, westerly 8 percent, and southwesterly 5 percent. It is apparent then, that Southeastern Vancouver Island experiences a climate considerably different from the "average" Marine West Coast type.

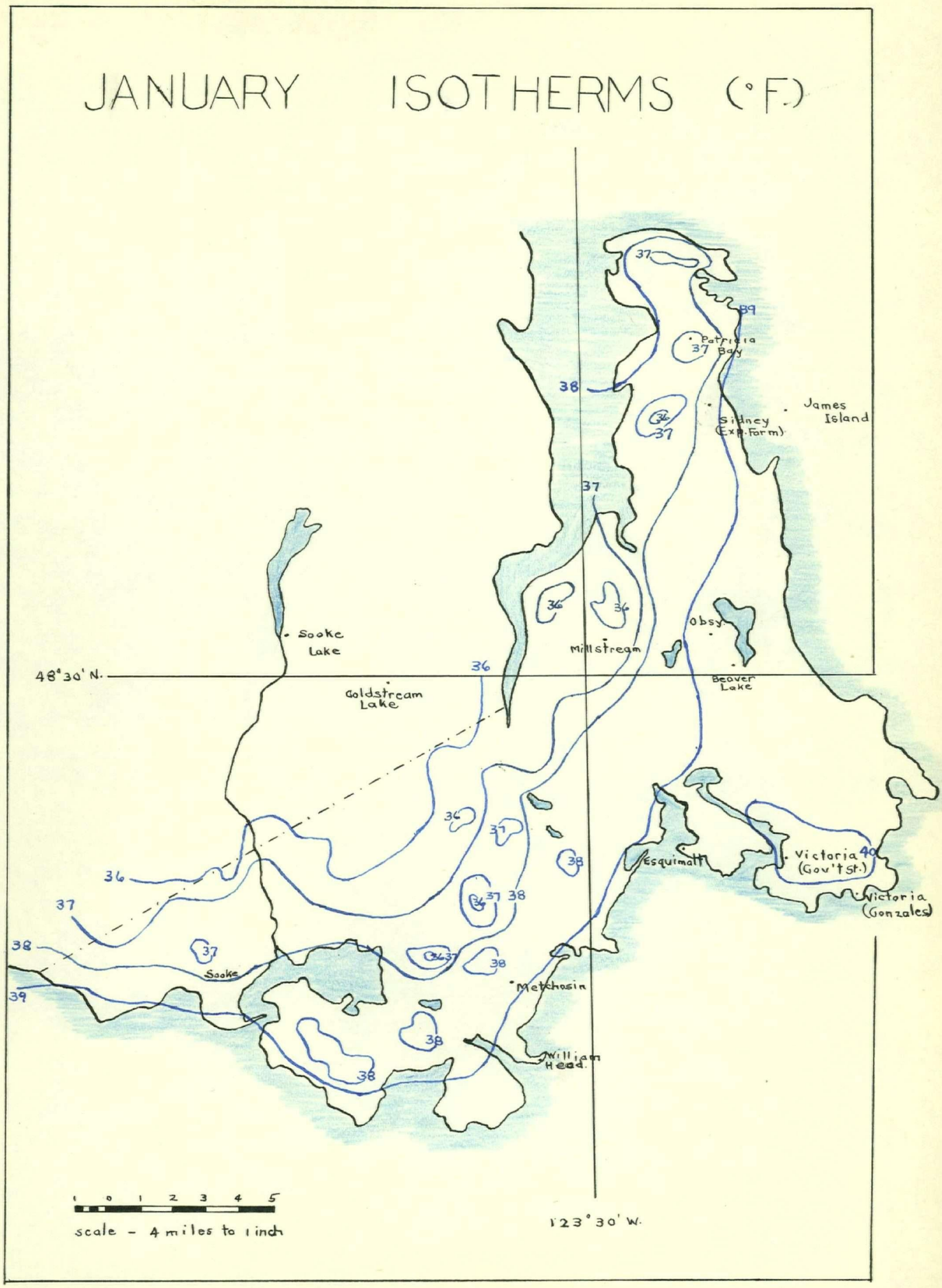
Considering the annual averages of mean daily temperature; Victoria's mean of 50°F., may be compared with Vancouver's 49°, Winnipeg's 35°, St.Catharines' 48°, Montreal's 43°, and that for Halifax, 44°.[1] However, mean annual temperature has little significance in a consideration of climate, since it does not indicate seasonality of temperature. Of greater importance is mean monthly temperature. The following table, listing mean monthly temperatures will give some idea of the seasonality, (and continentality) for the selected stations.[2]

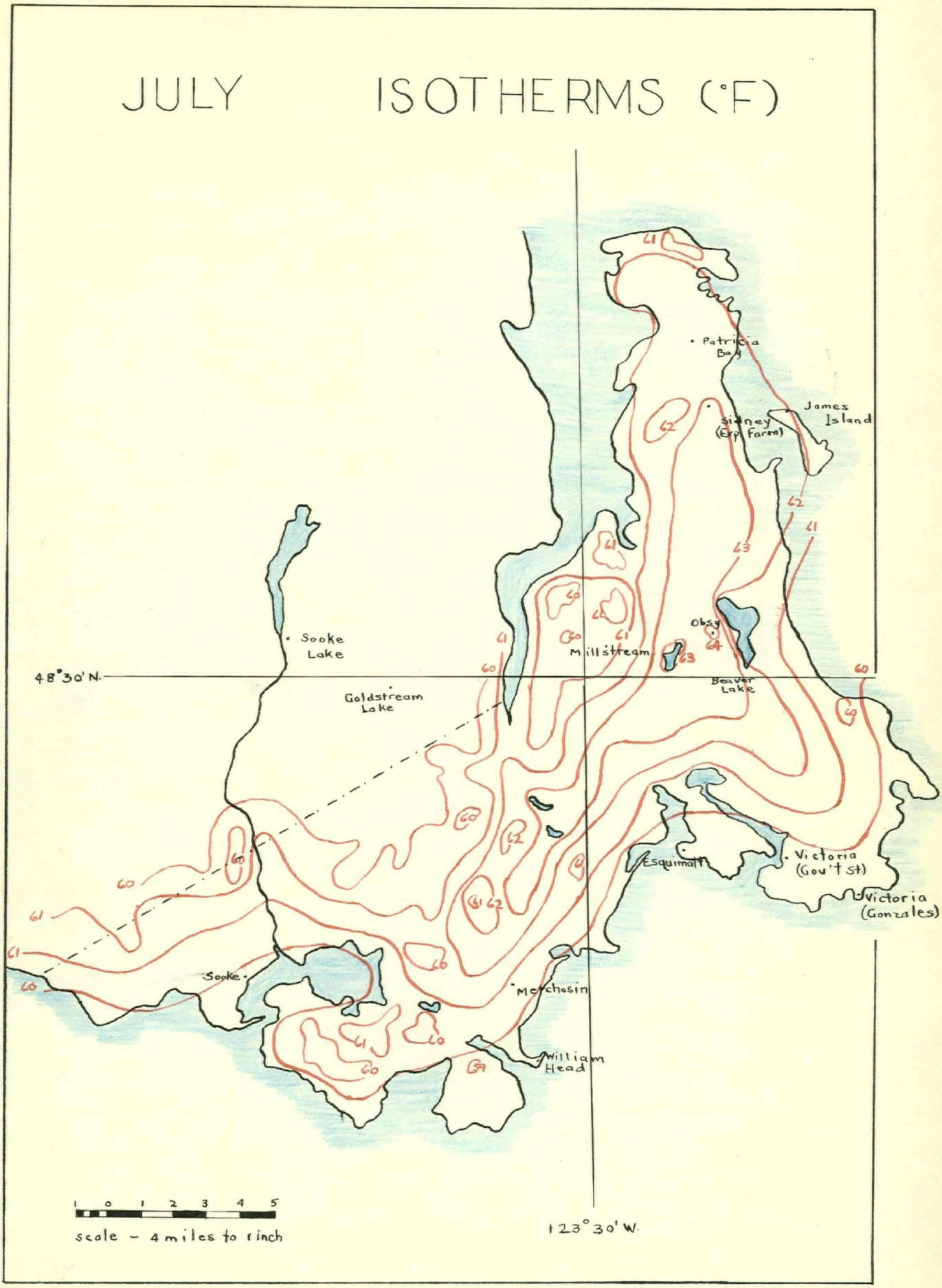
MEAN MONTHLY TEMPERATURE

	J	F	M	A	M	J	J	A	S	O	N	D	MEAN ANNUAL RANGE
VICTORIA	39	40	44	48	53	57	60	60	56	51	45	41	21
VANCOUVER	36	39	43	48	55	60	64	63	57	50	43	39	28
WINNIPEG	-3	2	16	38	52	62	67	64	54	41	22	6	70
ST.CATHARINES	26	25	33	44	55	66	71	69	63	52	40	29	46
MONTREAL	14	15	26	42	56	65	70	67	59	47	33	20	56
HALIFAX	24	23	30	39	49	58	65	65	59	49	39	28	42

1 Values obtained from a table of Temperature, Precipitation and Sunshine at Selected Stations in Canada, Met.Division, Dept. of Transport, Canada.

2 Ibid., passim.


JANUARY ISOTHERMS (°F.)
37
39
38
Patricia Bay
37
James Island
Sidney (Exp. Farm)
37
37
36
36
Obsy.
Millstream
Sooke Lake
48°30' N.
36
Goldstream Lake
Beaver Lake
36
37
38
Esquimalt
Victoria (Gov't St.)
40
Victoria (Gonzales)
36
37
38
37
38
37
38
Sooke
Metchosin
38
38
William Head
1 0 1 2 3 4 5
scale - 4 miles to 1 inch
123°30' W.


JULY ISOTHERMS (°F)
Patricia Bay
James Island
Sidney (Exp Farm)
Sooke Lake
Millstream
Obsy
Beaver Lake
48°30' N.
Goldstream Lake
Esquimalt
Victoria (Gov't St)
Victoria (Gonzales)
Sooke
Metchosin
William Head
123°30' W.
scale - 4 miles to 1 inch

The mean annual range shown in the last column of the preceding table well illustrates the ameliorating effect of the ocean on temperature--keeping winter temperatures mild and summer temperatures cool--reducing the amount of seasonal fluctuation.

The accompanying maps[1] of January and July isotherms will convey some impression of the local seasonal temperature differences within the region.

Since monthly mean temperatures can be misleading in that they may be composed of a number of very low and very high temperatures, the following graph of monthly averages of daily maximum and minimum temperature may form a useful visual comparison of the selected stations.[2] Probably one of the most significant facts illustrated by the graph is that, while Victoria's minima are greater than the maxima for Moose Jaw and St.Catharines in the three coldest months, the latter city has the highest minima for June, July, August and September. This is an important factor in the types of crops which can be successfully grown in the area of St.Catharines, as compared with that of Victoria. Quick maturing but heat loving plants could well be grown near the former centre, whereas Victoria's temperature regime is suited to tender perennials which do not require a great deal of summer heat. On the other hand, the

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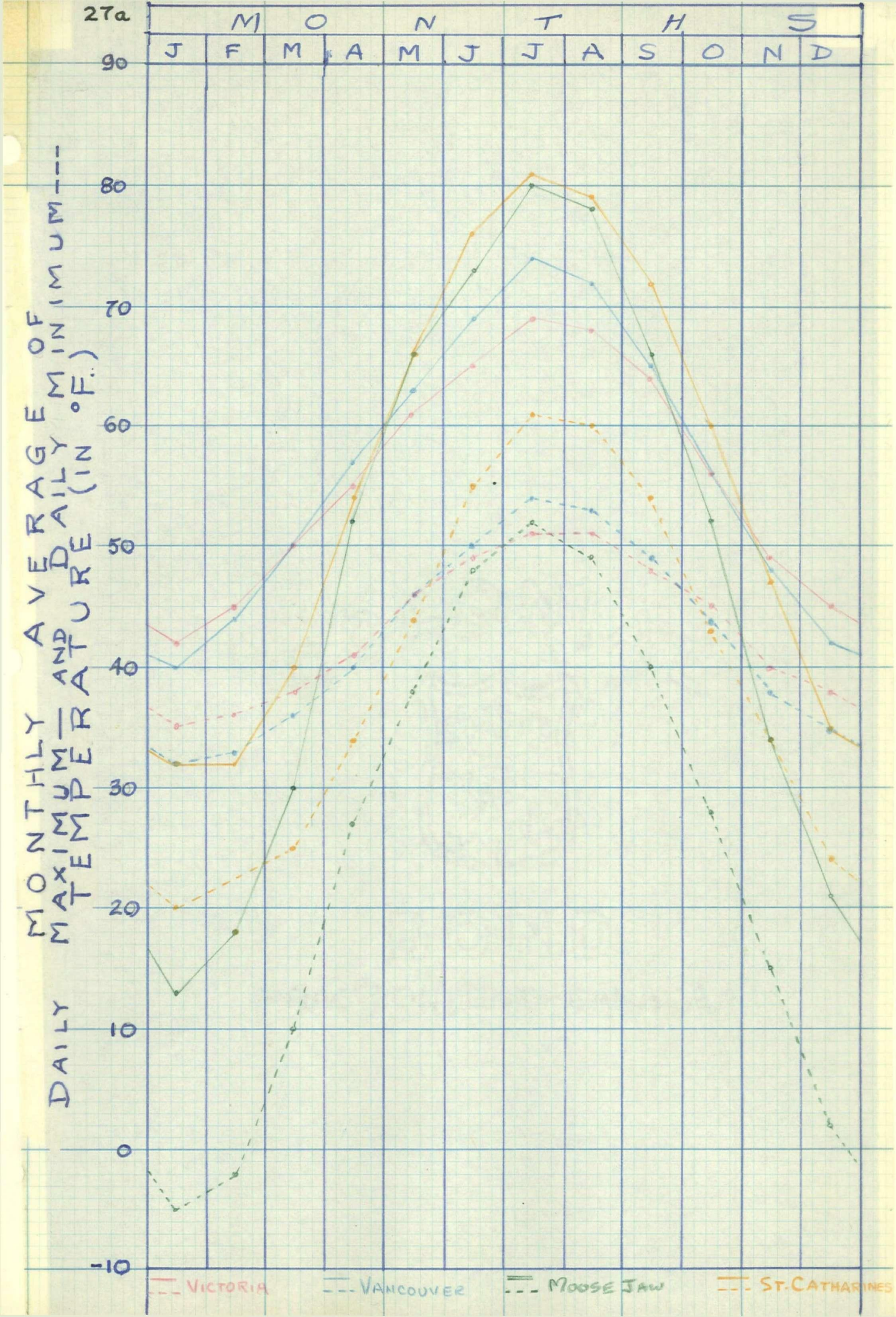
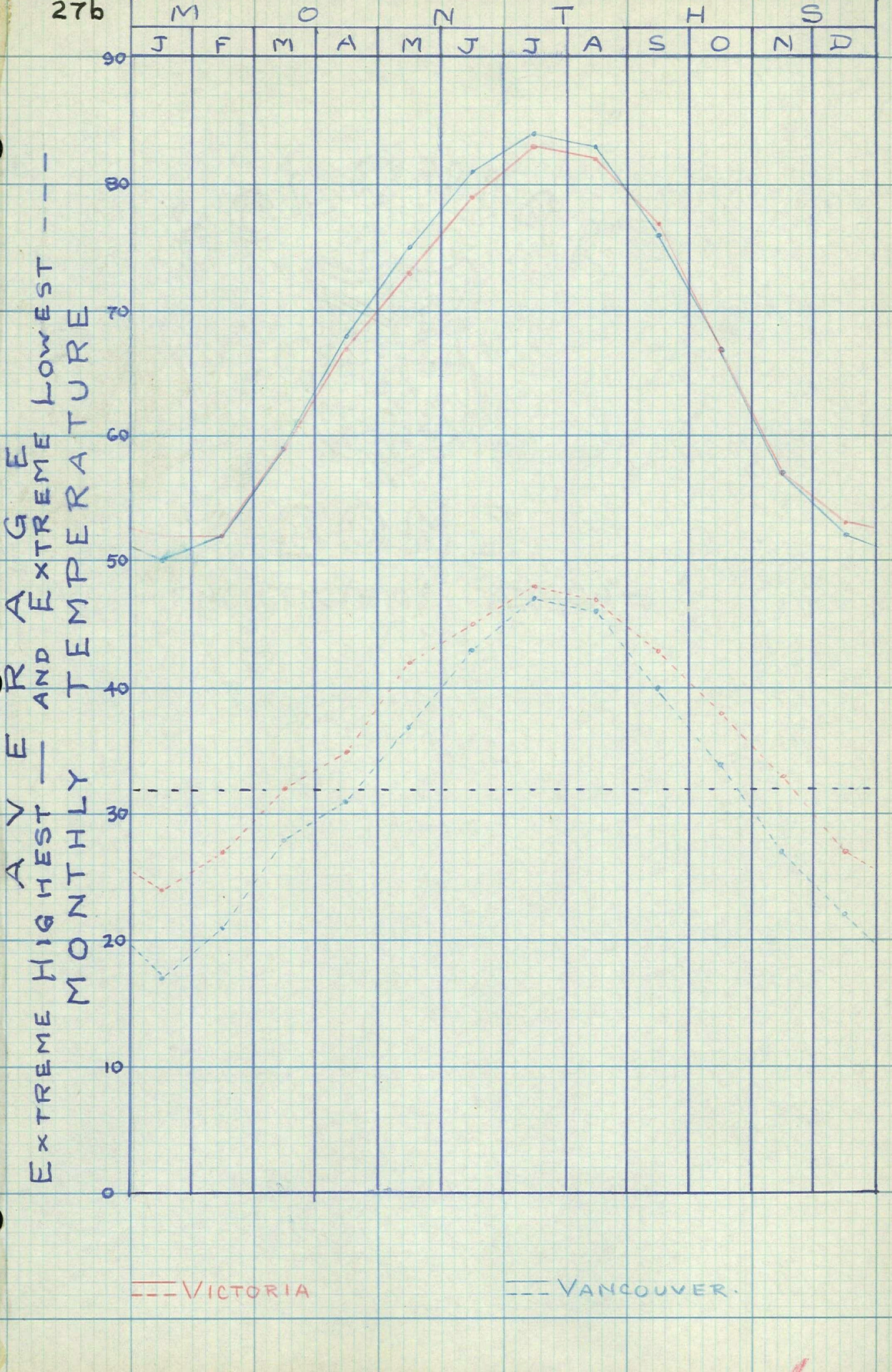
1 Statistics obtained from:
1. Climate of B.C., Reports for 1937 and 1947, Dept. of Agriculture, Victoria, B.C.
2. Climatic Summaries for Selected Meteorological Stations in the Dominion of Canada, vol. 1, Met. Division, Dept. of Transport, Toronto, Canada.

2. Statistics obtained from Climatic Summaries, vol.1, Dept. of Transport, Toronto, Canada.


MONTHS
J F M A M J J A S O N D
90
80
70
60
50
40
30
20
10
0
-10
DAILY AVERAGE OF MAXIMUM AND MINIMUM TEMPERATURE (IN °F.)
VICTORIA
VANCOUVER
MOOSE JAW
ST. CATHARINES


M O N T H S
J F M A M J J A S O N D
90
80
70
60
50
40
30
20
10
0
AVERAGE
EXTREME HIGHEST AND EXTREME LOWEST
MONTHLY TEMPERATURE
VICTORIA
VANCOUVER.

uniformity and mildness of temperature throughout the year at Victoria contribute to its desirability as a place in which to live.

Tentatively regarding Victoria as representative of the region as a whole, the accompanying comparison between Victoria and Vancouver will give some idea of the extreme temperatures likely to be encountered in Southeastern Vancouver Island as compared with the south coast of the mainland. The average, (over a period of 45 years for Victoria and 38 years for Vancouver), of the extreme highest and extreme lowest temperature recorded in each month of the year is shown in the graph.[1] Though it indicates the little difference existing between the extreme maxima at the two stations, it also shows the significant differences between the extreme minima--important in a consideration of the length of frost-free season and length of growing season. On the basis of this difference, a number of tender plants which do not thrive in the Vancouver area, can be successfully grown near Victoria. It is therefore a major factor in the success of the nursery and greenhouse establishments in the region.

An examination of the monthly average of daily maximum temperature, (over a 10 year period of observation), for stations within the region of Southeastern Vancouver Island, shows very slight differences between them. The following graph will illustrate this for both the maximum and minimum

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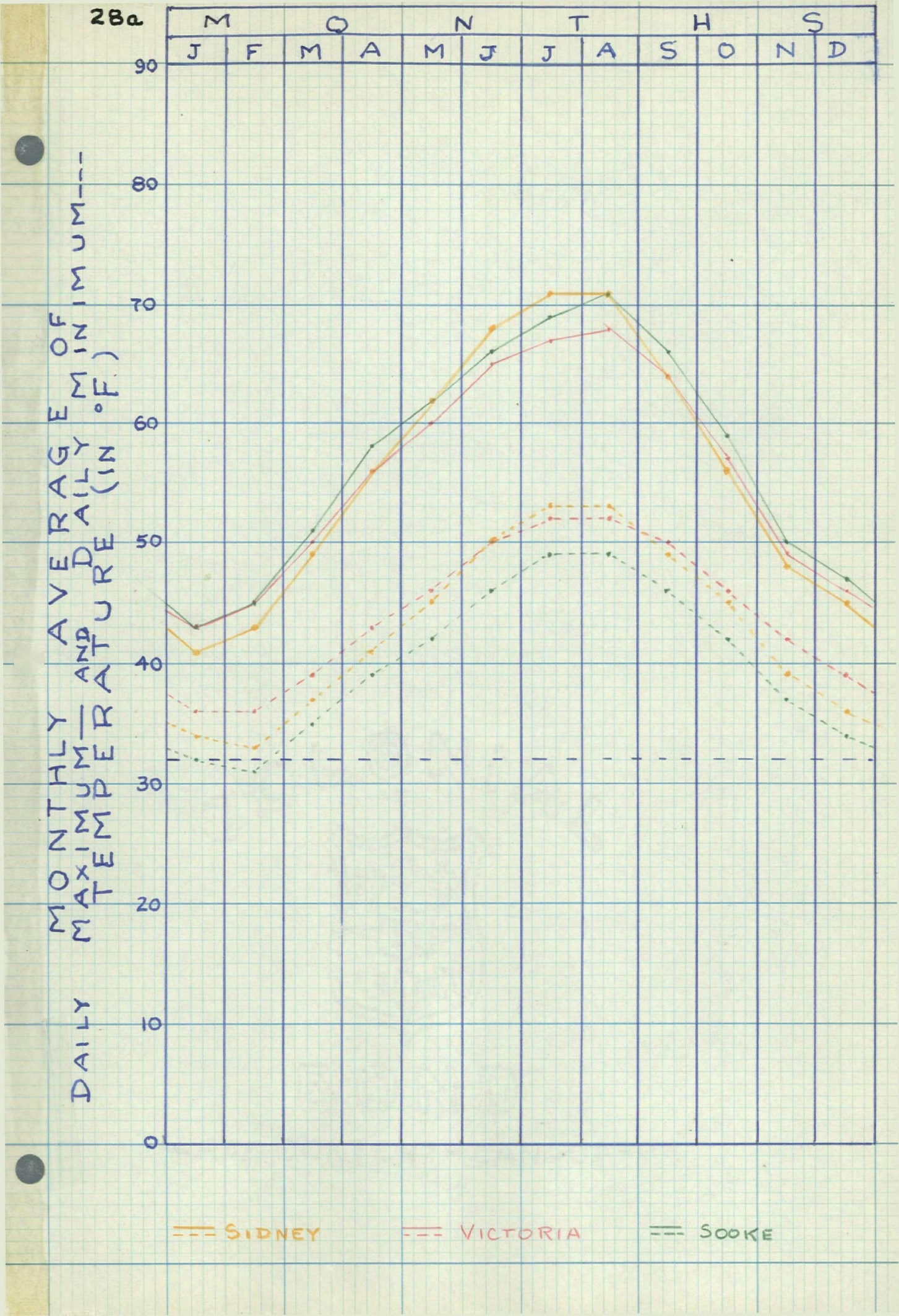
1 Statistics from: Climatic Summaries, vol. 1, Met. Division, Dept. of Transport, Toronto, pp.34 and 35.

28a


M O N T H S
J F M A M J J A S O N D
90
80
70
60
50
40
30
20
10
0
DAILY MAXIMUM AND MINIMUM—
MONTHLY AVERAGE OF DAILY MEAN TEMPERATURE (IN °F.)
SIDNEY
VICTORIA
SOOKE

values during the 10 year period.[1] While the differences between stations are relatively small, particularly in the maximum temperatures, there is a rather interesting difference between the minimum values. A close examination of the site of each of the stations seems to indicate that the factor of topography and air drainage is operative in causing the discrepancy. The station at Sidney (Experimental Station) is 100 feet above the sea, while that of Sooke is 125 feet, and Victoria's at Gonzales Observatory is 228 feet. From the Sidney station, a very gentle slope extends to Haro Strait, about one half mile to the eastward. The flat till plain extends northward and southward, but immediately west of the station stands the monadnock of Mt. Newton. The Victoria station is located near the top of the much smaller monadnock, Gonzales Hill. This hill is the highest elevation within a radius of 2½ miles, and it slopes steeply on three sides to the Strait of Juan de Fuca. Sooke station is located on a relatively narrow plain, about one quarter of a mile from the steep cliffs which form the northwest side of Sooke Harbour. To the west and southwest of the station lies Broom Hill, (925 feet), nearly as high and as large as Mt. Newton. To the north and northeast is the hilly topography of the upland. East lies Sooke Basin, surrounded by hills.

It seems then, that in periods of calm, clear, cold weather during winter, cold air, draining down Sooke

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1 Statistics from: Climate of B.C., Report for 1939, Dept. of Agriculture, Victoria, Table 2.

River Valley and from the surrounding upland of the Sooke area, fills Sooke Basin, flows through to Sooke Harbour, and out into Juan de Fuca Strait. In the meantime, cold air flowing from the rapidly cooling slopes of Broom Hill moves out onto the plain and into the Harbour. In time, an appreciable thickness of cold air will build up above the water surface of Sooke Harbour and Basin, until it is deep enough to flow over the lowland at the mouth of the harbour. The cold air flowing from Broom Hill and Sooke River valley will have, by this time, because of the reduced gradient, tended to stagnate over the plain, before spreading gradually out to the Strait. Thus minimum temperatures recorded at the station will be low in comparison to those of higher elevations.

At Sidney, under similar atmospheric conditions, cold air from the limited "upland" formed by the east slope of Mt. Newton, will flow downslope, over the very gently sloping till plain, and out to Haro Strait. However, the descending cold air, on reaching the foot of the monadnock, will move more slowly because of the gentle gradient from there to the sea, and it will tend to build up an appreciable thickness near the foot of the hill, because of the sudden checking of the gradient. Therefore, minimum temperatures, while not as low as those for the Sooke station, will be lower than those for Victoria. Here, the elevated position of the station precludes the possibility of cold air flowing to it while at the same time, with the inversion of temperature associated with calms during cold, clear weather, the

View from the east slope of Mt. Newton, a prominent monadnock on Saanich Peninsula. As shown in the centre background, the lower slopes support a dense stand of conifers, mostly Douglas fir. Air drainage from this slope has a local effect in reducing the length of the frostless season recorded at Sidney, (Dominion Experimental Farm), located near its base.

temperature at the station will be higher than that of the adjacent plain. On the other hand, the Gonzales station will have lower than average summer maximum temperatures, because of the elevation, and the exposure to sea breezes from Juan de Fuca.

The foregoing considerations lead to a discussion of the frost-free season. Connor[1] lists values for the continuously frost-free period at several stations within the region, as shown in the following table.

STATION	ELEV.	NO.YR. OBS.	AV.DATE LAST SPRING FROST	NO.YR. OBS.	AV.DATE FIRST FALL FROST	AV.FROST FREE PERIOD (DAYS)
SOOKE	125	36	April 21st	35	Oct.28	190
METCHOSIN	80	22	April 4th	23	Nov. 7	217
ESQUIMALT	45	19	April 14th	18	Nov.10	210
VICTORIA (Govt.St.)	58	17	April 3rd	16	Nov.24	236
VICTORIA (Gonzales Obsy)	228	32	March 4th	33	Dec. 4	275
LAKE HILL	100	1	May 18th	1	Oct.17	152
LITTLE SAANICH MT. (Obsy)	730	30	Feb.26th	30	Nov.27	274
SIDNEY (Exp. Stn.)	100	33	Mar. 29th	33	Nov.16	232
PATRICIA BAY (Airport)	55	6	April 4th	7	Nov. 3	213

While there is not a direct correlation for all stations, between altitude alone and frost-free period, this correlation does appear in the case of Metchosin, Gonzales, Little Saanich, and Sidney. There is some possibility that

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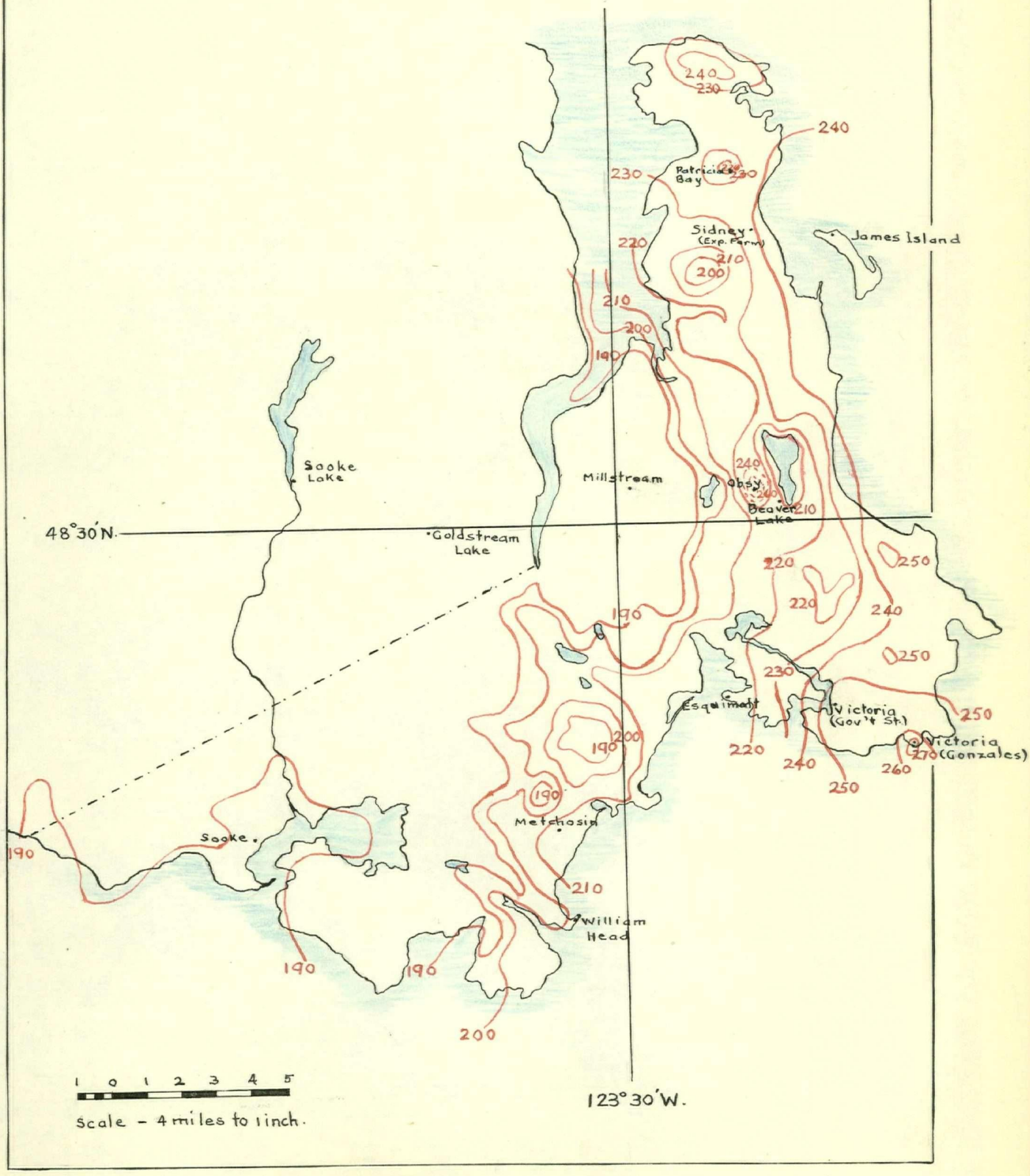
1 Connor, A.J., The Frost-Free Season in British Columbia, Met. Division, Dept. of Transport, Toronto, 1949.

FROST - FREE PERIOD (DAYS)



the readings from the Victoria Government Street Station, (discontinued since 1914), have been rendered slightly higher than "normal" by convection over the city. Thus during still, cold weather the convectional circulation of air over the city would offset any tendency for an inversion to develop in that area. In any case, the topographic location of the station was such that air drainage would not have been a particularly important factor in causing low minimum temper-atures. The value for Lake Hill, based upon only one year of observations, would not seem to be of much worth.

The "mean" frost-free period for the nine stations is 222 days, though this figure is probably slightly lower than the true average, since the Lake Hill value has been included. The accompanying map of frost-free season for the region, shows the approximate position of the isopleths, based upon the figures for preceding stations and the local topography.[1]

For comparison, the average frost-free period for a few Canadian cities is listed on the next page.[2] Note that the value given for Victoria is the mean of the Gonzales and Government Street readings.

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1 Values from: Connor, A.J., The Frost-Free Season in B.C., Met. Div., Dept. of Transport, Toronto, 1949.

2 Values from: Temperature, Precipitation and Sunshine at Selected Stations, Met. Div., Dept. of Transport, Canada.

TABLE OF FROST-FREE PERIOD FOR SELECTED STATIONS IN CANADA

STATION	AVERAGE DATE OF FROST@		AVERAGE FROST-FREE PERIOD (days)
	LAST SPRING	FIRST AUTUMN	
CHARLOTTETOWN, P.E.I.	May 13	Oct.22	162
HALIFAX, N.S.	May 11	Oct.14	156
FREDERICTON, N.B.	May 20	Sept.24	127
MONTREAL, P.Q.	April 28	Oct.17	172
LONDON, ONT.	May 16	Oct. 1	138
ST.CATHARINES, ONT.	May 7	Oct.20	166
TORONTO, ONT.	May 2	Oct.14	165
WINNIPEG, MAN.	May 27	Sept.14	110
SASKATOON, SASK.	May 26	Sept. 9	106
CALGARY, ALTA.	June 1	Sept. 6	97
KAMLOOPS, B.C.	Apr. 25	Oct. 8	166
PENTICTON, B.C.	May 7	Oct. 3	149
VANCOUVER, B.C.	Apr 3	Nov. 4	215
VICTORIA, B.C.	Mar. 18	Nov. 27	254
REGION OF S.E. VANCOUVER ISLAND	--average--		222

@ These dates refer to the occurrence of a minimum temperature of 32°F. or lower in a screen 4½ feet above the ground.

Since the frost-free season for Southeastern Vancouver Island is long, the growing season is also long. Taking a mean daily temperature of 43° as sufficient for vegetative growth, at least for the hardy plants, the region has a growing season of about eight months--from March to December. This is a most important reason for the success of early market vegetable production in the area. Certain seed bearing crops which require a long growing season to mature their fruit, are also well suited to the region.

At the latitude of the region, (average about 48°, 30'N.), the duration of summer sunlight is also long. A nomogram shows that for the latitude, April has from 12¾ to 14½ hours sunlight each day, May has 14½ to 15¾ hours, June, 15¾ to 16, July, 16 to 15, August, 15 to 13½, and September, 13½ to 12¼. Thus

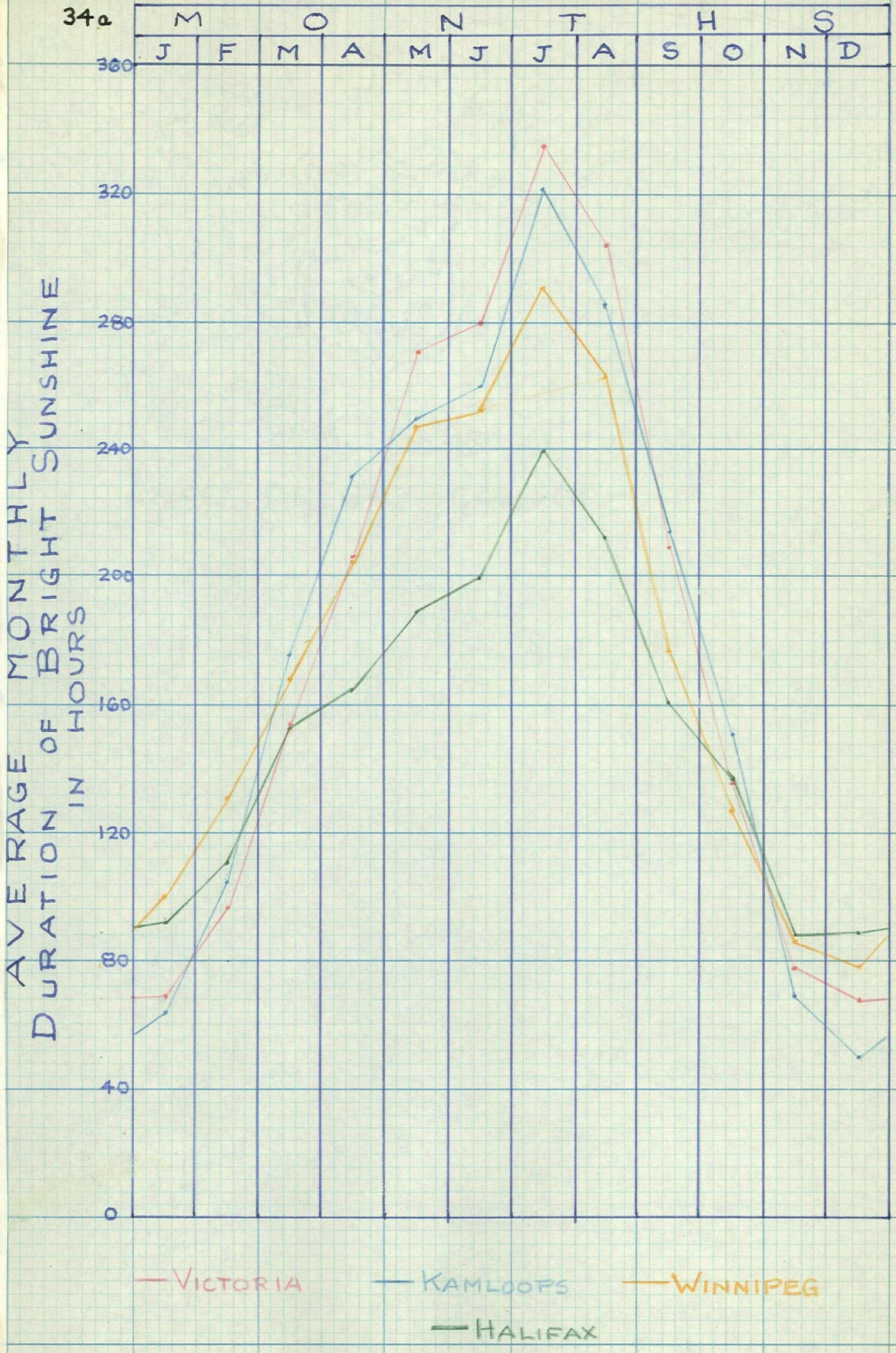
the months April to September inclusive, together average 15 hours sunlight each day. This is a factor in the growth of plants, particularly for those which require long summer days in their life cycle.

Considering the factor of sunlight, the importance of topographic control becomes apparent. Because of its sheltered position to leeward of the Vancouver Island ranges and the northwest spur of the Olympic Peninsula, the region lies in the "shadow" of rain bearing winds. Though frontal rains are common in winter, they are usually combined with orographic influences. Consequently windward slopes receive the greatest precipitation while leeward slopes are drier. Reduced cloud cover is a likely corollary though not necessarily so. By far the maximum amount of bright sunshine in received in the summer time, when the Pacific High Pressure Cell moves northward and brings stable atmospheric conditions to the region. While the maximum bright sunshine is received in the summer months, the annual total is high, as the following table shows.[1]

STATION	AVERAGE ANNUAL DURATION OF BRIGHT SUNSHINE (HOURS)
CHARLOTTETOWN, P.E.I.	1857
HALIFAX, N.S.	1835
MONTREAL	1803
TORONTO	2048
WINNIPEG	2124
CALGARY	2245
KAMLOOPS	2178
PRINCE RUPERT	1053
VANCOUVER	1832
VICTORIA	2207

1 Statistics from: Temperature, Precipitation, and Sunshine at Selected Stations, Met. Division, Dept. of Transport, Canada.

34a


M O N T H S
J F M A M J J A S O N D
360
320
280
240
200
160
120
80
40
0
AVERAGE MONTHLY DURATION OF BRIGHT SUNSHINE IN HOURS
VICTORIA
KAMLOOPS
WINNIPEG
HALIFAX

The Sidney average, as listed in the "Climate of British Columbia"[1] is 2,051 hours. The seasonal distribution of sunshine for a few representative stations is shown in the accompanying graph.[2]

As mentioned, Southeastern Vancouver Island lies in a rain shadow, and therefore precipitation within it is less than for adjacent areas. In annual total Victoria's 27 inches is about half that for Vancouver, one-quarter that for Clayoquot, B.C., three times that for Kamloops, a little more than Winnipeg's and the same as that for St.Catharines. An examination of the seasonal receipt of these annual totals shows that again, pronounced differences exist. The following graph will illustrate this seasonality.[3]

While a number of plants, notably those of Mediterranean origin and those which are wind pollinated, such as our native conifers, require a certain period of drought to complete their life cycle, most plants require considerable moisture during the growing season. Generally speaking, it is assumed that one tenth of an inch of equivalent rainfall is necessary each day for active growth of plants. Obviously stored soil moisture will provide a certain "carry-over", particularly in the heavier textured soils. According to Livingston and Shreve,[4] the limits of a drought are within any

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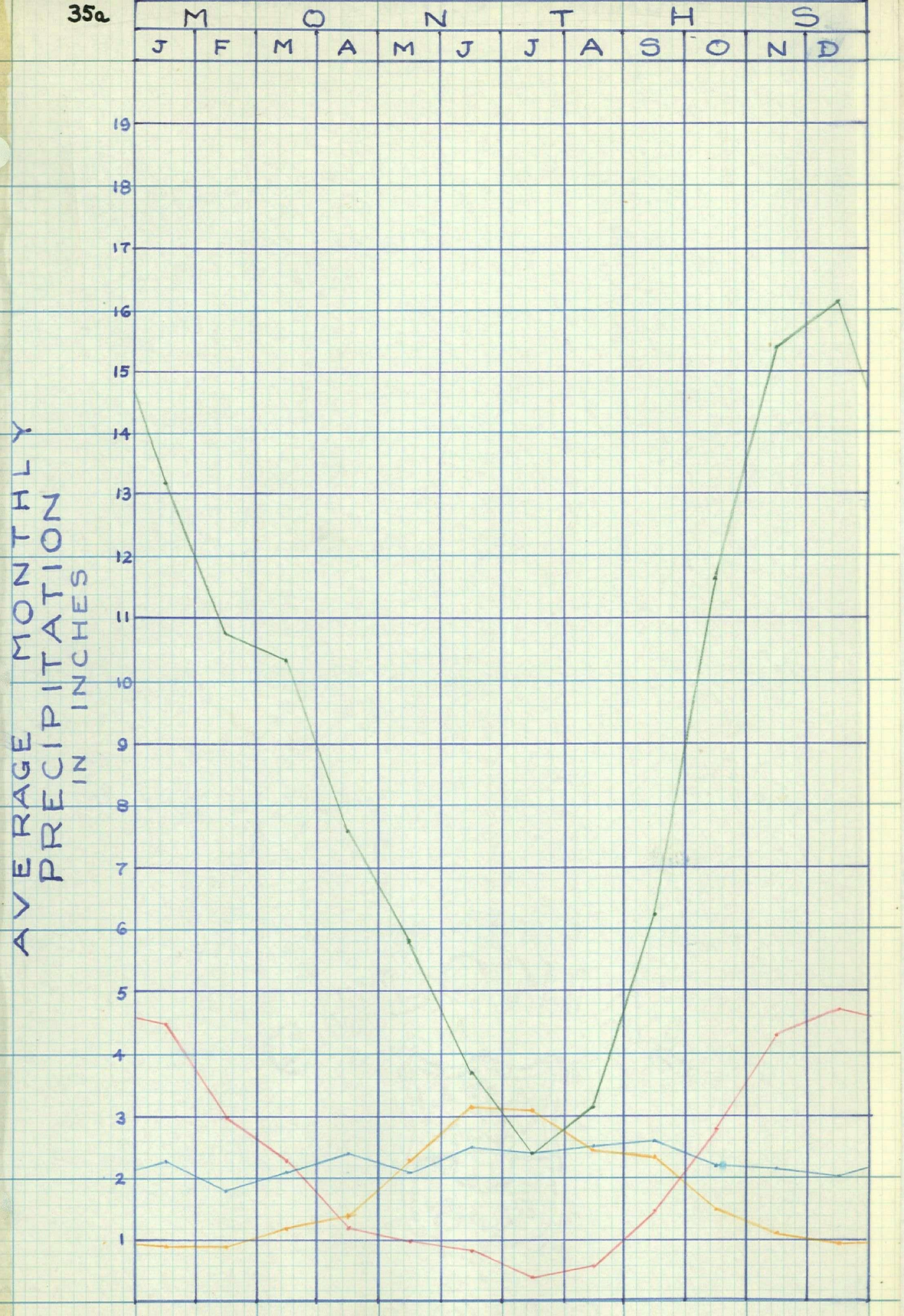
1 Climate of B.C., Report for 1945, Table 3, Victoria, B.C.1946
2 Dept. of Transport, op. cit.
3 Statistics from: Temperature, Precipitation and Sunshine at Selected Stations, Met. Division, Dept. of Transport, Canada.
4 Livingston, B.E. and Shreve, F., The Distribution of Vegetation in the United States as Related to Climatic Conditions, Carnegie Institute, Washington, Publication 284, 1921.

35a


M O N T H S
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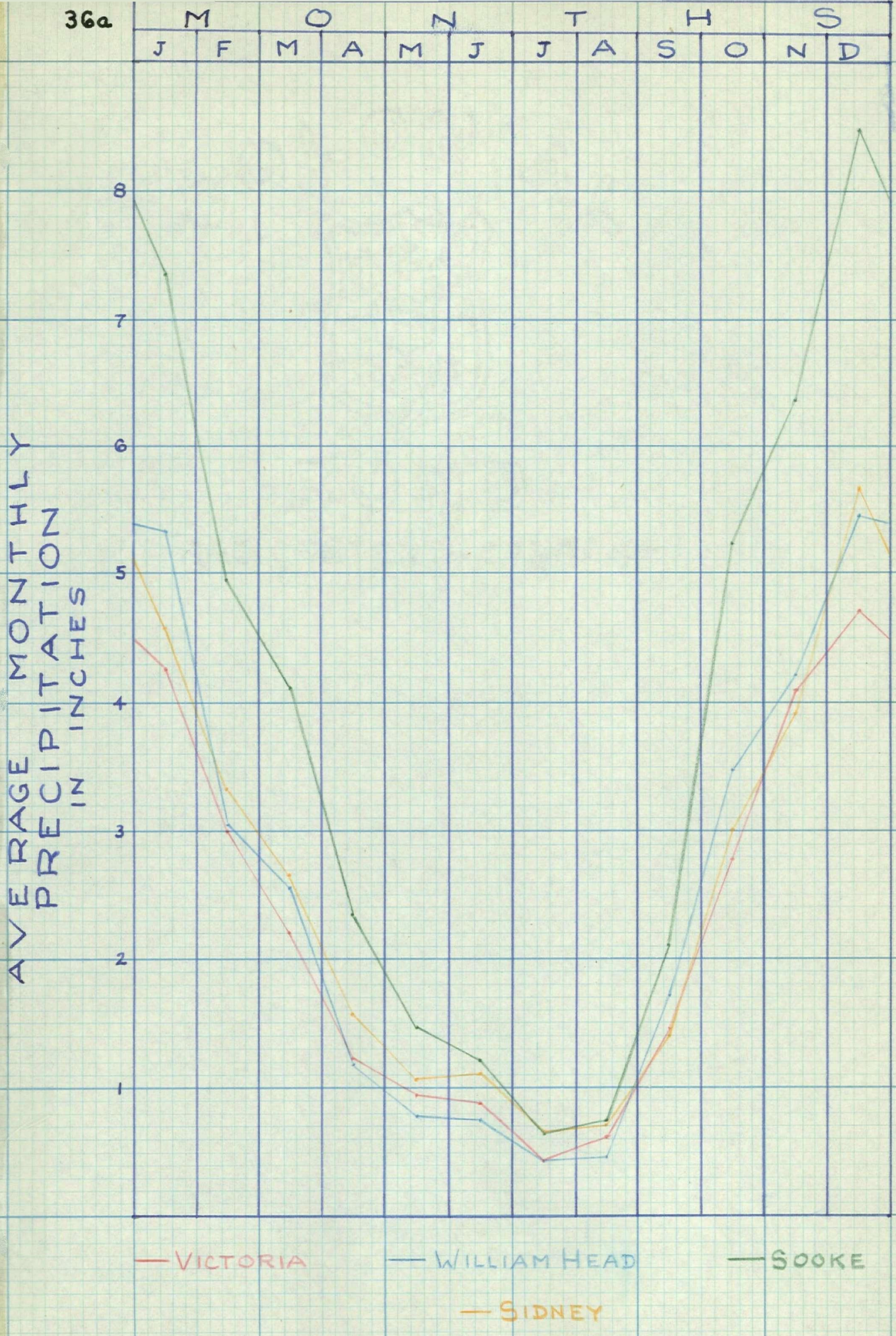
3
2
1
AVERAGE MONTHLY PRECIPITATION IN INCHES
VICTORIA
CLAYOQUOT
WINNIPEG
ST. CATHARINES

five day period having a total precipitation of 0.5 inches or greater. Consequently, Victoria experiences a definite summer drought, and for certain crops to be grown in the area, irrigation and soil moisture conserving practices must be applied. Winnipeg, on the other hand, though receiving less total annual precipitation, has a much more desirable distribution, as far as most plant growth is concerned. Besides the limited summer rainfall received at Victoria, there is considerable variation from year to year. While the graph is based on average values, Victoria has recorded a drought of 63 days. During this period, which occurred in 1926, from June 13th to August 16th, no measurable precipitation fell.[1]

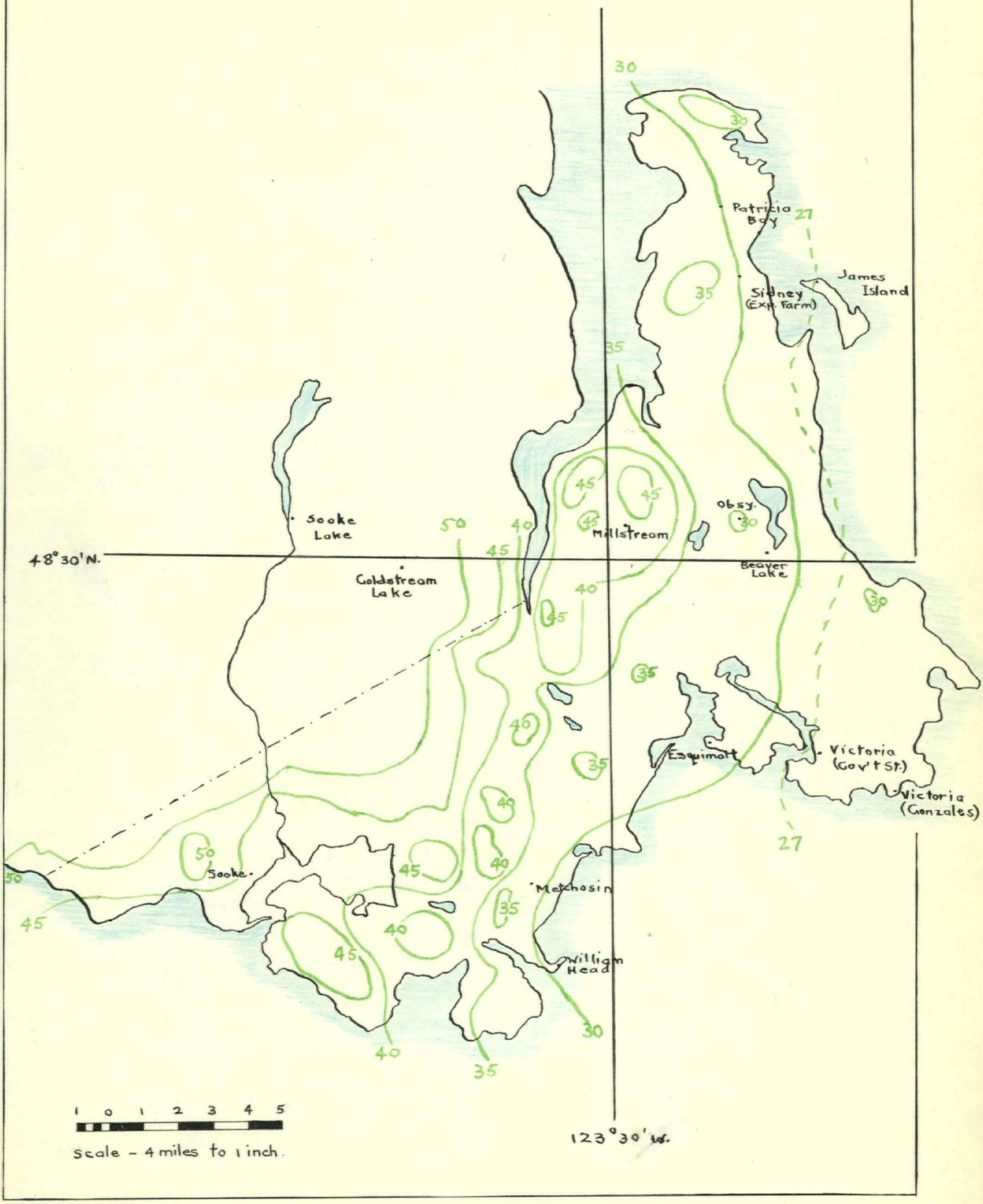
Within the region, there are significant differences in total annual precipitation, though the periodicity is much the same as for Victoria. Because of the mild winter temperatures most of the precipitation throughout the region falls as rain, though there is some snow, particularly on the uplands in the western portion. Goldstream Lake, for example, (outside the region, about two and a half miles northwest of the tip of Finlayson Arm), records seventy inches of snow each year, while Victoria records eleven inches and James Island, ten and a half inches. With this limited fall, snow seldom remains on the ground for more than one week at a time, and therefore, there is no chance for the accumulation of snow over the winter season. The accompanying graph shows the seasonal distribution of precipitation for the selected stations within the region, and the map shows the isohyets of

1 Data held in the Dept. of Transport Meteorological Office, Gonzales Observatory, Victoria, B.C.

36a


M O N T H S
J F M A M J J A S O N D
AVERAGE MONTHLY PRECIPITATION IN INCHES
8
7
6
5
4
3
2
1
— VICTORIA
— WILLIAM HEAD
— SOOKE
— SIDNEY

ANNUAL PRECIPITATION (INCHES)



average annual precipitation for Southeastern Vancouver Island.[1]

The average monthly and annual number of days with measurable precipitation of any sort, shows approximately the same pattern as the seasonal distribution and is shown in the following table for a few representative stations.[2]

STATION	YRS. OBS.	J	F	M	A	M	J	J	A	S	O	N	D	YR.
LONDON, ONT.	10	18	17	16	12	12	11	10	9	11	13	15	19	163
WINNIPEG	10	12	11	9	9	10	12	10	10	9	6	9	11	118
CALGARY	10	7	8	10	8	11	12	10	10	8	7	5	5	101
VICTORIA	10	18	14	15	10	10	8	6	5	8	13	17	20	144
PATRICIA BAY	5	16	14	12	13	14	8	4	5	8	14	17	16	141

As might be expected, the relative humidity follows somewhat the same seasonal distribution as the precipitation. The table below shows a longtime average of relative humidity for Prince Rupert, Victoria, and Kamloops.[3]

STATION	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
PR. RUPERT	85	83	84	81	80	83	85	86	85	85	87	86	84
VICTORIA	86	82	77	74	74	73	74	77	79	84	88	88	80
KAMLOOPS	78	76	70	58	57	58	55	59	64	71	77	78	67

Fogs are not frequent over the region, and those which occur are usually experienced in the fall months.

It has been seen that the region receives the greatest percentage of its annual precipitation in the winter six months--January, February, March, and October, November, December. The single months having the greatest proportionate rainfall are December and January. Winds for each month of the year at Patricia Bay (airport) and Victoria, (the only two stations within the region for which statistics are available),

1 Statistics from: Climate of British Columbia, Reports for 1937, 1939, and 1947, Dept.of Agriculture, Victoria, B.C.
2 Statistics from: Climatic Summaries, vol.1, Met.Division, Dept. of Transport, Toronto, Canada.
3 Statistics from: Climate of British Columbia, Report for 1937, Dept. of Agriculture, Victoria, B.C., Table 5.

are as listed below.[1]

PERCENTAGE WIND FREQUENCY BY DIRECTIONS

STAT.	DIR'N	J	F	M	A	M	J	J	A	S	O	N	D
PATRICIA BAY	N	5	5	2	2	2	2	1	2	2	2	4	3
	N.E.	9	7	8	8	11	8	9	10	9	6	8	6
	E.	2	4	3	6	7	7	11	14	11	8	4	2
	S.E.	17	19	24	24	27	31	36	31	26	25	21	20
	S.	6	6	5	6	3	3	3	3	4	7	7	5
	S.W.	13	14	20	20	14	14	9	8	11	13	14	17
	W.	26	22	15	15	13	11	10	11	17	20	22	21
	N.W.	18	17	18	15	18	18	12	11	12	13	16	21
	CALM	4	6	5	4	5	6	9	10	8	6	4	5
	AV.WIND SPEED IN M.P.H.	5.5	5.3	5.8	5.4	4.8	4.9	5.1	4.6	4.3	4.7	5.4	5.4
VICTORIA	N.	30	31	19	14	10	6	4	5	14	24	31	28
	N.E.	18	15	10	9	6	4	4	5	10	12	15	14
	E.	14	12	10	8	6	4	4	5	8	11	14	14
	S.E.	11	10	8	6	4	2	2	2	4	8	10	14
	S.	7	7	9	10	13	15	16	17	15	12	8	9
	S.W.	7	8	16	22	29	34	40	37	21	12	7	7
	W.	11	14	24	28	30	33	29	26	24	17	12	12
	N.W.	2	2	3	2	1	1	--	1	1	2	2	1
	CALM	--	1	1	1	1	1	1	2	3	2	1	1
	AV.WIND SPEED IN M.P.H.	12.4	11.6	11.6	11.7	12.0	12.3	11.9	10.6	8.7	8.9	10.7	12.8

From the table, there appears to be little correlation between wind direction and monthly precipitation for the region as a whole. In January, the most frequent wind direction at Patricia Bay is W., followed by N.W. and S.E. At Victoria for the same month, N. is by far the most frequent, followed by N.E. and E. In December, the most frequent winds at Patricia Bay are W. and N.W., while at Victoria they are N. and N.E. Possibly a more detailed analysis involving predominant wind direction on days during which rain fell, would give a better correlation. However, the varied topography and

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1 Statistics from: Climatic Summaries, vol. 2, Dept. of Transport, Toronto, Canada.

irregular shape of the landmass of Southeastern Vancouver Island would make a positive correlation difficult. Never-theless, the table does show the prevalence of sea breezes at both stations in summer months. From April to August inclusive, the predominant wind direction is S.E., followed by N.W. in just over half the frequency of the former. Though not shown in the table, the N.W. winds also record only half the velocity of those from the S.E. Apparently then, during the summer with intense heating of the land surface of the southern part of the Island, winds from the cooler surface of Georgia Strait blow from the S.E., over Saanich Peninsula and the Inlet to the larger land surface. With less intense and more localized heating of the Peninsula itself, weaker N.W. winds from Saanich Inlet blow toward the land, while at the same time, if statistics for Sidney were available, they would probably indicate E. or S.E. winds. Under similar summer heating of the land surface near Victoria, S.W. and Westerly winds are recorded, S.W. being slightly more frequent, and of slightly greater velocity than those from the West; and both at nearly double the speed of Patricia Bay's S.E. winds.

The greater velocity of winds throughout the year at Victoria as compared with Patricia Bay is partly a result of the elevation of the station and its exposed location. In addition, there may be some effect of funnelling of gorge winds up Juan de Fuca Strait. However, a definite determination of this possibility will probably have to wait until there are complete meteorological statistics for the Sooke area.

Some Effects of Climate in the Region

Probably the most obvious effect of the climate of the region lies in the character of the vegetation developed under it. While Vancouver Island and the adjacent mainland coast as a whole, is characterized by heavy stands of coniferous forest, Southeastern Vancouver Island, though supporting an abundance of conifers, is marked by the presence of Garry oaks and Arbutus, particularly in the drier areas. These trees have, in addition to extensive root systems, leaf adaptations which cut down the water loss through transpiration, enabling them to make best use of the available moisture. Man, however, through agricultural practices, has been able to set up artificial conditions under which more mesophytic plants may be grown. Such practices as dry farming, are designed to lower evaporation losses and conserve soil moisture.

This is not to suggest that crops cannot be grown in the region without summer irrigation. Even without dry farming techniques, woody plants with deep and extensive root systems flourish, since they are able to draw on stored ground water and also to intercept most of the limited summer rains. Grasses and associated herbaceous plants which make their vegetative growth in late winter and spring, will also thrive under the natural conditions within the region. These are able to make their vegetative growth when moisture is still abundant, and ripen their seed in early summer. Consequently, use of the land for hay or for seed growing is one of the common agricultural pursuits. The summer drought, however,

does restrict hay production and summer pasture during dry years. Such crops as the common vegetables require irrigation in the summer, though in some locations, such as bottom lands, little water is required for healthy growth.

A combination of climatic and physiographic factors in the region have exercised an important effect on its development. The region, for the most part, is well supplied with water. Scattered lakes dot the region, and though no significant hydro-electric sites are located within it, there is abundant water supply for the urban area of Victoria. A large part of the present supply, however, lies outside the regional boundaries. The northern portion of the region is an exception, in that it is poorly supplied with surface waters. Though domestic water is abundant, being partly supplied by the Victoria system, there is a limit in the amount available for irrigation and industrial purposes. This shortage is particularly acute in the summer months when the water table drops, and many of the irrigation wells and springs are thereby rendered useless. Some of these wells, particularly those located at the bottom of slopes where coarser material, such as Vashon drift, forms a thick superincumbent layer on Maywood clays, yield a steady water supply. These of course, are limited in their capacity. This shortage has affected industry in the northern part of the region.

Considering Victoria's climate as representative of the Southeastern Vancouver Island, the following polygonal graphs will give some idea of the biotic worth of the regional

climate.[1] These polygonal graphs embody eight separate climatic variables. The variables are, commencing at the "top" of the graph and reading clockwise: number of hours bright sunshine during the frostless season (F.S. Sun), total number of days in the frostless season (F.S. Da.), summer concentration of thermal efficiency (S.C. T-E), annual thermal efficiency (I'), annual precipitation effectiveness (I), total annual precipitation (P), precipitation effectiveness in the frostless season (F.S. P-E), and longest drought in the frostless season (F.S. L.Dr.). The values for I and I' are based directly on C.W.Thornthwaite's formulae[2]. The length of the longest drought in the frostless season is determined on the basis of Livingston and Shreve's definition of a drought.[3] Other values are obtained from consultation of various tables of climatic statistics.[4] Though actual

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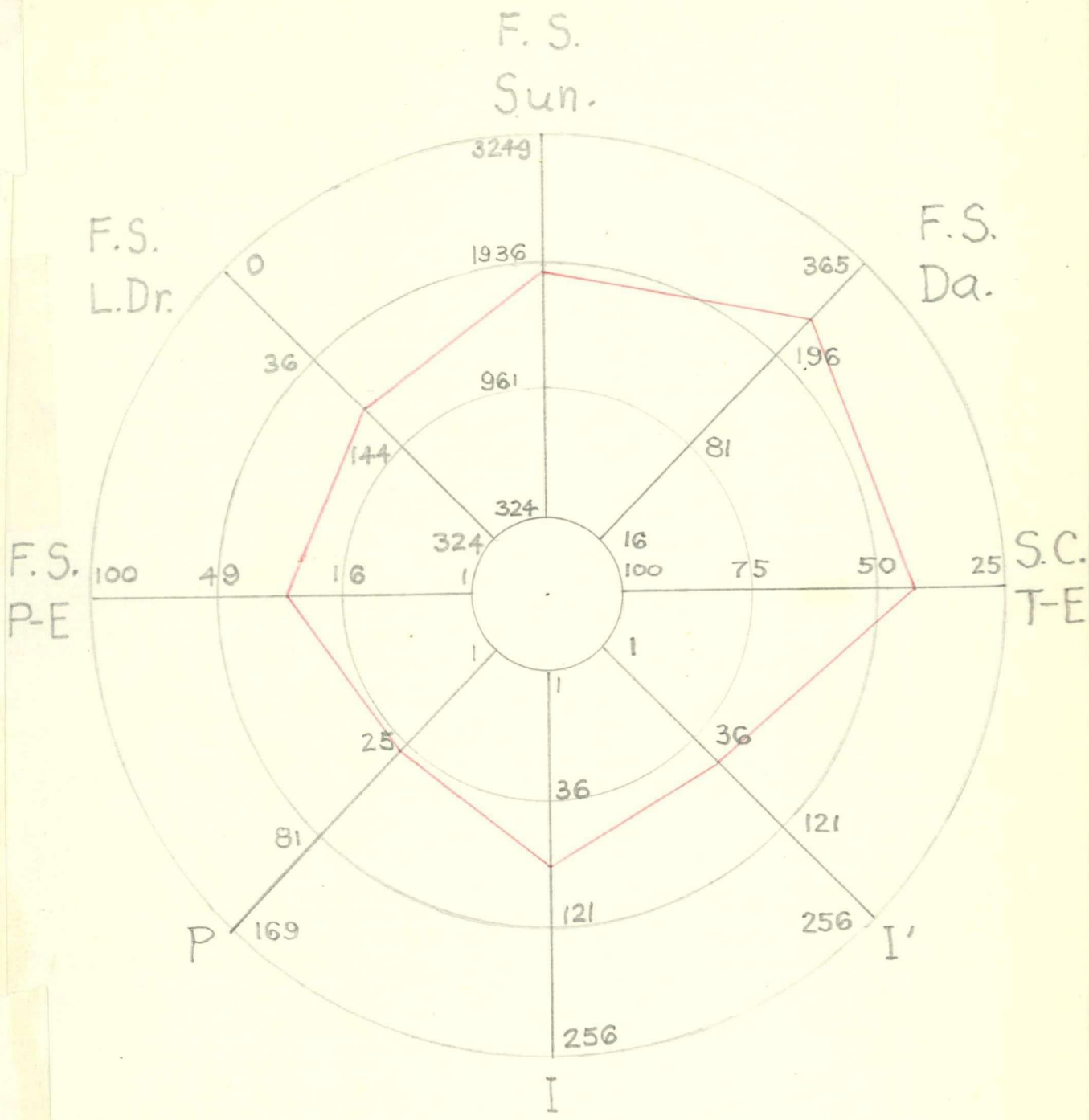
1 Basic scheme for polygonal graphing of climatic data was obtained during a course of lectures in the Department of Biology and Botany, University of B.C.

2 Thornthwaite, C.W. The Climates of North America According to a New Classification, Geog. Review, vol. 21, 1931, pp. 633-655.

3 Livingston, B.E. and Shreve, F., The Distribution of Vegetation in the United States as Related to Climatic Conditions, Carnegie Institute, Washington, Publication 284, 1921

4 (1) Temperature, Precipitation and Sunshine at Selected Stations in the Dominion of Canada, Met. Division, Dept. of Transport, Canada.

(2) Data held in Dominion Meteorological Office at Gonzales Observatory, Victoria.


F. S.
Sun.
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961
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F. S.
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F. S.
P-E
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S. C.
T-E
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I'
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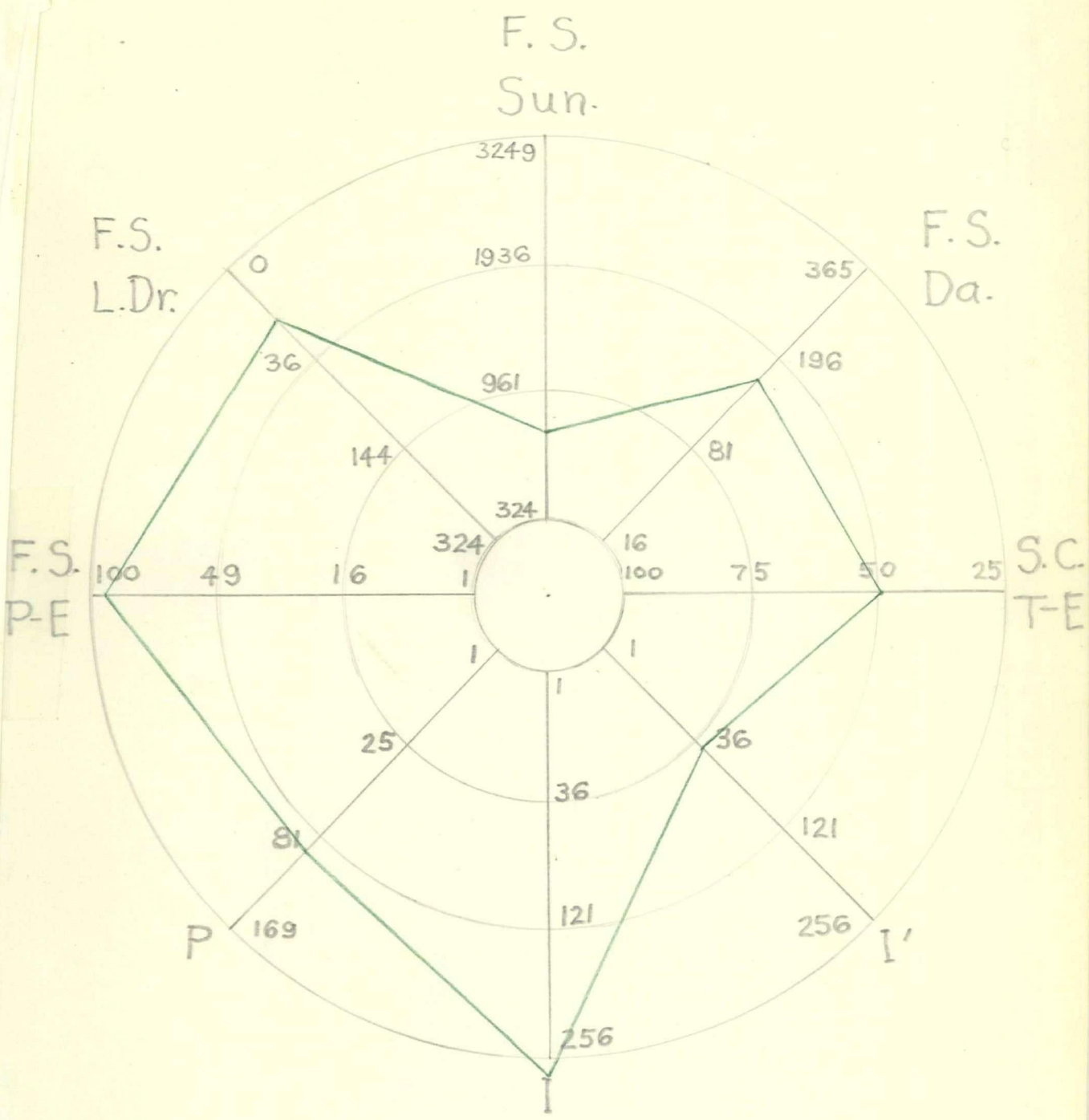
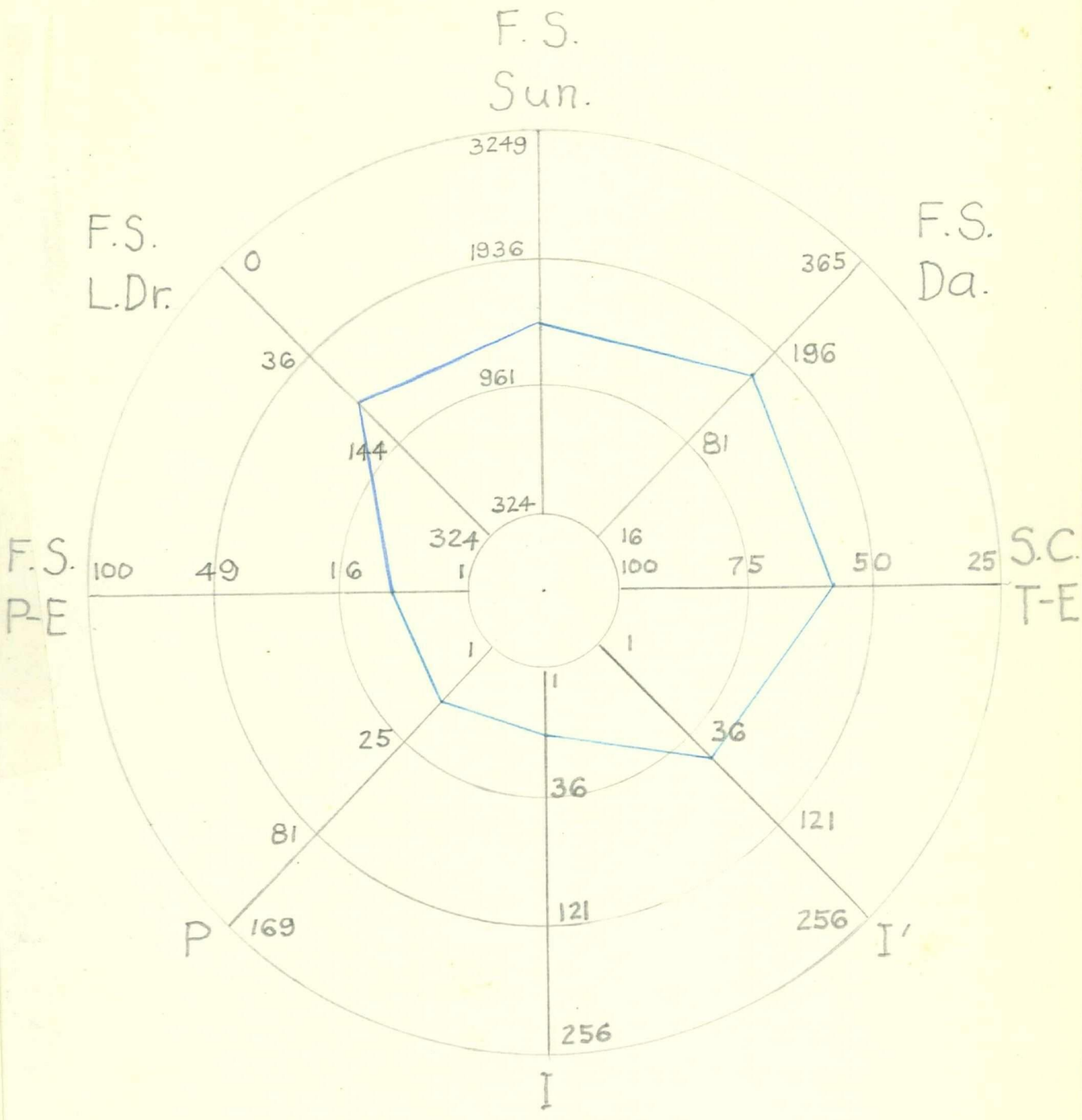
36
I
256
121

VICTORIA



PRINCE RUPERT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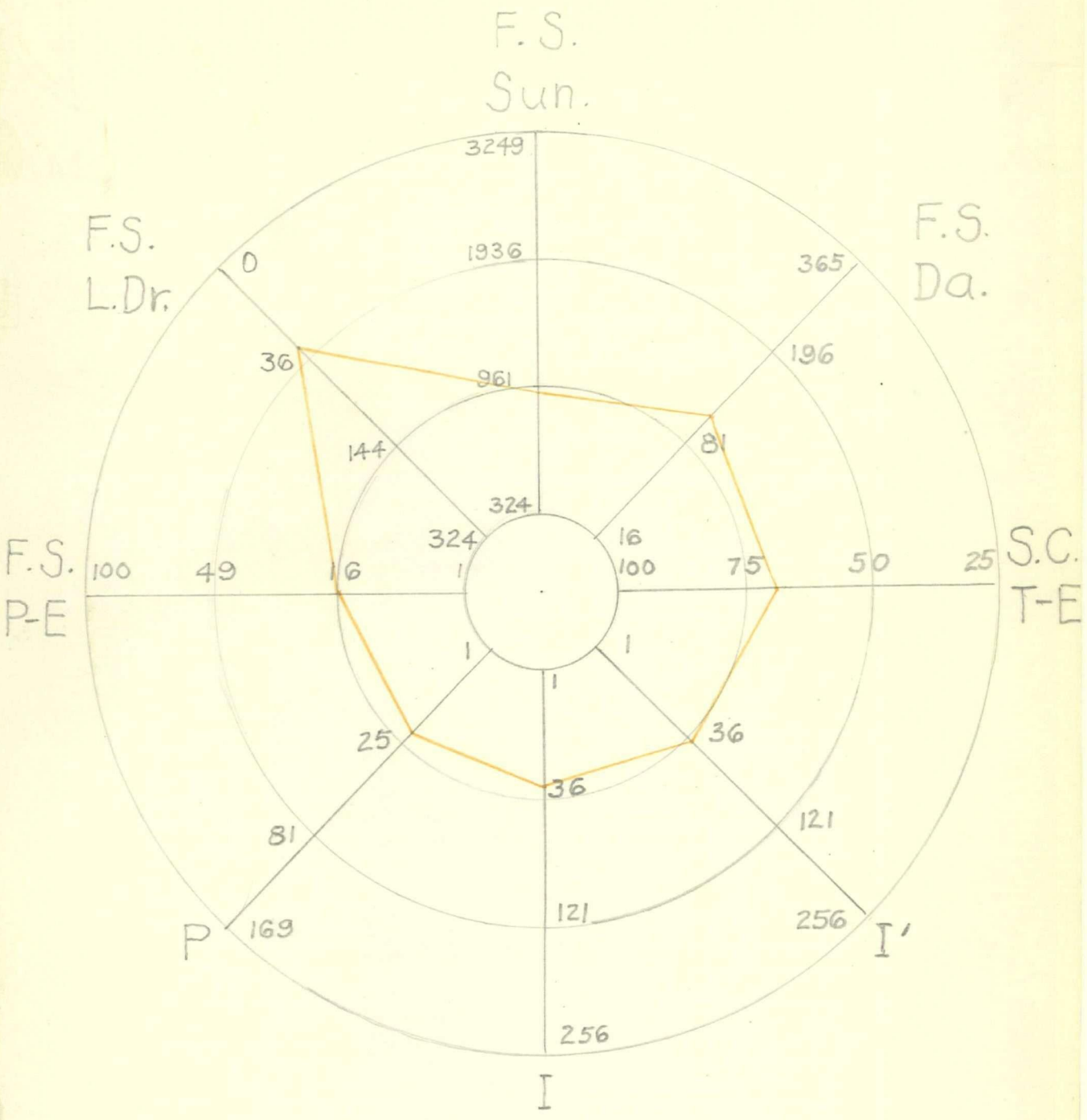
KAMLOOPS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WINNIPEG

values of the climatic variables are indicated on the graph, they are plotted as square root values. This procedure has been followed since the biotic worth of the various factors has been found to vary equally as their respective square roots. (In partial explanation of this, one can consider the biotic effect of a variation of 5 inches in precipitation at two stations, one receiving an average of 15 inches, and the other averaging 100 inches--obviously the biotic worth of 5 inches of precipitation varies with the total amount received.) The three annular "zones" represent hypo, meso and hyper values, the last mentioned occupying the outermost ring. Extreme values are plotted outside the graph, as is the case with annual precipitation effectiveness at Prince Rupert. The polygon for each station presents a fairly concise picture of that station's value as far as plant growth is concerned.

From the point of view of human habitation, the climate of Southeastern Vancouver Island is almost ideal, as shown by a comparison of the following hythergraphs.[1] Each year, this equable climate has brought thousands of tourists and vacationists to the region, and thus has meant a substantial proportion of the provincial income. The climate has also, at least to some degree, contributed to residential rather than industrial development of the urban centres. It is interesting to note in passing, that the

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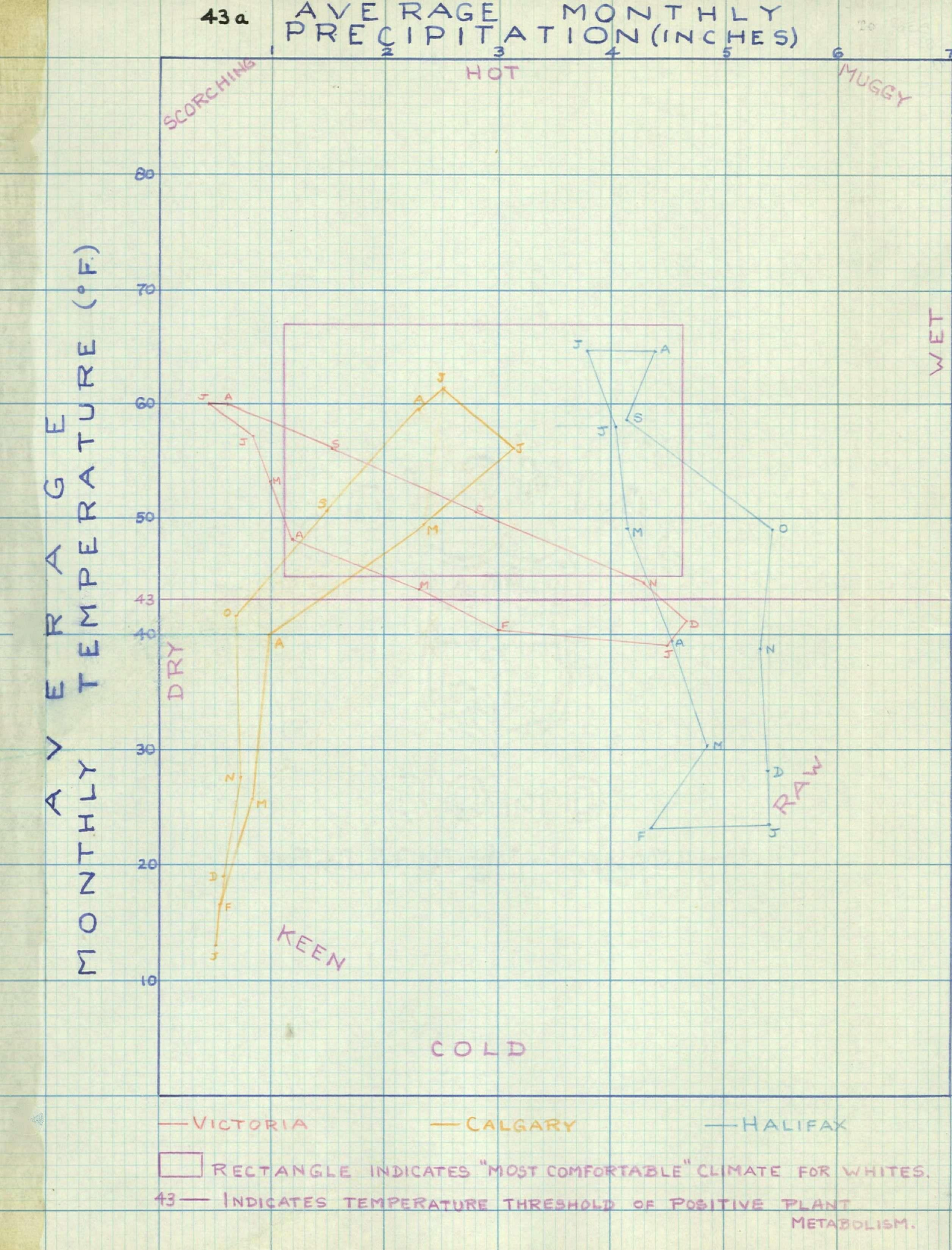
1 Statistics from: (1) Climatic Summaries, vol. 2, Dept. of Transport, Canada.
(2) Climate of B.C., Report for 1937, Victoria, B.C.
Hythergraph after Taylor, T.G., Environment, Race and Migration, p. 286

43a


AVERAGE MONTHLY PRECIPITATION (INCHES)
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2
3
4
5
6
AVERAGE MONTHLY TEMPERATURE (°F)
80
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60
50
43
40
30
20
10
SCORCHING
HOT
MUGGY
DRY
WET
KEEN
COLD
RAW
—VICTORIA
—CALGARY
—HALIFAX
RECTANGLE INDICATES "MOST COMFORTABLE" CLIMATE FOR WHITES.
43— INDICATES TEMPERATURE THRESHOLD OF POSITIVE PLANT METABOLISM.

establishment of the Dominion Astrophysical Observatory upon Little Saanich Mountain, one of the monadnocks in the region, was a direct response to climate. Relatively clear skies, uniformity of temperature, ~~clear skies~~, and a steady atmosphere are primary climatic considerations in astrophysical work. However, as previously mentioned, the summer drought does impose certain limitations on industrial development in parts of the region.

5. SOILS

Derivation

The soils of Southeastern Vancouver Island while derived from the country rock of the Island, have been mixed and transported through the agencies of glaciers and streams. There is then, a direct relationship between bedrock formations, the soils derived from these, and the manner of deposition.

The present distribution of the soils has been largely a result of glaciation, and thus the soils vary considerably, both in characterization and in depth, within small areas. As the glaciers retreated, the detritus was laid down as ground moraine, estuarine, lake, or fluvial deposits. The ground moraines, though not all alike, consist of unsorted materials. The estuarine and lake deposits, on the other hand, having been deposited in calm water, generally consist of finer materials--clays and silts. The river deposits are usually coarse textured, and have not evolved into good agricultural soils.

In the classification of the regional soils,

those derived from tills of the same rock origin, texture and mode of deposition have been grouped together. Some of the soils have been mixed, necessitating a separate classification, while peat soils and recently derived fluvial deposits are also classed separately.

The following names have been used to designate the soil groups and the soil families derived from them.[1]

Coarse textured glacial tills	1. Shawnigan (andesitic and granitic origin) 2. Keating (gneissic origin)
Lacustrine deposits	1. Cowichan
Stratified drift	1. Qualicum
Miscellaneous	1. Tolmie (a consistent and extensive mixture) 2. Unnamed; includes deltas, mixtures and peat.

Since their deposition in the Pleistocene, a number of factors have acted upon and altered the basic soil families. The soils have been weathered through the agencies of climate and natural vegetation, producting a fertile surface upon the inert and unaltered subsoil. The organic matter returned to the soil by the predominantly coniferous vegetation, is relatively small, consisting of a slowly decomposing fibrous mat--a distinctive feature of the soils along the British Columbia coast. This litter is not high in basic elements such as calcium, and hence it does little to

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1 Classification obtained from: Spilsbury, R.H., Soil Survey of the Southeast Portion of Vancouver Island, 1944 (unpublished).

neutralize the acid nature of the soils. In this acidic humus layer, soil organisms function to produce soluble compounds of great importance to plant growth. Much of these soluble compounds and other plant foods are unfortunately leached from the soil during the heavy winter rains, with resultant decreased fertility. Where drainage is restricted, as in valley bottoms and marshes, the dissolved material tends to concentrate, producing a particular soil characteristic in those areas. Often, where drainage is very poor, the organic matter which accumulates there, develops into various grades of peat or muck soils.

The many soil associates developed from the broad soil families as a result of the foregoing modifying factors, are themselves further modified. By clearing, draining and cultivation, man alters the entire relationships between soil, air and water, as well as the chemical, physical and biological processes. Thus the present soils of the region, while reflecting the basic raw mineral soils which were laid down during the Pleistocene, are also the product of a great many physical, chemical and biological processes which materially affect the fertility of the soil.

Soil Characterization

Subject to the multiple variations mentioned above, each soil family has general characteristics which identify it. The descriptions of the different soils listed below are intended to give some idea of the appearance and

economic worth of each.[1] The accompanying soil map (Plate I), indicates the distribution of the soils within the region.[2] A comparison between this map and the map of superficial geology reveals the close relationship existing between surface soils and underlying glacial deposits. The soils showing the closest relationship to the underlying deposits are those of the Cowichan family--having been derived from Maywood clays. In a detailed comparison of the soil and geological maps, it must be borne in mind that the latter not only represents a much older survey, but indicates the boundaries of the deposits only where they attain a significant thickness and are easily recognized.

A. Soils Derived From Coarse Textured Till

1. Shawnigan Stony Sandy Loam

This coarse textured soil is limited in its occurence within the region. It extends from the lowland into the rolling topography at the edge of the upland. Steep slopes are common, and in only rare instances can level areas of any extent be found.

The soil is fairly uniform, consisting of a thin organic mat covering a grey brown sandy loam. The grey brown sandy loam grades downward through porous horizons of much the same nature, to the impervious, underlying till at approximately two feet. Numerous boulders and gravel occur

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1 The detailed characterization of each soil was obtained from: Spilsbury, R.H., Soil Survey of Southeast Portion Vancouver Island, 1944, (unpublished).

2 Adapted from Map Sheets 9 - 14 inclusive, accompanying Spilsbury's soil report.

throughout the profile, making up at least half the soil mass. Because of the impervious nature of the till, peaty soils develop in even slight depressions. Because of the stony nature of the Shawnigan soils, they are not suitable for agricultural use.

2. Keating Sandy Loam

This is a coarse textured soil derived from gneissic rock and limited to the Saanich Peninsula. Topo-graphically, it varies from undulating to hilly in the vicinity of the upland areas. The main difference between this and the Shawnigan stony sandy loam, is that the latter, as its name suggests, is interspersed with much gravel and frequent boulders. The Keating sandy loam, however, while unsorted and light in texture, contains very little gravel or boulders.

A shallow black to dark brown surface layer, high in organic matter overlies a red brown, easily friable sandy loam. This red brown layer extends through slightly varying phases to a depth of about two feet, where it grades into the very dense, cemented, grey colored till. The thickness of the till layer varies, or may be absent, in which case the sandy loam surface soil overlies either the stratified sands and gravels of the Qualicum soil family, or the heavier Cowichan clays. Obviously, the detailed characteristics of the Keating soils will depend upon which of these types they overlay. This is also of importance in a consideration of moisture availability in these soils.

The Keating soils have been well developed for agricultural use wherever topography is favorable. The light textured, friable nature of the soil makes it ideal for strawberries, while raspberries, early market peas and potatoes and bulbs are also well adapted to it. The low moisture holding capacity of this soil, however, imposes a limiting factor on its use. Summer drought prevents pasture, hay and grain crops from being raised with any success, and early maturing crops must be relied upon.

B. Soils Derived From Lacustrine Deposits

1. Cowichan Clay Loam and Clay

These soils have been derived from finer soil particles deposited in pro-glacial lakes and shallow estuaries. They represent the most important and extensive of the soil families in the region. Topographically they are usually gently undulating, though in places, streams have somewhat dissected them. Because there are few steep slopes on these soils, most areas can be cultivated. The better drained portions are grouped as clay loams, while those which are poorly drained are clays.

On the better drained clay loams, a shallow dark brown layer of organic matter overlies a think, ashy, clay loam. This grades into a red brown clay loam which in turn, grades into clay at about 15" depth. The grey brown clay extends to the dense, impervious parent material found at about two feet. The drainage on these soils is moderately good, and cracks in the subsoil together with the high moisture holding capacity of the surface soil reduce the

Strawberries (foreground), and loganberries (left background), on a mixture of Cowichan clays and Keating sandy loams.

amount of surface runoff.

The Cowichan clays have a different profile to the clay loams. While the thin surface layer in each case is the same, the clays have an underlying horizon of black, granular clay which extends to a yellow clay, reached at about one foot depth. This extends to a tough, grey-blue, heavy clay overlying the dense laminated clay subsoil, found at about two feet.

Both the Cowichan clays and clay loams are free of stones except in the Sooke andSaanich areas, and in these areas, except for occasional boulders, the stones are not numerous enough to restrict cultivation.

The well drained clay loams are the better of the two soils, since they are friable and have no tendency to bake. In addition, the moisture holding capacity is high, and in consequence a wide variety of crops, such as forage crops, grain, and root crops, can be grown. Small fruits, particularly loganberries, and bulbs are extensively grown on these clay loams. The Cowichan clays are generally less desirable since they tend to bake and are late soils. Though underdrainage is frequently necessary, hay, grain, and root crops do very well, withstanding the summer drought better than similar crops planted on the clay loams.

C. Soils Derived From Stratified Drift

These soils have originated from stream sorted deposits, and hence they vary considerably in texture. They

Wheat in shocks, produced on Cowichan clays -- Saanich Peninsula.

all consist of rather coarse material however, and have been classed as Qualicum stony sand and Qualicum loamy sand. The former consists mostly of sand, gravel and stones while the latter is stone free.

1. Qualicum Stony Sand

This soil is found near the apex of fan deposits where glacial streams issued from the upland, well illustrated in the Colwood delta. Consequently the topography is a series of terraces, often marked by kettle holes.

Qualicum stony sand consists of stratified layers of coarse sand, gravel and stone, with occasional pans forming perched water tables. Where the pans are close to the surface, sedge and cedar swamps may occur, though at greater depth and within the root zone of forest trees, they may cause a sparse, stunted treecover. Generally speaking, the soil has no value for agricultural use, since it is stony and has low fertility and low water holding capacity.

2. Qualicum Loamy Sand

This soil occurs in terraces, as with the stony sand, though it may occur in uniform slopes extending from the flanks of the upland to the coast line. Generally speaking the soil has excessive drainage, but occasionally where pans develop or where it thinly overlies denser Cowichan soils, restricted drainage causes a definite change in profile characteristics. In general, the profile may be described as having a thin dark brown organic mat overlying a shallow horizon of grey loamy sand which in turn, grades into a light

brown loamy sand extending to about one foot depth. Beyond this, light colored sand occurs until the parent material is reached. The chief difference in profile between the unrestricted and restricted drainage types is that, in the former, the sub-soil is loose and porous, while in the latter it is dense and almost impervious.

The moisture holding capacity of the Qualicum soils is the lowest of all the soil types in the region. Because of this lack of drought resistance and the low inherent fertility, even the loamy sands cannot produce a light crop of hay. In cases where they have restricted drainage, there is a chance for marginal agriculture.

D. Soils of Miscellaneous Origin

These soils, with one exception, are of local occurence only, and are very limited in extent. The exception is the Tolmie sandy clay loam, which is fairly extensive in the Victoria--Gordon Head area.

1. Tolmie Sandy Clay Loam

These soils are an intimate mixture of Qualicum sands and Cowichan clays, whereas other mixtures of these two soil families consist of one profile superimposed upon the other. Topographically they are uniform and fairly level, with a tendency to depression.

The Tolmie soils have a relatively thick, (6"), black surface layer of sandy day loam, overlying a more dense light grey, sandy clay loam. This grades into a tough, more dense, layer of the same material. At a depth of about two

feet, the latter grades into the impervious clay (Cowichan), parent material. The proportion of sand to clay varies, so that the texture may range from sandy loam to sandy clay. In each case, the water holding capacity remains high.

These soils are almost entirely cultivated, and are extensively used for small fruits, notably loganberries and currants, together with seed crops and bulbs. The urban area of Victoria has now expanded over a large proportion of the Tolmie soils.

2. Delta Soils

Delta soils are shallow soils of recent origin and are found at the mouths of the large streams in the region, particularly in the Sooke area. Because they are fed by seepage from surrounding higher land, delta soils are more uniformly supplied with moisture during the summer drought than is any other type. Since they represent eroded material from any of the previously mentioned soil families, they vary considerably, and have been distinguished on the basis of texture. The fine textured group, in spite of the shallowness, have well developed, mature profiles, partially due to heavy herbaceous and deciduous cover which they support.

Agriculturally the fine textured delta soils are of great value. They possess a high degree of fertility, friable structure, and moisture content, and while subject to periodic flooding, they are well suited to practically all crops grown in the region, with the exception of tree fruits.

The coarse textured delta soils include sandy

tidal flats, and gravelly river bars. Since they consist of coarse sand and gravel, they have no agricultural value.

3. Peats

Most of these soils are less than twenty acres in extent, and represent old shallow lake beds, or other topographic depressions. Generally speaking, with drainage these soils can be made very productive and are widely used for truck farming, particularly near the urban centres.

4. Mixed Profiles

These soils are limited in extent, and extremely varied, consisting of a surface soil of one family and a subsoil of another family. Among the combinations are: Qualicum loamy sand over Shawnigan till, Shawnigan till over Cowichan clay and Keating till over Cowichan clay.

Two of these mixed profiles, like the Tolmie sandy clay loam, are associated with the Cowichan soils, and because they are arable they will be briefly mentioned.

The first consists of a stony sandy loam surface over a Cowichan clay subsoil. The surface has become mixed with the clay producing a sandy to clay loam, the depth of which varies from a few inches to nearly two feet. Because of the clay subsoil, this mixed soil is generally poorly drained. It occurs mainly around the base of Mt. Newton, and a large portion of it has not yet been cultivated.

The second mixture is somewhat similar to the first. It is made up of a stony sandy loam surface over a Cowichan clay subsoil. The clay subsoil varies in thickness

and where thin, it has little effect in forming a loam with the sandy surface soil. In depressed areas it often develops a suitable mixture, but it is generally poorly drained. With drainage, this soil can be made productive. This mixture occurs mainly in the Otter district, and it has not been fully developed.

Summary of Soil Resources of the Region

Soon after the settlement of Southeastern Vancouver Island started in the 1840's, small farming communities were established at Sooke, Victoria and Saanich. These communities grew in proportion to the expansion of Victoria, and today, most of the arable acreage has been, or is at present, cultivated.

While there is considerable non-arable upland, and numerous outcrops of bed-rock occur, there is also much land suited to agriculture. The most extensive and important of the soils within the region are those of the Cowichan family--clay loams and clays. They were among the first soils to be cultivated. Associated with these are the Tolmie sandy clay loam and the two mixed types previously mentioned. The Tolmie soils have long been cultivated and represent some of the best soils in the region, while the two mixed types represent part of the acreage still available for agricultural expansion. The Keating sandy loam is limited to the Saanich area and has been extensively developed for strawberry and bulb growing, Unfortunately, a considerable

acreage of the Keating soils is non-arable because of topography, since they mantle much of the upland area. On the soil map, pockets of this soil type occuring with rock outcrops remain unclassified.

The Qualicum stony sands occur largely in the Colwood delta and are non-arable. A number of small holdings have been developed on them, however, due to the proximity of Victoria. Because of the expansion of Victoria, there is an increasing opportunity for development of some of these Qualicum soils, particularly the restricted drainage phases lying near ~~Victoria~~ that centre. The main utilization of these soils is in mining. The Qualicum stony sands are the chief source of sand and gravel in the region.

The following table[1] represents an acreage summary of soil families in Southeastern Vancouver Island:

	ACRES
Shawnigan stony sandy loam	5,920
Keating sandy loam	7,335
Cowichan clay	21,155
Cowichan clay loam	5,695
Qualicum stony sand	4,480
Qualicum loamy sand	2,120
Qualicum loamy sand (restricted drainage)	380
Tolmie sandy clay loam	7,165
Delta stony sand	320

(continued)

1 Spilsbury, R.H., Soil Survey of Vancouver Island, 1944, (unpublished), p. 55a

Delta soils	640
Peat	1,240
Mixed profiles (unrestricted drainage)	1,760
Mixed profiles (restricted drainage)	3,885
Rock outcrop and water	17,605
TOTAL	79,700

6. NATURAL VEGETATION AND PLANT AND ANIMAL ECOLOGY

Natural Vegetation and Settlement

When the first white residents moved into the region of Southeastern Vancouver Island, they cleared land which was covered, for the most part, by a fine stand of coniferous forest. This forest was an asset which was utilized for many construction purposes. Hand hewn and hand sawn lumber were the only building materials readily available. The alternative was importation of these materials via a long and expensive sea route.

The Douglas fir was widely used, since it was both strong and durable, The native cedars were also extensively used, particularly for roofing and fences. The Douglas fir was the most abundant of the forest trees, while both western hemlock and western red cedar were common. These conifers, while generally abundant, formed their heaviest stands where moisture was most available. Thus the Otter, Sooke, Goldstream and Highland districts--upland areas--were very heavily timbered. The settlers were quick to take advantage of these forest resources, and small sawmills sprang

Looking from Sooke road to the N.W. shoulder of Redflag Mountain. Dry pasture in the foreground is bordered with alder and fir in the near background. Slopes of the mountain are well clothed with Douglas fir second growth. Bare rock outcrop can be seen on the upper slopes.

up to meet the local demand for lumber. One of the first of these was established at Sooke as early as 1850. Forests remain today one of the region's major resources.

The drier eastern and southeastern portions of the region within what has been termed the Madrona--Oak transition,[1] supported generally smaller trees, but in greater variety of species. The deciduous species particularly were found here, in groves, or interspersed among the conifers. One of the most noticeable of these deciduous trees, the Garry oak, (Quercus Garryana), favored the drier areas, especially in the vicinity of rock outcrops. The arbutus, (Arbutus Menzies), an evergreen species also thriving in the drier areas of the region, formed a sharp contrast with the conifers. Neither it nor the oak was utilized to any extent for structural purposes. Their former abundance is attested by the areas named after them, Oak Bay and Arbutus Cove being two of the better known of these place names. Broad leaved maples and red alder were largely restricted to stream banks, lake shores or other localized areas too wet for the conifers. In addition to the tree species, a profusion of shrubs and herbs occupied places where the soil was thin or where winter rains caused periodic flooding.

Though the forest was recognized as an asset, the heavy tree cover was also a problem. Clearing methods were slow and laborious, and farms a few acres in extent

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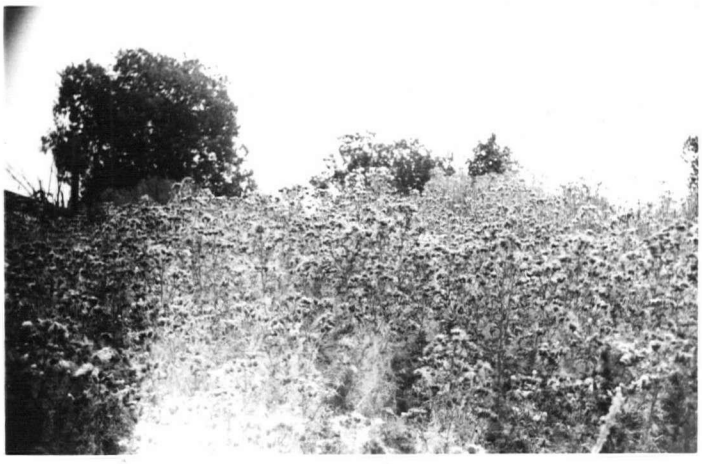
1 Halliday, W.E.D., A Forest Classification for Canada, Forest Service Bulletin 89, Dept. of Mines and Resources, Ottawa, 1937.

Mixed cover near Mt. Douglas. Spiraea and willow are prominent in the shrub layer, while arbutus (Arbutus Menziesii), and Douglas fir form the tree layer.

meant years of toil. Land was first cleared in the areas of lighter cover, and gradually expanded until all the best agricultural land in the vicinity of the settlements was under production. In spite of the difficulties involved, agricultural settlement continued to spread particularly in the Victoria--Saanich area, where the most extensive acreages of good land were found.

The expansion of settlement had its reciprocal effect upon natural vegetation. As the land was cleared, a new succession of plant communities appeared in the cut over and burnt over areas. Tracts of alder and willow grew up where fir and hemlock had stood, and the conifers became increasingly less prevalent except in the upland areas. Not only were new plant successions originated, but exotic species were introduced, some of which invaded the region with considerable success. One of these, the ubiquitous broom, (Cytisus scoparius), was imported to the region by William Grant, the first settler in the Sooke area. In some cases this plant has become a pest, and has ruined acreages of former rough pasture. However, since it favours dry, rocky locations, it does not readily spread to arable land. Of greater seriousness to the farmer are the Canada thistle, (Cirsium arvense), and quackgrass or couch (Agropyron repens). Both these exotic species have thriven in the region. Of the latter, Kephart has said: "With the possible exception of the Canada thistle, quackgrass is the most

1. Looking east from East Sooke Road near Metchosin. Dry pasture fills the foreground. The dark mass extending from centre to right in the near background is yellow broom, (Cytisus scoparius). It has invaded the pasture seen in the centre of the photograph.



2. Canada thistle (Cirsium arvense), in the seed bearing stage. Borne on plants averaging 3½ feet high, the downy seed is easily carried by the wind from infested areas to neighbouring cultivated lands. Once established, the weed is difficult to eradicate.

notorious of all weeds and probably causes a greater monetary loss than any other single species of plant."[1]

The various lower plant forms, specificably the plant diseases, which have been introduced to the region, while not as conspicuous as the higher forms, probably cause a greater annual loss to agriculture. Such diseases as scab of apples and pears, (Venturia inaequalis), late blight of potatoes, (Phytophthora infestans), and clubroot of Crucifers (Plasmodiphora brassicae), cause considerable losses. Some plant diseases are present in other areas of British Columbia, but are conspicuously absent from Southeastern Vancouver Island. Among those are "Little Cherry" and Fireblight of pears and apples.[2]

The foregoing plant diseases are of minor importance, however, unless drought and winter injury are included. While winter injury is limited because of the long frostless season, summer drought is the limiting factor of crop production in non-irrigated areas.

Slope, Soil, Water and Vegetation Relationships.

In any of earth's regions, a delicate balance exists between soil, water and vegetation. Each of these factors acts upon the others, and any change in one factor, must affect the balance of the whole. This balance exists both in the broad aspect of the region as a unit and also in

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1 Kephart, L.W., cited in Grass, The Yearbook of Agriculture, 1948, United States Department of Agriculture, U.S. Government Printing Office, Washington, 1948, p. 728

2 Foster, W.R., (Provincial Plant Pathologist), letter to the writer, 29th July, 1949.

the smaller subsidiary units comprising the region. Thus the relationships in one area are reflected by a stand of conifers, in another by a sedge meadow, and in another by an alder grove. To man, probably the most important of these relationships are those directly affecting soil and agriculture.

Since Glacial time, a succession of plant communities has converted the raw mineral tills into a variety of immature and mature soils, the profiles of which reflect all the factors of slope, water, and vegetation. The surface horizons developed respond to the nature of the vegetative cover, forming an acidic fibrous mat under the conifers. Because of the acidity, the soil organisms which cause decomposition of the organic matter are fungi, rather than bacteria. These mycorrhizal fungi perform an important function in the soil by producing soluble organic compounds which are distributed through the soil and thereby made available to plants. The acidity, however, varies from fairly high under the Douglas fir-hemlock cover in the upland areas, to less acid under the deciduous trees and neutral in the drier park-like areas near the coast. Not only within the region, but on the Island as a whole, acidity varies. In the northern portion heavy rains and the thick hemlock-spruce cover combine to produce the most acid of the Island soils. In Southeastern Vancouver Island, the lighter rains and more open cover develop more neutral soils.

The percolation of groundwater varies with the slope and the porosity of the soil, but it tends to collect in valleys and low lying areas. This produces temporary water tables, important to some crops, particularly summer pasture. The change in water relationships produced by these temporary water tables is usually indicated by a luxuriant cover of swordferns, mosses and deciduous trees such as red alder and broad-leaved maple - in contrast to the conifers. This vegetative type produces a black, granular humus instead of the fibrous mat under the cone-bearers. In some cases, where the soil is continually water-soaked, the organic matter accumulates forming peat and muck deposits, or possibly sedge meadows.

Should the vegetation be removed from a large area, the balance is disrupted, often to the detriment of the area as a whole. The organic layer becomes depleted, soil becomes compacted and particularly in areas with considerable slope, runoff becomes serious. Water tables drop and streams become intermittent. Generally speaking, however, clearing of vegetation within the region of Southeastern Vancouver Island has been restricted to the flatter areas for the development of farm lands. The upland areas, though logged at various times, have not been completely stripped of their cover. Thus, while the soil, water and vegetation relation-ships have been changed, they have not combined to form a serious erosion problem within the region. The numerous

small peat bogs found scattered through the region, particularly in its northern half, are of great importance in their control of moisture relationships. During periods of heavy precipitation they are capable of absorbing and retaining a great volume of water which is gradually released as seepage to groundwater, or to small streams. This seepage is consequently of considerable importance to irrigation wells. It seems likely that the problem of decreasing reliability of springs and wells in the North Saanich District has resulted from the draining of bogs and the almost complete clearing of the tree cover.

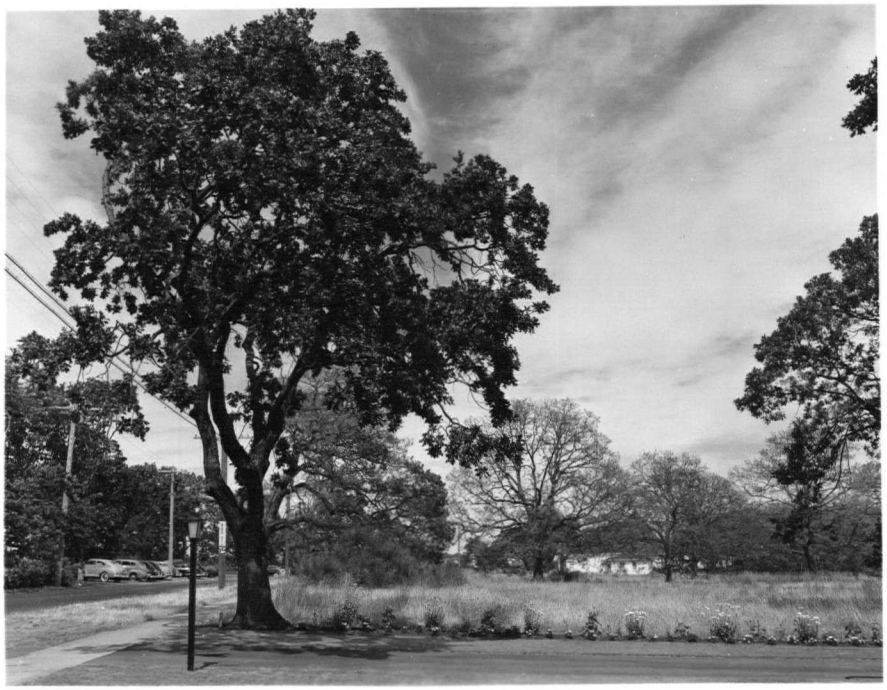
Animal Life and Settlement

The first white settlers in Southeastern Vancouver Island found an abundance of game to supplement their diet. Deer, grouse, and wildfowl were common in all areas, and remain so today, though they are most abundant in the less developed southern and southwestern portions of the region. Here, the wildlife resources attract tourists and urban residents alike, and thereby make a contribution to the local income. Few large predators find habitat in the region except in the west and southwest, where cougar occasionally become a problem to local farmers, particularly to sheep raisers.

Among the animal resources of the region are the various fresh and salt water fishes, important alike to sportsmen and to industry. Of the fishes, salmon are the most valuable, and form the basis of one of the most important industries. Though these fish are migratory species, they

are common along the ocean littoral during the spring and fall months. The Pacific salmon (genus Oncorhynchus), spend varying lengths of time, depending on the species, in fresh water after hatching. After this period they descend to the sea where most of their growth is attained. Generally, this descent to the ocean occurs during the spring months. The adult salmon return from the ocean in the fall months to spawn and die in the streams whence they came. The fall "run" is heaviest, and forms the object of intensive fishing. Salmon are caught commercially in great numbers in the Sooke and Juan de Fuca areas, while sport fishermen crowd the waters of Saanich Inlet to take a small share of the annual catch. Various species of cod, halibut, herring, tuna and pilchards are also important commercial fishes locally taken.

Of considerable significance in the geographic pattern of the region are the lower forms in the animal kingdom. Because of the great variety of plants which can be grown, (a response to climate), a great variety of animal pests parasitic on these plants, are also to be found. The hemlock looper, the black-headed budworm, and the Douglas Fir tussock moth cause considerable annual losses to forestry. The oak looper, (Lamodina somniaria), while not a parasite of commercial timber species, has caused extensive damage, (defoliation), in the vicinity of greater Victoria. Other parasitic insects attack cultivated crops. The Western ten-lined June beetle is a most important pest of strawberries, loganberries and tree fruit seedlings. In some parts of the



Oak loopers (Lamodina somniaria), and their effect on foliage. In the past three years the loopers have cause extensive damage to local stands of Garry oaks. This animal is similar to the hemlock looper which has seriously affected some forest stands on Vancouver Island.

region, this insect has forced growers to discontinue strawberries on light and medium textured soils, where as high as 70% losses have occurred.[1] Root weevils, the Western raspberry fruitworm and the leafhopper are other species causing considerable damage. The leafhopper, (Typhlocyba tenerrima), a serious pest in Europe, appeared in the region as late as 1947. The European apply sawfly, though not known to occur anywhere else in Canada, was first recorded in the region in 1940, and has become a major pest of apples on Vancouver Island. During World War II, when vegetable seed production developed as an important phase of agriculture in the region, the cabbage seedpod weevil became, and remains, a major hazard to turnip and cabbage seed production.

Nearly all the agricultural insect pests found in Southeastern Vancouver Island are introduced species. They are usually from Europe, the climate and agriculture being largely similar to those of the western part of that continent. Most of these pests are without their natural parasites, and as a result they often assume epidemic proportions. In addition to chemical controls, efforts have been made to introduce their respective parasites and some of these have been fairly successful. Those parasitic upon the pea moth and the European earwig are among the more successful. Nothing definite is known of the mode of introduction of any of these pests, but the fact that their first appearance was near the coast would indicate that they were brought by ship.

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1 Andison, H., (Provincial Entomologist), interview with the writer, 25th July, 1949.

Some undoubtedly migrated up the coastal plain from Oregon and California, but few if any, have crossed the Rockies.

7. HUMAN GEOGRAPHY OF THE REGION

History of Exploration and Settlement[1]

When Don Manuel Quimper, the first white visitor to Southeastern Vancouver Island, sailed into Esquimalt harbour, he found the region peopled with Indians. Those in the Esquimalt--Victoria area comprised the Songhees tribe, while the Saanich and Soke[illegible] tribes occupied the Saanich and Sooke areas respectively. These tribes were members of the Cowichan group, and therefore were of Salish origin, obtaining their livelihood chiefly from coastal areas, and practicing little or no cultivation. Since food was always plentiful in the region, the Indians were relatively numerous before the advent of white men. Today little remains of the Indian culture, though their descriptive place names survive in "Esquimalt" --"Is-whoy-malth" (place of shoaling waters), and "Cowichan" (basking in the sun). Sooke has derived its name from the Soke Indians formerly inhabiting the area. The names "Metchosin" and "Saanich" are other inheritances from the former culture. The few native Indians now living in the region occupy a small number of typically squalid reservations in the Sooke, Metchosin and Saanich districts.

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1 The specific dates used in the historical outline were gleaned from several sources, notably the following:-
(1) Bancroft, H.H., History of British Columbia, The History Company, San Francisco, 1890.
(2) Howay, Sage, Angus, British Columbia and the United States, Toronto, Ryerson, 1942.
(3) Robinson, L.B., Esquimalt, Quality Press, Victoria, 1947.

Quimper in his sloop, "Princessa Real", (the "Princess Royal" of Nootka fame), found that the Strait of Juan de Fuca, up which he sailed, opened to the northeastward forming a wide roadstead. Thus the natural configuration of the region's southern half lead him directly to Esquimalt Harbour, where he anchored in 1790. The harbour of Sooke was also discovered by Quimper. Because of their positions near the entrance to the Strait, it seems natural that these two harbours should be the first to have been discovered in the Juan de Fuca area. In 1791 two other Spanish ships from Nootka arrived at Esquimalt, or as Quimper had named it, Puerto de Cordova. José Narvaez, in command of one of these ships, later sailed up what is now Georgia Strait carrying out a survey of the coast. He was the first white man to discover Vancouver harbour. Don Galiano and Don Valdes in two small survey vessels, detached from Malaspina's exploring expedition, were the last Spaniards to visit Southeastern Vancouver Island. According to his journal, Galiano was impressed by what he saw of the hinterland of Esquimalt, but the Spaniards made no attempt to settle the region. Today, the Spaniards, like the Indians before them, are more remembered for their place names than for their development of the region's resources.

Captain George Vancouver in 1792 had met Valdes and Galiano off Vancouver harbour, and had proceeded with them to survey the waters of Georgia Strait. Following his

visit to Southeastern Vancouver Island and the "Nootka Convention", signed in 1795, no white development took place in the region for some fifty years. During these fifty years, the Oregon boundary dispute had arisen between the sovereignty of the Hudson's Bay Company and American settlers in the "Oregon Country". As hope for a settlement of the boundary at the Columbia River faded, Company officials decided to replace Fort Vancouver by a new trading post further north, in undisputed territory. In consequence, James Douglas, the Chief Factor, made a careful survey of the south coast of Vancouver Island in the Company's sloop, "Cadboro". Since he regarded the southwest coast of the Island as too exposed, he carefully examined the harbours of Sooke, Esquimalt and Victoria. Douglas was interested in establishing a Company fort which had to be self supporting in order to function. Consequently he discarded the better harbours at Sooke and Esquimalt for that of Victoria, or "Camosack" as it was known to the Indians. This Indian place name has some significance in Douglas' choice. In the latter's report, he favorably describes a large tract of clear land adjacent to the proposed fort site. This tract had apparently been cleared by the Indians in their search for Camass root. Camass is a herb of the lily family, the bulb of which was a favorite food of Indians. The district around the harbour of Camosack was named by them "Camosun" or "Place for Gathering Camass". The agricultural potential of Victoria's hinterland was thus early exhibited as a factor in the settlement of the region.

Not long after the establishment of the fort, transfer of headquarters of the Western Department, Hudson's Bay Company, was made from Fort Vancouver (Washington) to Fort Victoria. James Douglas, now in charge of the Western Department, moved with his family to Victoria in 1849. In the same year all of "Vancouver's Island" was leased to the Hudson's Bay Company. The lease was granted on the condition that the Company should commence settlement of the Island. Also in 1849, Vancouver Island became a Crown Colony, with the appointment of a Governor. Douglas became the second Governor, as well as retaining his position of Chief Factor. Under his able direction farm lands spread rapidly in the vicinity of Victoria. While the first settlers in the region took up land in valleys or in the better watered portions, cultivated land soon occupied a large part of the arable area. In the meantime, as a result of the Boundary Dispute, and later, the Crimean War, Esquimalt Harbour developed as a naval base. Lacking Victoria's agricultural hinterland, few farms were cleared and Esquimalt became increasingly specialized as an outfitting and repair base for ships, both merchant and naval. The Royal Navy and the Company cooperated very closely, the Navy lending much needed assistance in building roads, clearing land and suppressing occasional Indian disputes.

A great stimulus to the spread of settlement in the region came in 1858 when the Cariboo gold rush began. In a few months, Fort Victoria changed from an isolated trading post to a boom town of several thousand people. The Hudson's

Bay Company soon ceased to be the only business concern, and a commercial district grew up, resulting in the post's incorporation in 1862. Another impetus to development occurred in 1868. At this time, Vancouver Island and the mainland territory were united as the crown colony of British Columbia, shortly after which, Victoria became the colonial capital. The period of rapid expansion for Southeastern Vancouver Island ended shortly after the establishment of the Canadian Pacific Navigation Company in Victoria. After the first Canadian Pacific train arrived at Vancouver in 1886, the former city's commercial domination was lost to Vancouver and Seattle.

By this time, however, Victoria's hinterland was well established. In the same year that the transcontinental railway was completed, the opening of the Esquimalt and Nanaimo railway made available a new area of the Island's forest and mineral resources. This railway was later extended to Alberni and Courtenay.

Shortly after the founding of Fort Victoria, settlement had also started at Sooke and later at Sidney. William Colquhon Grant, in 1850, cleared the first farm in Sooke, and the venture was so successful that several other Scottish families moved to the area, settling the shores of Sooke Harbour. Since the first influx of settlers, growth has been slow, for the amount of good agricultural land is limited. It soon became apparent that the immediate hinterland of Victoria held the greater promise for development, since here lay the greatest acreage of arable land. Never-

theless, the forest resources of the Sooke area have made it one of the major regional centres for logging.

The Saanich area, on the other hand, was originally settled in the 1860's by two Scots -- Cariboo gold miners who had bought land in the area. It is probably indicitative of the hardy pioneer spirit of the Scottish people, that practically all the first settlers in South -eastern Vancouver Island were Scottish, or of Scots parentage. A wagon road was built between North Saanich and Victoria, and in the 1870's another road was built further to the east. The roads opened up the most fertile lands in the region for settlement, and cultivation expanded steadily. In 1894 a railway was built, linking the town of Sidney with Victoria. While it aided in the agricultural and industrial expansion of the Saanich Peninsula, this railway, affectionately known as the "Cordwood Limited", ceased operation in 1919. It could not face the competition of modern highways.

Present Population [1]

(a) Distribution

The present distribution of population in the

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1 The population figures, unless otherwise indicated, are estimates for 1949, and are based on information obtained from the following sources:-
(1) British Columbia Facts and Statistics, vol. II, Dept. of Trade and Industry, Victoria, 1949.
(2) Regional Industrial Index of British Columbia, Dept. of Trade and Industry, Victoria, 1948.
(3) Estimated Population of School Districts, Dec. 1947, Dept. of Health, Division of Vital Statistics, Victoria, B.C.

POPULATION DISTRIBUTION OF SOUTHEASTERN VANCOUVER ISLAND

KEY

URBAN AREA (ESTIMATED POPULATION 100,500)

2,500 PEOPLE

250 PEOPLE

region largely reflects the underlying physical controls. The lowland areas are generally well populated while the upland portions have a sparse population. Consequently the Victoria-Saanich area is heavily peopled in contrast to the Sooke area. The former area is largely a till-covered lowland. Here, soils are generally fertile and agriculture is the primary occupation. Since agriculture employs a large number of people in comparison to other primary industries, it follows that the Victoria--Saanich area should be well populated on the basis of agriculture. The western and southwestern portions of the region possess forest and mineral resources but relatively small acreages of arable soil. These resources of forest and mine require a proportionately small population for their exploitation.

Because of her agricultural hinterland combined with a harbour and other site factors, Victoria early developed as the commercial and industrial centre for the region. Here the secondary and tertiary industries are concentrated. These industries require great numbers of workers. Thus Victoria and its suburbs make up the great bulk of the regional population. Other, much smaller centres such as Sidney, Metchosin and Sooke, follow the same pattern. They are transportation, collecting and distributing centres which form the nuclei of population for their surrounding areas. The accompanying population map will show the general distribution within the region.

(b) Density

The present population of Southeastern Vancouver

Island is approximately 110,000, or over two-thirds that of the whole Island, and about ten percent of the provincial population. Considering Victoria and the municipalites of Oak Bay and Esquimalt as constituting the urban area, 70% of the population is urban. A large part of the rural population is agricultural, obtaining all or part of the family income from farming. Most of this population is concentrated in Saanich Peninsula, as shown by the accompanying map.

The average population density in the region as a whole is 550 per square mile, while the density excluding the urban area, is about 163 persons per square mile. However, when one considers the rural population density in terms of arable land, it is much higher, amounting to 430 per square mile, or one person for every one and a half acres of arable land. Since part of the "rural" population, particularly in the Saanich districts and on the outskirts of the urban area, derive all or part of their income from sources other than farming, these figures tend to be misleading. Individual farms, from which the operator derives his total income are much larger than the statistics would suggest, though they vary according to the type of farm. Besides this, the intensive nature of most of the agriculture carried on means high returns from relatively small acreages and hence correspondingly high population density. The urban area according to the 1941 census, was seven and one quarter square miles, and maintained

a density of 6,078 persons per square mile.[1]

(c) Growth of Population

While the population of the region has shown a slow but steady increase from 1871 to 1931, there has been a marked increase in the decade 1931 to 1941. This recent increase, while resulting in part, from the influx of service and technical personnel during World War II, has been greatest in Saanich Municipality - a rural area. The increase in Inner Saanich population appears to have largely resulted from migration from other parts of Canada, notably the prairie provinces, whence many "retired" farmers have recently moved to the coastal area. Most of these immigrated to the region in response to the equable climate and the ideal living conditions in the Victoria area. A considerable number of them take up small holdings sufficient to provide fresh vegetables and maintain a few chickens or possibly, a dairy cow. The gain in population since 1921 in the Victoria-Saanich area, and the estimated population in the unorganized

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1 Population, 1871 - 1941, (Reprint, pages 1 - 176 of vol. 2), King's Printer, Ottawa, 1944. p.9. The urban area here refers to the city of Victoria proper, (exclusive of the municipalities), and does not include the settlements at Sidney and Sooke.

territory of Sooke, Colwood and Langford is shown in the following table.[1]

					Increase over 1941	
	1921	1931	1941	1947	No.	%
Esquimalt District Municipality	3,458	3,274	3,737	4,500	763	20.4
Oak Bay District Municipality	4,159	5,892	9,240	11,500	2,260	24.5
Saanich District Municipality	10,534	12,968	20,535	26,000	5,465	26.6
Saanich (Inner)@			15,062	22,000	6,938	46.1
Victoria (city proper)	38,727	39,082	44,068	61,400	17,332	39.3
Unorganized territ. of Sooke, Colwood and Langford				4,500		

@ Inner Saanich (included in the "Saanich" figure) refers to the inner wards of Saanich, voz. wards 1, 2, 3 4, and 7. In general terms, these wards lie south of a line drawn from the south end of Prospect Lake to the north end of Blenkinsop (Lost) Lake, thence northeasterly to Cordova Bay.

(d) Composition

Similar to the Canadian average, the large majority of the regional population is made up of British Isles stock. Of this national group, English comprise the greatest number, followed by Scottish and Irish. Of the remaining national groups, Chinese and Scandinavians form the greatest percentages, 4½% and 2% respectively. The percentage of Asiatics, while about equivalent to the

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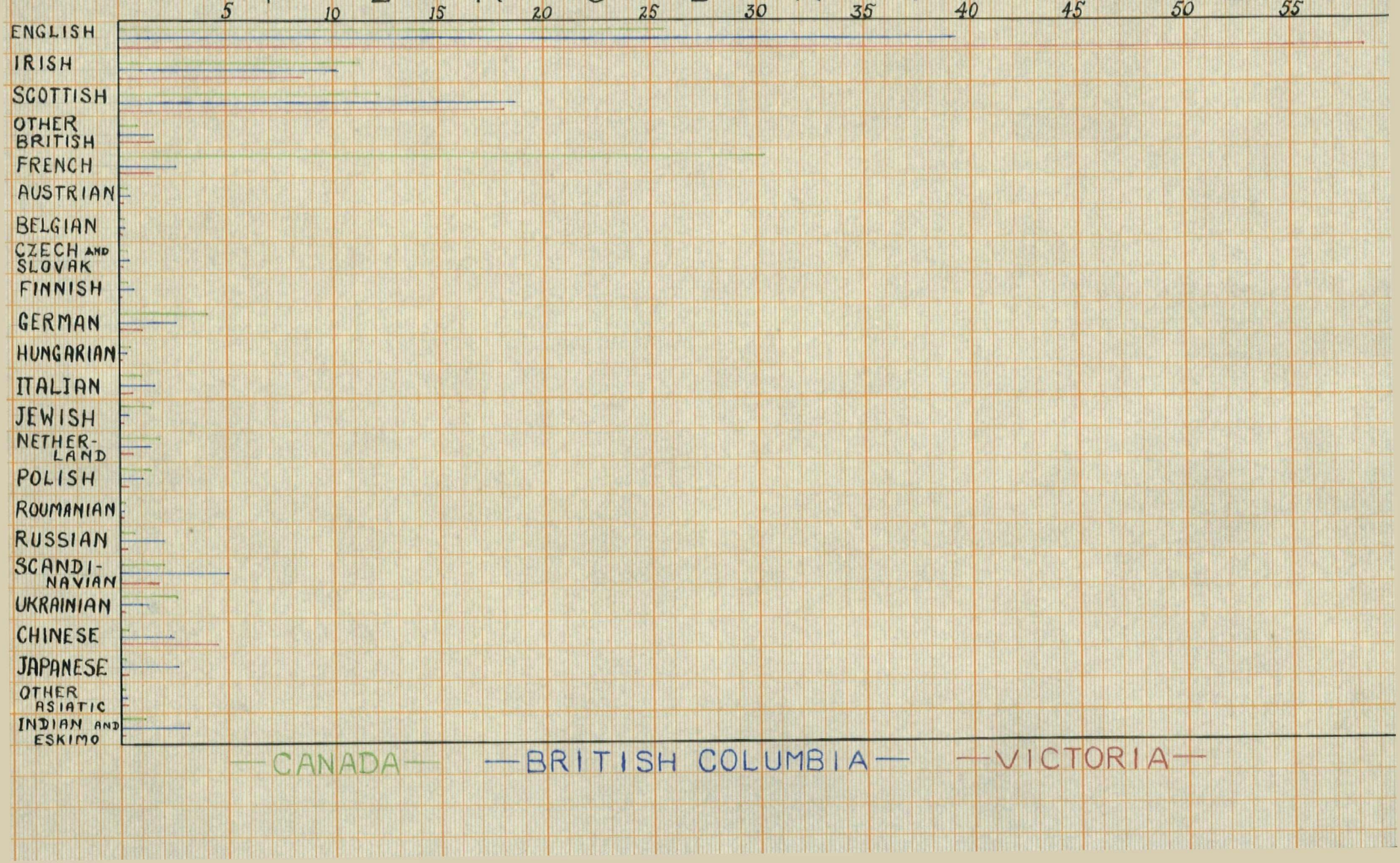
1 Statistics from: (1) Population, 1871 - 1941 (Reprint, pages 1 - 176 of vol. 2) King's Printer, Ottawa, 1944, p. 144.

(2) Estimated Population of School Districts, December, 1947, Dept. of Health and Welfare, Div. of Vital Statistics, Victoria. The figures in the table exclude native Indian population.

(3) What the Household Controllers of Health in the Saanich and South Vancouver Island Health Unit Territory Know About Their Local Public Health Unit (mimeographed report)-Div. of Vital Statistics, Dept. of Health and Welfare, Parliament Bldgs., Victoria, B.C. Jan. 1949.

T5a

POPULATION BY NATIONAL ORIGIN
PERCENTAGE



British Columbia average, contrasts with that for Canada, where total Asiatics average less than 1%. Among the reasons for the higher percentage of Asiatics on the coast and in the region is the influx from California. During the gold rush days in B.C., a number of Chinese migrated northward from the California fields. Many of these became agriculturalists particularly truck gardeners, near the urban centres. The long frost free season in the region is well suited to this form of agriculture. Hence there is a considerable number of Chinese engaged in this pursuit in the Victoria area. Another influx of Asiatics came to B.C. as labourers during construction of the railway. Besides these reasons, the relative proximity of the B.C. coastal area to the Orient has added to the percentage of Orientals here.

Though statistics are not available for the region as a unit, those for greater Victoria[1] are probably representative. The accompanying bar graphs[2] compare the

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1 Greater Victoria is that portion of the region made up by Victoria city proper and the municipalities of Esquimalt, Oak Bay and Saanich.

2 Statistics for the year 1941, obtained from:
(1) The Canada Year Book, 1946, King's Printer, Ottawa, 1946
(2) Population Tables A-4 and A-13 (mimeographed), Dominion Bureau of Statistics, Ottawa, Canada.

population by national origins of Canada, British Columbia and Victoria.

In 1941, 58% of Victoria's (city) population was Canadian born, while over 31% was British born (outside of Canada), and 11% was foreign born.[1] This is considerably different from the Canadian average, which lists, for the same year, 82% Canadian born, 9% British born (outside of Canada), and 9% foreign born.[2] One of the reasons for the high percentage of British born is the number of service personnel of British birth, who have retired in Victoria.

The birth rate for Victoria, (city proper), in 1941 was 18 per thousand, while those for British Columbia and for Canada in the same year were 18 and 22 respectively.[3] These figures may be compared with 42 births per thousand in Costa Rica (1944), 38 per thousand in Egypt (1942), 18 per thousand in England and Wales (1944) and 15 per thousand in France and Belgium, (1939).[4] If birth rate may be regarded as a criterion of living standard, the relatively low rate for Victoria would indicate a correspondingly high standard of living. The death rate in 1941 was 13 persons per thousand

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1 Canada Year Book, 1946, King's Printer, Ottawa, 1946. p.109
2. Ibid., p. 108
3. Ibid., pp. 141 and 144
4. Ibid., p. 142.

for Victoria, 10 per thousand for British Columbia and 10 per thousand for Canada.[1] Comparative figures for foreign countries are 9 deaths per thousand in the Netherlands (1939), 10 per thousand in New Zealand (1944), 11 per thousand in the United States (1944), 12 per thousand in England and Wales (1944), 15 per thousand in France (1939), and 29 per thousand in Egypt. (1942)[2]

According to a recent survey,[3] the occupations of "heads of households" in the region, shows the following proportions:

Occupation of Head of Household	Percentage of the Regional Population
Labourer	16
Skilled	48
Professional	12.3
Retired	23.7

The survey also tabulates the estimated income of the regional population in three groups as shown below.[4]

Income Group		Percentage of Regional Population
Under Average	Less than $1500/yr.	21.7
Average	$1500 - $2500/yr.	61.3
Over Average	More than $2500/yr	17.0

Within the region, North Saanich has 37% of its

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1 Canada Year Book, 1946, King's Printer, Ottawa, 1946, pp.155 and 157

2 Ibid., p. 156

3 What the Household Controllers of Health in the Saanich and South Vancouver Island Health Unit Territory Know About Their Local Public Health Unit, (mimeographed), Division of Vital Statistics, Dept. of Health and Welfare, Parliament Bldg., Victoria, B.C., Jan., 1949, p. 28.

4 Ibid., p. 24

population in the "under average" group, Lakehill has less than 10% and Sooke has less than 20% in this class. The large percentage of people in the $1500 - $2500 income group would indicate a high standard of living in the region.

8. INDUSTRIES

The use of the natural resources of Southeastern Vancouver Island has been fairly extensive. Although figures are not available,[1] agriculture appears to be the most valuable primary industry, followed by forestry and fishing. Agriculture, as would be expected, has its greatest concen-tration on the Saanich Peninsula, while forestry is concentrated in the upland topography of the southwest. Nearly all the secondary and tertiary industries are centered in the urban area of Victoria.

A. Primary Industries

Mining

Though non-metallic deposits constitute the chief mineral wealth of the region, some gold, copper and iron deposits are known to exist.

Gold occurs in many of the streams in the western part of Southeastern Vancouver Island, but only in minor

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1 Most published figures include all of Vancouver Island and the Gulf Islands as a unit. Some unpublished material was obtained, breaking statistics down into census divisions, but except for the mineral industry no information as to production, number of persons employed, or relative values of production, was available to the writer, for the industries within the region.

quantities. Goldstream River, in the west dentral part of the region was so named from the gold bearing gravels worked there in the early days, though relatively little gold was ever taken from the area. Hardrock mining for gold was carried on for a limited period at Skirt Mountain, near the southern end of Saanich Inlet. Active mining operations were carried on from 1898 until 1902, when work was suspended, and not resumed until the fall of 1924.[1] Since then some development work has taken place, but in recent years the claims have not been considered economically workable.

Copper deposits in the region are more or less closely connected with the upper Jurassic intrusives. Shear zone deposits occurring in the Sooke gabbros of east Sooke area in the vicinity of Mount Maguire have been prospected, but no mining has been carried on. Though admirably suited with relation to road or water transportation facilities, and producing ore of approximately 5% copper, the deposits, after a flurry of prospecting in the period 1915-1918[2], fell into disuse. It would appear that there is some possibility of future copper mining in this area, though under present economic conditions the deposits are not extensive enough to warrant further development.

Iron ore does occur along with copper in the Sooke gabbros, but it is apparently of no commercial value,

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1 Annual Report of the Minister of Mines, for the Province of British Columbia, 1924, King's Printer, Victoria, 1925, pp. 253-255

2 Annual Report of the Minister of Mines, B.C., for the years 1904,'07,'08,'15,'16,'17,'18,'25,'28,'29,'31.

being too limited in extent and of low iron content. Also in the same area, near Young Lake along DeMamiel Creek, is an impure iron deposit in the form of ochreous clay. This deposit does have some commercial significance as a possible source of base for coloured paints.

The non-metallic deposits in the region of Southeastern Vancouver Island, are, in addition to the ochreous clay, chiefly sand and gravel, clays, crystalline limestones and building stone. The sands, gravels and clays are obtained from the stratified glacial deposits and thus they are well distributed in the area. As would be expected, the sand and gravel deposits have been quarried near the roads and railways for filling and grading purposes. In addition they have been used extensively for structural purposes, notably in the construction of the Victoria breakwater, and they are still widely used as ingredients in concrete. The sand and gravel deposits which are most extensively used, are those laid down during the Vashon recession in the Colwood delta, near Albert Head. Here, ease in quarrying and availability of water transport cut operating costs to a minimum.

The clays of the stratified drift deposits (Maywood clays), are also well distributed in the region. At various times these have been used for making bricks and drain tiles, pottery, and in the manufacturing of Portland cement. One clay pit near Selkirk Water in west central section of Victoria, is still being used for brick and tile. Another formerly used deposit is located at Bazan Bay on the Saanich Peninsula.

1. Quarrying the Cordova sands and gravels near Cordova Bay. Output of this operation is about 15 yards of washed and sorted materials per hour.

2. Bazan Bay brick and tile works. Cowichan, (Maywood), clays are scooped by tractor from "pits", (partly shown in centre foreground), then conveyed to the moulds and kiln, (background).

3. Stratified superficial deposits near Tugwell Creek. The prominent bedding planes indicate fore-set beds. The deposits are here used for road construction and maintenance.

Limestone deposits occur as the Sutton formation, within a limited area in the central part of the region west of Esquimalt Harbour, and also at Tod Inlet. These areas were formerly exploited for the manufacture of cement, flux and burnt lime. Probably the most utilized deposit was that on Tod Inlet, taken up by the Vancouver Portland Cement Company. Rosebank and Parsons Bridge were sites of former plants in the Esquimalt area, utilizing the Sutton limestones for burnt lime and silica brick respectively. None of these plants is now in operation.

An excellent quality of crushed stone, a greyish-green basalt, is obtained from the Metchosin volcanics at Albert Head, but the fractured and sheared nature of the rocks throughout the region makes them unfit for building stone. North of Esquimalt Harbour, a deposit of diatomaceous earth is known to occur in the valley of Tod Creek, draining Prospect Lake, but up to the present, it has not been utilized.

The presently exploited minerals in Southeastern Vancouver Island are entirely non-metallic, consisting of clay, sand and gravel. These materials are quarried largely for local use, and consequently the mineral industry is a minor one. The following table lists the value of clay products and of sand and gravel in the region.[1]

Value of Mineral Production in Southeastern Vancouver Island

	1947	1948
Clay products	$103,548	$108,422
Sand and gravel by commercial producers	$321,715	$332,533

1 Pearson, H., Mining Statistician, (Dept. of Trade and Industry), letter to the writer, 28th July, 1949.

The chief areas of production are near Albert Head and Cordova Bay (sand and gravel), and at Victoria and Bazan Bay (clay). Most of the clay produced is used in the manufacture of bricks and drain tiles. Since the reserves of these materials are very extensive, it seems likely that a gradual expansion of this phase of the mineral industry will be coincident with urban expansion.

Fishing

Commercial fishing occupies the ocean littoral from the tip of Saanich peninsula to the southwest extremity of the region. Saanich Inlet is set aside as a fishing preserve open only to sport fishermen. The chief fishes caught are salmon, cod, halibut and tuna. The following table[1] will give some idea of the relative amounts of the various species caught.

(See next page for table)

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1 Figures obtained from Fisheries Statistics of Canada, 1944, Dept. of Trade and Commerce, Ottawa, 1946, table 31. The figures are listed for a District No. 3 subdivision titled: "Shoal Harbour to Sombrio Point including Victoria Harbour." Shoal Harbour is at the N.E. tip of Saanich Peninsula, and Sombrio Pt. is on Vancouver Island's S.W. coast between Jordan River and Port San Juan.

Fish Caught and Landed			
Totals for Shoal Harbour to Sombrio Pt.		Totals for B.C.	
Species	Quantity (cwt.)	Quantity (cwt.)	Value ($)
Salmon	17,228	1,075,719	7,255,524
Ling cod	6,163	84,250	830,828
Tuna	3,388	4,636	79,676
Halibut	3,362	131,671	2,231,794
Cod (sic)	2,226	9,414	52,260
Soles	2,086	31,826	166,824
Grayfish (dogfish)	1,462	22,339	25,606
Flounders	1,452	20,889	63,777
Red cod	597	31,637	141,592
Bass	447	607	1,923
Blackcod	437	22,325	266,938
Herring	367	1,871,038	1,391,980
Skate	124	818	4,153
Pilchards	4	1,182,325	1,063,577
SHELLFISH	Quantity (cwt.)	Quantity (cwt.)	Value ($)
Clams	6,383	28,366	58,869
Oysters	170 (bbls.)	19,883	129,644
Crabs	155	7,204	44,095
Shrimps	26	388	7,937

While most of the fish are caught well offshore, a considerable percentage of the salmon are caught in traps at Sooke. A large proportion of the oyster catch is centred at Sooke Basin while most of the clams are caught and processed in the Saanich area.

There are both full time and part time fishing operations carried on in the region. The full time fishermen often own their equipment, though occasionally they operate craft owned by the larger companies. Usually they are equipped to catch either ground fishes or surface feeding species, depending on the season. Some of these full time fishermen have small but sturdy boats and fish the inshore waters.

They supply the urban demand for fresh fish. "Full time" fishermen experience several periods during the year when they are not actively engaged. Termination of fishing seasons and bad weather are the major "breaks" in their routine. During these periods equipment is overhauled but no outside occupations are engaged in.

Part time fishermen considerably outnumber those engaged full time. These men take employment as loggers, millworkers or similar jobs. Particularly in the Sooke area, many of them own small farms. During the fishing season, especially when salmon are "running", they engage in a short, intensive period of fishing. They employ the same methods as those used throughout the Gulf area--chiefly trolling, along with gillnetting and seining. Though many of these men own their equipment, many others operate company owned craft on a commission basis.

A considerable proportion of the fish catch, particularly salmon, is exported, both to other parts of Canada and overseas. Some of the clam and oyster catch is exported, but most of the shellfish and groundfish are consumed within the region. The production of fish and fish products will probably remain fairly constant. There is room for some expansion in the cultivation of shellfish, particularly oysters, but the catch of the finned fishes varies little from year to year. Until research makes more information available regarding the cycles and life habits of the various commercial species, little expansion is likely to occur.

Forestry

Forestry along with agriculture, makes up the bulk of the value of primary production in Southeastern Vancouver Island. Forestry began in the region as early as the 1840's when small sawmills were set up at Sooke and at Victoria. Lumber export started in the 1860's and though expansion was slow at first, the opening of the Panama Canal in 1914 presented new markets and boosted production. Lumber is, today, probably the major single export commodity of the region. Most of the export goes to the United States and to the United Kingdom, while nearly all of the remainder goes to other Commonwealth countries.

Though the figures have probably changed considerably since 1937, the following table[1] will give some idea of the timber resources in the region--figures represent acres.

	Drainage Basin		
	Finlayson Arm	Sooke	Total, Vancouver Is.
Merchantable Timber	26,000	44,700	3,487,700
Immature Timber	36,800	4,000	403,400
Not Restocked			
Logged	1,800	300	128,600
Logged and Burned	1,300	2,200	144,100
Burned	1,000	6,000	48,000
Total not Restocked	4,100	8,500	320,700
Total Productive Forest Land	66,900	57,200	4,211,800
Non Productive			
Barren	--	3,000	1,009,600
Scrub	101,000	22,300	2,573,000
Swamp and Water	2,500	700	179,400
Total Non-Productive	103,500	26,000	3,762,000
Agriculture			
Cultivated	4,000	700	46,700
Total Area	174,400	83,900	8,020,500

1 Mulholland, F.D., The Forest Resources of British Columbia, King's Printer, Victoria, 1937, Table p.81 and map p.91

The Finlayson Arm subdivision as given in Mulholland's report, extends south and east at a line drawn from the head of Sooke Basin around the northern end of Sooke Lake thence northeastward to Cowichan Bay. The Sooke subdivision lies adjacent to the former. Its northern boundary curves westward around the northern end of Sooke Lake, thence almost due south to Otter Point. Consequently, only about two-thirds of the area of the Finlayson Arm subdivision and about one-fifth of the area of the Sooke subdivision, lie within the regional boundaries. Because of the large proportion of cleared land in the Victoria-Saanich-Sooke area, approximately one-third of the merchantable resources of the former sub-division and one-sixth of the resources of the Sooke sub-division lie within the region.

Nearly all of the annual cut is softwood, chiefly Douglas fir (Pseudotsuga taxifolia), western hemlock (Tsuga heterophylla) and western red cedar (Thuja plicata). The hardwoods, largely maple (Acer macrophyllum) and alder (Alnus rubra), are used in furniture manufacturing. Most of the cut goes into the production of sawn lumber for export, while a considerable proportion is used locally in the manufacture of sash and doors, shingles, furniture and boxes. There are no pulp or paper mills in the region.

High lead logging is the usual method of exploitation, though there is an increasing tendency toward the use of caterpillar tractors and arches, yarding direct to logging roads. This is a more flexible method of logging

and leads to better forest conservation through selective or strip logging rather than clear cutting. After felling, the logs are loaded on trailer trucks or logging rail cars and transported to the booming grounds, or sometimes, direct to the mill. Because of the irregular shape of the region and the much indented coastline, sheltered bays and coves suitable for temporary storage of logs are numerous. Here the logs are made up into various types of rafts or booms and towed to the mills at convenient intervals.

Though there are a few scattered sawmills in the Sooke, Langford and Highland areas, the large permanent mills each with a capacity of about 40,000 f.b.m./day, are located along Victoria's waterfront. There is a particular concentration of mills along the shores of the Inner Harbour and Selkirk Water, where logs can be rafted direct from the booming grounds at Sooke and Saanich. The sawn lumber is then available, by means of a short motor truck or scow haul, for loading on deepsea ships at Ogden Point piers. The mills at Victoria handle timber which has been cut far outside of the regional boundaries, as well as that cut within the region itself. Perhaps 5/6 of the logs handled at Victoria are cut outside the region. Some of the mills are owned by large logging concerns, others handle logs sold to them by various companies.

The average annual timber cut in the Vancouver

Log booms in Cooper Cove, Sooke Basin. Part of a sawmill operation can be seen on Goodridge Peninsula, (centre background.)

Forest District is about 2,000 million board feet.[1] As planks and sawn lumber this cut would yield approximately 100 million dollars. Between one half and two-thirds of this production comes from Vancouver Island, but only a very small proportion of the Island cut is produced within the region. According to the Vital Statistics Registration District Returns for 1946,[2] the following annual payrolls were attributed to forestry:

Description	Payroll (1946)@
Logging and Log Hauling	223,835
Sawmills, Planing Mills and Box Factories	1,181,357
Shingle Mills	155,013
Sash and Door and Veneer Mfg.	346,971
Total	1,907,176

@ 1946 is the most recent year for which figures are available.

Possible expansion of forestry in Southeastern Vancouver Island would be along the lines of greater utilization of existing stands and species rather than areal expansion. At present, agriculture and forestry seem fairly well adjusted -- forestry occupying steeper slopes and soils too poor for general agriculture. As with most accessible forest areas of B.C., there has been serious overcutting in Southeastern Vancouver Island. Hence a large part of the

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1 Mulholland, F.D., The Forest Resources of B.C., King's Printer, Victoria, 1937, P. 71. The Vancouver Forest District is made up of Vancouver Island and the adjacent mainland. In this district, Vancouver Island comprises from ½ to 2/3 of the annual cut.

2 Grouped payroll figures covering some phases of industry were made available through the courtesy of Mr. J.R.Meredith, Research Statistician, Regional Development Division, Dept. of Trade and Industry, Victoria, B.C.

forest area is in second growth not yet merchantable. With sustained yield management of this second growth, forestry should continue to supply a large part of the primary income in the region.

Agriculture

Agriculture in Southeastern Vancouver Island is characterized by great diversity. The choice of the particular type of farming engaged in depends upon the relationships of both natural and human factors. The natural factors include water supply, topography, soil and distance from markets. Among the cultural variables are price, both of land and crops, marketing facilities, taxes and distribution of population. The relationships expressed in the agricultural pursuits are not always easy to define and once defined, they are not constant, since the cultural landscape is in a continual state of flux.

(a) Small Fruit Farming

Small fruit production is probably the most important agricultural pursuit in the region. The individual farms are small, usually three to fifteen acres in extent, though not necessarily all the acreage is in fruit. This is a big advantage in regions where natural cover is heavy and expensive to clear. Probably the most important control in determining the farm size is the great amount of hand labour required. In addition, these farms must be located on good transportation routes and relatively near the consuming centres, since rapid transportation is vital at

the peak of the berry season.

Small fruits require a fertile, well-drained soil, long frostless season and low summer precipitation. However, a large part of the grower's success is his ability to keep abreast of changing markets, a thorough knowledge of fruit culture, and availability of a nearby labour supply in the picking season. Since the harvest season lasts only a few weeks, large markets must be found. Outlets are sought in the local urban market, outside markets, and local freezing and processing plants, (for canned fruits, jams and wines). The location of the processing plants is fairly important, since several different fruits should be available if operations are to be economical.

Small fruits are relatively a very valuable crop. Wheat, for example, may yield only fifteen or twenty dollars to the acre, while an acre of berries may yield several hundred dollars.[1]

Most of the small fruit crop is made up of loganberries and strawberries. Strawberries are grown on the gently to strongly sloping land, preferring a well-drained, sandy loam underlain by a firmer subsoil. Thus, the Keating Sandy Loams are ideal for strawberry production. The cane fruits --loganberries, raspberries, blackberries and their associated species--are generally grown on the more level areas and bottom lands, requiring fertile soil, slightly more moisture than strawberries, and absence of very hot

1 Strawberries and raspberries average one and three-quarter tons per acre, logans nearly two, and blackberries, about three and a half tons to the acre. One ton of fruit would be roughly equivalent to 1,000 quarts.

A loganberry plantation on an area of mixed Cowichan — Keating soils.

weather. The Tolmie soils are widely used for the cane fruits as well as for bush fruits --currants and gooseberries. Though the long frostless season of the region is ideal for cranberries, the soils do not appear acid enough to warrant their commercial production. Grapes of the Concord type are grown, but seem to lack the sweetness found in those grown in the California area.

The following table[1] lists berry acreage in the region by district:

(See table on next page)

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1 British Columbia Dept. of Agriculture, Vancouver Island Berry Acreage - 1946, (unpublished).

BERRY ACREAGE 1946

	District and No. of Growers				
	56 Gordon Head, Mt.Tolmie, Cordova Bay	17 Royal Oak, Colquitz, Lake Hill.	172 Elk Lake, Keating Saanich-ton	14 Colwood Metcho-sin Sooke	259 Totals all Districts
STRAWBERRIES					
Total	8-5/8	1	114-1/8	2½	126¼
1946	4-5/8	3/8	47	1¼	
1945	3	3/8	40-7/8	1¼	
Pre-1945	1	¼	26¼	-	
RASPBERRIES					
Total	1-7/8	2¼	21¼	3½	28-7/8
1946	7/8	-	2½	-	
1945	3/8	-	2½	1¼	
Pre-1945	5/8	2¼	16¼	2¼	
BLACKBERRIES					
Total	2¼	1¾	20-1/8	-	24-1/8
1946	-	-	3/8	-	
1945	-	1¾	¾	-	
Pre-1945	2¼	-	19	-	
LOGANBERRIES					
Total	32-13/16	6	198½	1-3/16	238½
1946	¼	-	22	-	
1945	1½	6	38-1/8	-	
Pre-1945	31-1/16	-	138-3/8	1-3/16	
RED CURRANTS					
Total	1½	-	1/8	-	1-5/8
1946	¼	-	-	-	
1945	-	-	-	-	
Pre-1945	1¼	-	1/8	-	
BLACK CURRANTS					
Total	10½	¾	1/8	1/8	11½
1946	-	-	-	-	
1945	¾	¾	-	-	
Pre-1945	9¾	-	1/8	1/8	
GOOSEBERRIES					
Total	2-5/8	-	1/16	1/16	2¾
1946	-	-	-	-	
1945	-	-	-	-	
Pre-1945	2-5/8	-	1/16	1/16	
RHUBARB					
Total	1¾	2-7/8	-	-	4-5/8
1946	-	-	-	-	
1945	-	-	-	-	
Pre-1945	1¾	2-7/8	-	-	

(b) Specialty Crop Farming

Specialty crop farms like the berry farms, are small, but intensively cultivated. Skill and experience in production, adequate storage and transportation facilities and available markets are probably as important as soil and climatic conditions.

Certified vegetable and flower seed production is a phase of specialty farming which developed in the region during World War II. While demand for seed insures a steady market, the industry is highly specialized, since some flowers and vegetables will set abundant viable seed under optimum conditions only. Turnip, cabbage, garden pea, carrot and sweet pea seed are among these. A considerable percentage of the B.C. vegetable and flower seed production is grown within the region. A favorable aspect of the summer drought in the region is that seed crops mature and can be successfully harvested before fall rains commence. Potatoes and potato seed are also produced as specialty crops. The latter, particularly, is a recently developed and lucrative operation. Potatoes are subject to a number of pests and diseases, including the difficult to control tuber flea beetle, a recent immigrant from Colorado. Consequently, elaborate rotations are practiced to prevent infestation of the soil. Clover for two years--potatoes for one year--peas or beans one year--potatoes for one year; is a typical rotation.

Bulb farming in Southeastern Vancouver Island accounts for over one-third of the British Columbia production.

Leek seed production on a Cowichan _ Keating soil mixture at the Dominion Experimental Farm, Sidney. The seed has begun to mature.

Though bulbs have been grown for many years in the region there was great stimulus during World War II. The main outlet is to the Canadian trade. Besides the bulbs themselves, large shipments of cut blooms of narcissi and tulips are expressed as far east as Winnipeg. Modern air transport has considerably facilitated these shipments. Though acreage is relatively small, a valuable crop may yield from one to two thousand dollars per acre. The Tolmie sandy clay loams and Cowichan clay loams found extensively in the Victoria--Saanich area are ideally suited to bulb culture. The following table[1] indicates the approximate bulb acreage in the region.

BULB SURVEY

	"VICTORIA" (includes Saanich area)		TOTAL B.C.	
	ACREAGE	QUANTITY (approx.)	ACREAGE	QUANTITY (approx.)
NARCISSI	93½	9,350,355	229	22,908,605
TULIPS	87-3/8	8,735,990	146-1/8	14,601,170
HYACINTHS	1½	63,916	3¾	145,916
GLADIOLI	6	607,000	106	10,594,250
IRIS (bulbous)	38	5,702,160	43	6,480,910
IRIS (others)			¾	5,200
LILIES	2¾	68,000	18-7/8	467,955
DAHLIAS	1/8	500	4-5/8	18,500
PEONIES			7½	45,000

Total acreage all bulbs (1947): 559-5/8 acres

Greenhouses and nurseries form another phase of specialty crop farming in Southeastern Vancouver Island. Highly trained management and labour, nearness to the urban area and suitable soils are vitally important. Because of

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1 British Columbia, Dept. of Agriculture, Bulb Survey - [illegible] - 1947. (unpublished).

the mild winters and high percentage of sunshine experienced in the region, over half of British Columbia's greenhouse acreage is located here. Usually, each nursery has a considerable area under glass, and a great variety of ornamental and nursery stock can be grown. Nurseries supply most of the tree and berry fruit stock used by local growers. Among other ornamentals holly is supplied and its production has built up a favorable export trade. Though no detailed figures on nursery acreage is available, the following table lists the area under glass.[1] The table gives the area for Vancouver Island as a whole, but nearly all of this is located within the region.

GREENHOUSE SURVEYS 1923 - 1947

District	1923	1929	1935	1941	1947
Vancouver I. (whites)	570,930 (51 growers)	746,324 (110 growers)	868,299 (155 growers)	888,277 (160 growers)	1,047,562 (179 growers)
Vancouver I. (orientals)	382,382 (9 growers)	1,018,024 (22 growers)	1,545,234 (45 growers)	1,779,360 (48 growers)	1,593,438 (36 growers)
Total B.C.	1,905,180 (120 growers)	3,385,681 (260 growers)	4,612.787 (515 growers)	5,152,998 (577 growers)	5,066,950 (552 growers)

(c) Dairying

Dairy farms are well distributed through the region, small farms retailing milk to the local settlements. In addition there is a concentration of dairy herds near

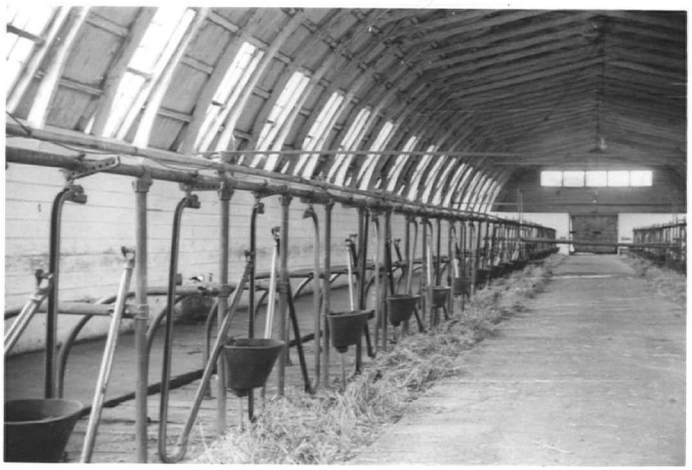
1 British Columbia, Dept. of Agriculture, Greenhouse Surveys 1923 - 1947 (unpublished)

1.Looking southeast over the coastal plain from the top of Mt. Douglas, with Cadboro Point and Discovery Island in the left background. Several greenhouses are visible in the centre of the photograph.

2.Part of a nursery located on Cowichan soils. Roses show in the foreground, while a variety of ornamental trees form the background. Posts, (centre and right), support water pipes which operate the sprinkling system.

Victoria, to supply the large demand for fresh milk. Vancouver Island receives large daily shipments of fresh milk from the Vancouver area. Though Saanich Peninsula supplies part of the regional demand, Southeastern Vancouver Island is not self-sufficient in this commodity. Dairy farms are usually found in the low-lying areas, where groundwater seepage makes up for the low summer precipitation. Farms range from fifteen to over sixty acres; a large part of which is usually in rough pasture. Though the minimum satisfactory size for a dairy farm is about forty acres, numerous small operators depend on rented acreage for additional hay and pasture. Small orchards and gardens are common adjuncts. Many operators, not classed as dairymen, do keep small herds in combination with poultry, fruit growing and general farming. Dairymen in the region cater to the urban demand for fresh milk. It seems likely that considerable expansion of the dairy industry is possible. Summer drought remains a problem because it limits summer pasture.

The actual location of the farm is influenced by many factors, including quality of pasture, competition with other enterprises, availability of feed and proximity to market. Since cost of feed is a major expense, farm grown supplies must provide a large share. Clover and timothy are usually grown together and used for hay and pasture, occupying about one-quarter of the farm area. Oats and thousand-headed kale are used for green feed, while feed corn, peas and vetch are grown for ensilage. Sugar beets and mangels are frequently grown to provide a valuable item of winter feed. Other than



Interior of one of the larger dairy barns in the region. About 90 cows can be accommodated in the stalls, (left and right).

family gardens, the remainder of the farm is usually comprised of woodlot or stumpy pasture with low carrying capacity.

Animals kept are selected grade or purebred Jerseys, Guernseys, and Holsteins. The annual yield from a good cow is approximately six hundred gallons. Farm practices are adjusted so that the milk production is steady. About half the herd is freshened during the winter months and the other half during the summer months.

Practically all the dairy production is in the form of fresh milk for the urban market. Some butter, ice-cream and a small amount of cheese are also produced by the larger creameries, but little if any liquid milk is processed to evaporated or condensed milk. The work on dairy farms is constantly tying but the income is high and steady. Generally speaking, a dairy farm provides a surer income than other types of agriculture in the region.

(d) Truck Farming

Truck farming is carried on intensively near the urban markets, particularly by Chinese growers. Aided by a long frostless season, growers can place early vegetables on the local market before adjacent areas can compete. Thus yields are high in value, though large amounts of painstaking hand labour are required.

Onions, lettuce, asparagus, cauliflower, celery, beans, squash, -- in short all kinds of vegetables--flourish in the region. Relatively cool summers are requisite, and the long growing season permits several crops. This farm

Truck farm near Mt. Douglas. Tomato plants occupy the foreground, with beans (right), and pickling peppers, (left). This farm is one of many near the urban market, operated by Chinese.

type is found in lower lying areas where the water table is not far from the surface. Peat soils, with drainage, are excellent for vegetables, since they are rich in soil nutrients and organic matter, have a high moisture holding capacity, and have abundant groundwater supplies. Typical yields vary from 12 to 14 tons per acre for carrots and beets, 15 to 30 tons per acre for cabbage, 6 to 8 tons per acre for beans and 3 to 6 tons per acre for peas. Because of the mild winters, hardier vegetables can be grown almost on a year round basis. Cash income from truck farming, acre for acre, parallels that from small fruit farming.

(e) Poultry Farming

This is another highly specialized type of agriculture which has shown considerable growth in recent years. Though poultry farms cover only a few acres the price of land must be low, consequently those in the region are located on the poorer or non-arable soils. Qualicum stony sand and Qualicum loamy sand are well suited, since they are well drained and provide "grit"--an essential part of poultry diet.

The long frostless season in the region is a considerable advantage in producing fresh eggs during winter, when prices are higher. On the other hand a pronounced disadvantage exists in that little grain feed is locally produced and cost of feed is correspondingly high.

Most poultry farms in Southeastern Vancouver

White Holland turkeys on a poultry farm near the urban centre.

Island depend on the production and sale of eggs as the chief source of income. The best suited birds for this purpose are Single Comb White Leghorns and New Hampshires. The "average" hen lays 150 eggs per year. A capital investment of between $4.50 and $5.00 per bird and a flock of 700 to 1,200 birds is necessary to produce commercial eggs as a sole means of livelihood.[1]

Some breeders, located close to the urban market, specialize in crossbred table birds. The New Hampshire-Cornish cross is mainly used for this market. Other poultrymen specialize in breeding stock or baby chicks for the general trade.

Turkeys are well adapted to the climate of the region. The long dry summers and the cool autumns which encourage early feathering, are particularly favorable. Turkey poults are very susceptible to dampness and the gravelly soils in the central and south central portions are especially well suited to them. The Broad Breasted Bronze, Black, and White Holland are the popular breeds. Turkeys are sold for meat, the largest sale being to the holiday trade.

Poultry farmers often have a kitchen garden and perhaps a fruit orchard, but as flocks demand constant attention, little time is left for other phases of agriculture. Income from poultry farming varies considerably with changing prices and markets. Under adverse economic conditions, many small operators are forced out of business.

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1 Vancouver Island and Gulf Islands, British Columbia, Dept. of Agriculture, Agricultural Settlement Series, Circular No. 2, Victoria, 1946, p.17.

(f) General Farming

General farming represents a combination of several crop and livestock enterprises, and though returns are not as high as with most specialty crops, income is less variable. Thus a single farm may grow oats, clover and vetch, keep a few dairy cows, pigs and poultry, and an acre or two of vegetables along with tree or bush fruits. A few milk cows are particularly desirable, since in addition to income from the sale of milk, any surplus can be used to feed pigs and chickens. Consequently mixed or general farms are largely self-sufficient in food and always have something which can be sold to meet expenses. Many general farms also have a woodlot, providing fuel and fencing, or possibly, a small cash income.

Since transportation and nearness to urban markets is not essential, these farms are more generally found in the outlying areas of Sooke and Saanich. Farm size varies depending upon how much land the individual operator can look after and the quality of the farm site.

The particular type of crops raised for sale can be varied from year to year in accordance with the demand. Vegetables usually occupy an important place in the mixed farm and a wide variety is grown - lettuce, carrots, potatoes, cabbage, squash, corn, tomatoes and the like. An orchard containing a few apple, cherry, pear and plum trees is usually associated with this type of farm. Walnuts and filberts are sometimes grown and find a ready market.

1. General farm near Saseenos, with Sooke Basin in the background. Cocked hay and a small orchard are apparent on the left, while a vegetable garden is visible on the right.

2. One of the scattered arable areas in the broken topography west of Metchosin. Various cover types can be seen. Garry oaks (Quercus Garryana), centre, and mixed alder, maple and fir (left background), can be seen.

One or two horses are sometimes kept for use as draught animals and a small flock of sheep is an occasional adjunct particularly in the south central and southwestern areas. Home apiaries are also frequently found on the general farms, though little more than home requirements is produced. Bees have been found to winter well in the region. The principal nectar-bearing native flora are the Dutch clover, fireweed, madrona, salal, snowberry, thistle and Oregon grape.

(g) Tree Fruit Farming

There are a number of commercial apple and cherry orchards in the region. Most of these were planted many years ago. Today, planting of tree fruits, with the exception of cherries, is not recommended except for home orchards.[1]

Apples, plums and pears are grown in small orchards, and some of the plum and pear crop is canned locally. Cherries do reasonably well. Because of the cool nights, maturation is slow, producing a fleshy cherry of good eating quality. In addition, the summer drought is a favorable factor in preventing splitting of the fruit. Walnuts and filberts grow satisfactorily, but plantings are very limited. Generally speaking, none of the tree fruits grown in the region can successfully compete with those from the Okanagan.

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1 Vancouver Island and Gulf Islands, British Columbia, Dept. of Agriculture, Agricultural Settlement Series, Circular No. 2, Victoria, 1946, p. 10.

Filbert trees (right foreground), on Keating sandy loam.

(h) Sheep and Part-Time Farms

Though beef cattle are not raised in Southeastern Vancouver Island because of the limited range, occasional sheep farms occupy large tracts of land too dry, too stony or too rough for cultivation. About three to five acres is required to support one sheep, and consequently considerable area is needed for a large flock. For this reason, and because they make good use of rough pasture, sheep ranches are most common in the outlying Metchosin, Sooke and Otter districts. Pasture is frequently leased from the government or from logging companies. Only a limited amount of hay is required for winter feed, since the animals can graze almost year round.

Relatively little labour is required on a sheep ranch as compared with most other farming operations. The greatest amount of hired help is needed during the spring lambing and shearing. Some lambs, born in the fall, are marketed from January to March as "hothouse lamb". Lambs are usually sold for meat when about five months old, weighing from seventy to ninety pounds each. Generally speaking, income from meat sale is about twice that from wool.

Fur farming is another type of livestock or animal specialty farming carried on in the region. A few fur farms are in scattered locations on the Saanich Peninsula. Among the favorable factors to the fur industry are the uniformity of temperature and the relatively moist atmosphere --producing a better quality pelt. Availability of fish feed is another important consideration. Horsemeat is imported

from the Prairies by carload lots and held in refrigeration until required. Lack of refrigeration facilities at Sooke tend to prevent expansion of the fur industry in that area. The major unfavorable factor appears to be the objection raised by neighbouring farmers, and various municipal restrictions. Silver fox and mink are the two important fur-bearers raised.

Part-time farms are found near the urban area. The operators of these farms derive a portion of their income from other sources, but obtain part of their livelihood from the farm. These holdings are usually small - from 5 to 10 acres - and are often owned by retired people and pensioners. A few part time farms in the central and southwestern part of the region are operated by loggers or fishermen.

B Secondary (Manufacturing) Industries

Several factors are required for the establishment of a manufacturing industry - raw materials from primary production, power and water sources, labour, capital and a market. Southeastern Vancouver Island has relatively large amounts of certain raw materials and a dependable labour supply, but power sources and markets are limited. To some extent, water supplies are also limited. In the northern part of the region, lack of water has restricted industry. Victoria has a plentiful water supply for present needs. Such an establishment as a sulphite plant, however, requiring

large amounts of fresh water, would have difficulty in obtaining sufficient supply.

The chief form of power used in the area is hydro electric. This is available from a plant at Jordan River, some eight miles northwest of Muir Creek, and therefore beyond the regional boundary. The combined output of this hydro development and a small auxiliary steam plant located at Brentwood, amounts to only 55,000 H.P. These plants supply power to domestic and commercial users not only within the region, but as far north as Nanaimo. Obviously, there is little power available for added industrial users. Within the past two years, however, the development of the B.C. Power Commission plant at Campbell River, has meant new supplies for up-Island centres and consequently less load on the Jordan River Plant. Besides this, the Campbell River development, when complete, will deliver some 150,000 H.P. and power lines are being erected to bring some of this energy to the Victoria area. Just how much will be available to commercial users is indefinite, but the bolstering of energy supplies should make possible a considerable expansion of industry in Southeastern Vancouver Island.

The addition of electrical power is particularly significant when other energy sources are considered. The nearest commercial coal deposits are located in the Nanaimo area which has an output of about 230,000 tons annually.[1]

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1 Annual Report of the Minister of Mines, King's Printer, Victoria, 1948, p. 204.

While this coal is suitable for commercial use, it is limited in amount, being equivalent to about 40,000 H.P.[1] Besides this, the coal reserves at Nanaimo are almost depleted, and it is doubtful if significant production will continue after 1952. There are reserves of suitable commercial coal at Comox, which should last approximately thirty years, but again, production is very limited.

Alberta coal can be imported at a competitive price with Island coal. Nevertheless, it is doubtful whether this or other forms of energy can compete in the region with hydro-electric power available at about the same cost.

The other major problem to manufacturing in the region is one of markets. The regional population comprises the bulk of that on Vancouver Island - a limited market. While most of B.C.'s population is concentrated in the southwest, Vancouver presents overwhelming competition in manufactured goods. Seattle and other cities in the Northwest prevent an outlet in that direction. With Vancouver Island providing a limited local market, the alternatives, if manufacturing is to expand, is through very competitive overseas export, or production of specialty articles. It is likely then, that on the basis of markets, expansion of industry in the region will be slow, paralleling regional and Island population expansion. The manufacture of specialty articles is a possibility which has not yet been proven.

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1 The following conversion figure appears on p.282 of the Annual Report of the Minister of Mines for the year 1933, King's Printer, Victoria, B.C. "For the purpose of comparison it may be stated that one developed horse-power per year is equivalent to the power value of 6 tons of coal."

The principal raw materials of the region are logs, fruit and vegetables and fish. Sawmills, packing plants and canneries convert these raw materials, but generally speaking, the manufacturing is restricted to simple processing. Consequently, much of the value of secondary industry is lost to the region. In recent years, however, there has been a trend toward greater use of the raw materials, particularly forest products.

A few plants produce window sashes and doors, wooden boxes and barrels. At least one plant makes furniture from local hard and softwoods, though it has been found necessary to import hardwoods, notably from Australia and Central America, to obtain suitable veneers. Of the local hardwoods, Red Alder is the most important to furniture manufacture, since it provides excellent core stock over which veneer is laid. Most of the wood products are marketed in southern Vancouver Island. Because of the availability of suitable woods and the numerous marine activities in the region, boat building is a small, but well-established industry. All types of small pleasure and work craft are constructed at some fourteen different establishments, most of them in Victoria. A match factory also contributes to more complete use of forest resources. With more energy becoming available it would seem that the manufacture of such materials as plywood, pre-fabricated structures and wooden panelling might be possible subsidiaries of existing industries. Again, markets seem to be the main problem. The high initial cost

in establishing plants of this type would require assured markets for the manufactured goods. Another economic factor is the cost of transporting logs. At present, in sheltered waters, a log tow of 20 miles is but little more expensive than a tow of 50 miles. Consequently, the best grade logs, ("peeler logs"), required in the plywood industry, are towed direct to Vancouver. That city has the advantage of established plants, and a much larger local market.

The agricultural and fish resources of the region present limited possibilities to further utilization other than for extractive commodities. While there are several cold storage plants, only one establishment is designed to process fruits and vegetables. This plant and an adjacent winery handle most of the surplus small fruit production of the Saanich Peninsula. The plant cannot operate at a reasonable margin of profit until the local and export demand for fresh fruit has been satisfied. The expansion of the small fruit industry in the region is largely limited by markets. Unless berry acreage is considerably expanded, it seems unlikely that there will be any need for further development of fruit processing plants.

One fish cannery is located on Esquimalt Harbour and there are a few cold storage and fish curing plants in Victoria. A clam cannery operates at Sidney. The Esquimalt plant has facilities for extracting fish oil from the offal. The particular process involved is a chemical one. This does not permit fish meal and fertilizer to be produced along

with the fish oil. The offal from the curing and processing plants at Victoria is not in sufficient amounts to warrant a by-product plant. It is taken by barge to the Vancouver fish oil and fertilizer plants. Further expansion of fish processing plants in the region will probably depend upon expansion of the associated primary industry, and at present, this seems unlikely.

The following table[1] gives group payroll figures for most of the agricultural and fish processing plants in the region.

	Description of Industry	1946 Payroll ($)
1	Canning and packing fruits, vegetables, flour milling and cold storage.....	34,540
2	Canning and packing fish, fish wholesaling, fish oil and fertilizer manufacture.....	358,966

Heavy industry is limited by lack of raw material and energy sources in Southeastern Vancouver Island. No metallics are produced within the region, and no coal suitable for coking is available on the Island. Shipbuilding, using imported steel, is the only heavy industry. Its existence in the region seems largely dependent upon two factors - skilled workmen and shipyard facilities. A Dominion Government drydock, one of the largest in existence, was completed at Esquimalt in 1926. This dock is fully equipped to handle the largest ships afloat, and has been a considerable stimulus to ship building and ship repairing in the region.

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1 Figures made available through the courtesy of Mr. J.R. Meredith, Regional Development Division, Dept. of Trade and Industry, Victoria, B.C.

Esquimalt has long been an outfitting and repair base for naval ships, and since this work is limited, but steady, a nucleus of equipment and trained personnel is available for ship construction. Two well-equipped yards, one at Esquimalt and one at Victoria, have facilities for building ships up to a size of about 12,000 tons gross. During World War II, merchant vessels, naval ships and a variety of smaller craft were built. Shortly after the war, contracts were reduced, and other than for occasional construction jobs, most work is limited to repairing and refitting. The Esquimalt yards cater to naval contracts and repair work in connection with the large graving dock. The Victoria plants handle smaller craft such as tugs, harbour craft and the like.

A number of smaller secondary industries characterize the industrial portion of the region. A paint manufacturing plant, a roofing company, a few flour and feed mills, a brewery, a textile plant and similar establishments have been built in Victoria to supply the local demand. Most of the raw materials used in these industries are imported. In these cases, position of the industries with relation to transportation facilities and markets, is more important than local resources.

C. Tertiary Industries

As with all cities, a great variety of tertiary or service industries cater to the public demand in the urban centres of the region. Laundries, fuel yards, trucking services, construction companies, service and repair stations,

machine shops and a host of retail stores together contribute a large share of the income in the region.

The following table[1] lists 1946 payrolls for some of the tertiary industries.

DESCRIPTION OF INDUSTRY	1946 PAYROLL ($)
1. Retail stores	3,618,295
2. Municipal corporations, school boards, library boards, parks boards, etc.	2,961,183
3. Building construction, not exceeding four storeys, structural carpentry, masonry, roofing, installation and removal of machinery, ornamental iron works, etc.	1,286,426
4. Repair and service stations (approximate)	1,258,000
5. Fuel yards, retail lumber yards and builders supplies, cartage and warehousing and domestic ice plants.	977,383
6. Hotels and restaurants (approximate)	932,000
7. Printing, lithographing and engraving	805,867
8. Power laundry, cleaning and dyeing	641,765
9. Wholesaling	623,501
10. Lathing, painting, plastering, window cleaning and insulation of buildings	429,909

Tourism also contributes an important share of the income from tertiary industry. Though detailed statistics are difficult to obtain, traffic counts show that from Jan. 1st to Aug. 1st, 1949, a total of 22,530 foreign licensed cars, carrying 63,954 passengers entered Victoria.[2] In addition, 4,765 visiting Canadian cars carrying 13,893 passengers, entered the region.[3] Many resorts, hotels and

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1 Figures made available through the courtesy of Mr. J.R. Meredith, Regional Development Division, Dept. of Trade and Industry, Victoria, B.C.

2 Figures obtained from Victoria and Island Publicity Bureau, (G.I.Warren, Commissioner), Victoria, B.C.

3 loc. cit.

auto courts scattered throughout the region cater to the tourist trade, capitalizing on the local climate and scenery and "British" atmosphere. The long summer days and the associated dry, relatively sunny weather are the favorable climatic features. The upland topography of the west and southwest offers opportunity for scenic drives. Besides this, the fine roads serving the Saanich Peninsula provide tourists with an opportunity to see the agricultural side of the region. Facilities for sport fishing, yachting, golfing and riding are also major attractions. The view of the Olympic Range and Mt. Baker from Victoria waterfront is a well advertised factor of the local environment. It is often said that some Americans come to Victoria to see their own mountains.

Many attractive retail stores cater especially to the American tourists. Some of these stores display fine British woolens and chinaware. Others advertise curios and antiques, while numerous "tea" shops add to the "old country" atmosphere. Auto courts and tourist hotels are scattered through the region but have their greatest concentration in the immediate vicinity of Victoria.

Transportation

The transportation and communication pattern, another phase of tertiary industry, developed first as sea routes. The Hudson's Bay Company vessels, and later, intercoastal shipping, formed the first connections between Victoria and the outlying parts of the region. Today,

Southeastern Vancouver Island is well served with roads, particularly in the central and northern portions, as well as railways, airways and steamship services. Location of the routes strongly reflects local topography, and the routes, in turn, have made an imprint on the economic and cultural development of the region. The general map, (Plate II), indicates the main transportation routes in the region.

A class I highway extends from Victoria to Campbell River, with branch lines to Sayward, Port Alberni, Cowichan Lake, Shawnigan Lake and Sooke Lake. Another class I road connects Jordan River with Victoria while a branch route extends from Colwood to East Sooke. These highways have numerous class III sideroad connections which serve the Otter, Sooke, Metchosin and Esquimalt land districts. The Victoria--Saanich area is very well supplied with class I and II highways assuming, with their tributary roads, a rectangular pattern in contrast to the serpentine route of those in the south and west. The Highland District is poorly served with roads, and those which do exist reflect topography in their sinuous pattern like the roads of the Metchosin --Sooke area.

The Esquimalt and Nanimo Railway offering passenger and freight service, extends from Victoria to Courtenay, (140 miles), with branches to Cowichan Lake and Port Alberni. The Canadian National Railway has a line from Victoria through Metchosin and Sooke, along Sooke River, Sooke Lake and Shawnigan Lake to Cowichan Lake. This line

maintains a passenger-car service, but is primarily concerned with freight. Another C.N.R. line connects Patricia Bay and Victoria. It was designed to shorten the rail-barge haul from Vancouver as well as to serve the Saanich area, but is now seldom used. Present-day planners are attempting to purchase the right-of-way in order to construct a speed highway between Victoria and the Patricia Bay airport.

The Canadian Pacific Railway operates a twice-daily ship service between Victoria, Seattle and Vancouver. Less frequent C.P.R. coasting services connect Victoria with the west and east coasts of the Island and Gulf Island ports. The Puget Sound Navigation Company operates a car and passenger service between Victoria and Port Angeles, while several deepsea lines connect Victoria with the American west coast and other foreign ports.

Trans Canada Airlines maintain services between Victoria and other Canadian cities, and a regular air service operates between Victoria and Seattle. Strictly speaking, the air service is to Patricia Bay, near Sidney, some eighteen miles from Victoria. Here, a suitable tract of flat land well away from the urban concentration was available. A favorable site for an adjacent seaplane base was also a determining factor in its choice. Airline buses complete the service to Victoria. Chartered plane services to all parts of Vancouver Island and coastal British Columbia also operate from Patricia Bay and from the seaplane base at View Royal in Esquimalt Harbour.

The transporation pattern in the region strongly

reflects basic topographic control. The road pattern forms a rectangular pattern in the Victoria--Saanich area but has a serpentine appearance in the more broken country of the west and southwest. Because of its location with respect to the remainder of the region, the Victoria area has a radial transportation pattern. Roads extend west, northwest, and north, while sea routes radiate southwest, south and southeast from Victoria. North of Victoria, particularly in the Saanichton and Sidney areas, the greatest continuous extent of flat topography in the region is found. Here the road pattern is typically rectangular.

The sinuous nature of the road pattern in the west and southwest is directly related to topography. Besides this it shows indirect topographic control. In these areas, agriculture is limited and population is sparse. Consequently, roads are few and poor.

The railway routes also conform to physiography. Wherever possible they follow flat -bottomed, glaciated valleys, or the drift covered lowland.

Cities

Victoria is the terminus for most of the transportation and communication routes in southern Vancouver Island and is the commercial centre for the region. The limits of Victoria's hinterland are difficult to define, but the city's wholesale distributing area has a radius of some sixty

miles.[1] Generally speaking, the whole Island represents the hinterland from which Victoria can draw resources. Though Victoria lost her commercial supremacy to Vancouver with the completion of the transcontinental railway, the early start and strategic location have remained favorable factors in her commercial development. Port facilities are limited, but are designed to handle all types of cargo. While James Bay and the Inner Harbour have facilities for industrial craft and coastal steamships, the Outer Wharves and the Ogden Point piers handle deepsea traffic. The latter, built at an approximate cost of $5,000,000 have adequate berthing for five ships and are connected with a grain elevator of 1,000,000 bushels capacity, a lumber yard and a large cold storage plant. Most of the foreign trade from the port involves extractive commodities, lumber, fish and fish products and a minor amount of agricultural products. The imports are mostly manufactured articles and food products. As is any port in Canada, the great proportion of the foreign trade, both imports and exports, is with the United Kingdom and Commonwealth countries and the United States. It should be noted that the domestic and intercoastal trade with the region is larger and in greater variety of products than the foreign trade. Because her hinterland is limited, Victoria's surplus of goods for foreign export is relatively small. The port is of very minor importance in world trade. On the other hand there is considerable local trade between Victoria and the other Island ports, as well as between Victoria and

1 Hatcher, G.T., (Director, Bureau of Economics and Statistics, Victoria), interview with the writer, 23rd July, 1949.

Vancouver. The trade with the latter centre is particularly important. Victoria exports some goods - chiefly agricultural and forest products to Vancouver. The return trade is far greater, however. Not only food products, such as fluid milk, but also a host of consumer goods are imported via Vancouver and the lower mainland.

In addition to being a commercial centre, Victoria is the political centre for the province and the military and cultural centre for Vancouver Island. The Provincial Legislative Buildings and associated government offices occupy an important place in the city and in the life of its people. The city is also a centre for the Canadian armed forces. Naval and military establishments are located in Esquimalt, while the airforce maintains a joint land and seaplane base at Patricia Bay. In addition to junior colleges in the region, Victoria College, affiliated with the University of British Columbia, offers the first two years of University education. The adjacent Provincial Normal School offers teacher training. Several business schools, trade schools and art schools also contribute to Victoria's cultural atmosphere.

Sidney, on the east coast of the region near the tip of Saanich Peninsula is the local centre for North Saanich. A population of approximately 1,200 gain their livelihood chiefly from agriculture, fishing, retail business and tourism. The town has port facilities for coastal steamers

and a C.P.R. service operates from Sidney to Steveston (near Vancouver), while another ferry operates between Sidney and Anacortes. The recently built airport at Patricia Bay has been a great stimulus to Sidney's growth, particularly with regard to retail business and tourism. This town was the former location of the Sidney Roofing and Paper Company. Lack of adequate water supplies forced the industry to move out of North Saanich to the Victoria area.

The settlement at Sooke on the west side of Sooke Harbour, about twenty-three miles from Victoria, forms the local collecting and distributing centre for Otter and Sooke land districts. With a population of about 700, it is the centre of an agricultural, forestry and fishing area. In the past fifty years, Sooke has shown a steady, but only very slow expansion. Lack of large adjacent areas of agricultural land has been one of the main limiting factors. Forestry is the major local industry, supplemented by general farming and fishing. Many of the inhabitants are part-time employees in the logging industry. During the slack seasons, these men often operate small farms or engage in fishing.

In addition to the main population centres in the region, there are a number of minor settlements serving the rural areas. These usually consist of a post office, a few stores and perhaps a school. Saanichton, Brentwood, Prospect Lake, Cordova Bay and Royal Oak in the Saanich Peninsula, and Langford, Colwood, Luxton, Metchosin and East Sooke in the central and southwestern portions, are the most important of these.

9. LAND UTILIZATION

The dominant uses of land in Southeastern Vancouver Island are agriculture and forestry. These two primary industries occupy nearly all of the regional area. Urban development is expanding but is largely restricted to the east central portion. It is residential rather than industrial. Parks, other recreational areas and Indian reserves make up most of the remainder.

Agriculture

The agricultural use of the land is concentrated north of Victoria on the Saanich Peninsula. Scattered pockets of cultivated land extend through the central and southwestern portions of the region. Small fruit culture is probably the most important single agricultural pursuit. This industry occupies sandy loam and silt loam soils on hillsides as well as more level areas. Berry farms are small but returns from them are high. Most, but not necessarily all of the farm is in fruit production. Far the greatest acreage is in loganberries. Loganberry growing has expanded, but the expansion has been restricted to central Saanich. Strawberry acreage is about half as great as that devoted to loganberries, while raspberries and blackberries together cover less than half as large an area as the strawberry lands. Strawberry growing has spread in all parts of the Peninsula, but the greatest increase has been in the central part. Raspberry culture has shown a small but steady growth in recent years, but blackberry growing has remained almost constant.

Strawberries are a major agricultural export crop. About twenty carloads are exported each year, chiefly to prairie markets. Most of the loganberry crop is consumed locally or processed into jams and wines. Some of the jam is later exported, primarily to overseas markets.

Specialty crop farming is another important phase of agriculture in Saanich Peninsula. Again, farms are small and intensively cultivated, and returns are high. Bulbs, especially narcissus and tulip varieties, are probably the most valuable of the specialty crops. Bulb farming is concentrated north of Victoria in the Mount Tolmie - Gordon Head area. Though the total area involved is only about 560 acres, bulbs and associated cut flowers form a considerable export item. Most of the export is to prairie markets.

Flower and vegetable seed production, nurseries and greenhouse culture are other phases of specialty agriculture. Vegetable seed production is a recent innovation which has proven very successful. Well over half the greenhouse acreage is operated by orientals.

Dairy farms are well distributed through the region, but there is a particular concentration near the large urban market at Victoria. Farms must be at least 40 acres in extent to function well. Many operators keep small herds in conjunction with other phases of agriculture. All the milk produced finds a ready market for Southeastern Vancouver Island is not self-sufficient in this product. Most of the dairy output is consumed as liquid milk.

Truck farming is well developed near the urban centre of Victoria. Peat soils and bottom lands are favored locations for these farms. Early market crops are grown for local consumption and command high prices. A great variety of vegetables are cultivated. Several crops of some of these are produced in one season.

Poultry farms occupy scattered locations relatively near the city market. There is some concentration in the sandy and gravelly soils of the Langford-Metchosin area. Most of the chicken farms gain their income from the sale of fresh eggs. Turkey farmers supply meat chiefly to the holiday trade. The poultry industry has expanded in recent years but to the present has not attained particular significance.

General farms are well distributed throughout the region, though they are more common in the outlying areas. In the Sooke area particularly, a small flock of sheep is an occasional adjunct. These farms are practically self-sufficient in food. Although individually they supply only small amounts of market produce, collectively they represent a major phase of local agriculture.

Tree fruit farming, sheep raising, fur farming and part-time farming make up most of the remaining agricultural uses. Individually, none of these operations at present contributes very significantly to the income of the region.

Forestry

Forestry, the second major industry of Southeastern

Island largely occupies the rugged terrain of the west and southwest. Some arable or partially arable acreages at present support forest, and some of this comprises farm woodlots. Most of the region's forest area has been cut over, so that a preponderance is now in various stages of second growth, not yet merchantable.

The annual forest cut is essentially softwood --Douglas fir, western hemlock and western red cedar. A small amount of hardwoods, mostly broad-leaved maple and red alder, are also cut and are used in local furniture manufacture. The softwood cut goes into sawn lumber for export, sash and doors, shingles, furniture and boxes. Sawn lumber is far the most important of these. It is used locally as well as exported. Lumber export, which began in the 1860's, has expanded steadily and is probably the most important single export from the region today. Much of this export, however, is locally processed from logs cut well outside the regional boundaries.

Other Land Uses:

Mining occupies only a few scattered locations in Southeastern Vancouver Island. It is restricted to non-metallics-- sands, gravels and clays. The main centres of sand and gravel quarrying are in the Colwood delta and in the Cordova Bay area. Clay is dug from pits at Victoria and at Bazan Bay. Though the reserves of these materials are high, the use is purely local for various construction purposes. The clay goes into the production of bricks and drain tiles.

Generally speaking, the land used in these operations is unfit for agricultural use.

Other than for the ocean littoral, fishing in the region is primarily a recreational pursuit. This use centres around the numerous small streams and lakes in the western and southwestern portions. Small natural parks also contribute to recreational use of the land. One of these lies adjacent to the regional boundary northeast of Sooke River in the Otter District. Another park is located largely within the Highland District and centres around Thetis Lake.

Indian reserves are set aside at Sooke, Esquimalt and Saanich. Those in Saanich occupy the largest acreages. The general map (Plate II) shows the distribution of these reserves. Some contain poorer soils and rock outcrops. The South Saanich and East Saanich reservations, on the other hand, include considerable acreages of good arable land--Cowichan clays and clay loams and Keating sandy loams.

Victoria's urban zone has expanded over an extensive area of Cowichan and Tolmie soils. Most of this expansion involves residential land use. The immediate vicinity of the harbour is used for a variety of industrial purposes, primarily simple processing of regional resources. A few of these industries utilize imported materials, producing goods for local markets. With the exception of sawmilling, no large single industry dominates the industrial area. While Victoria is not a competitive industrial centre, income from secondary industry is locally important. The

great variety of tertiary industries--retailing, servicing, tourism, and the like, provide far the largest percentage of regional income. They also offer employment for most of the regional population.

10. SUMMARY AND CONCLUSION

Southeastern Vancouver Island presents a varied picture to the geographer. The upland topography of the west and southwest, on the one hand, is characterized by forest industry, with attendant sparse population and relatively few roads. Inland, scattered areas of suitable soils are occupied by general farms, while along the coast the many bays and harbours are centres of fishing activity. On the other hand, extensive areas of modified glacial tills in the central and northern portions are widely developed for a variety of agricultural pursuits. Population is concentrated here, and transportation routes show a dense, rectangular pattern. An urban area has developed in response to the natural harbour and its agricultural hinterland. The present day hinterland of this urban area extends far beyond the regional boundaries so that it now includes most of Vancouver Island.

The various types of rocks underlying the region have not yielded significant quantities of mineral ores. Some potential copper deposits have been prospected but have not been

exploited. Nevertheless, glaciation has left a till mantle which has yielded abundant supplies of non-metallics. Besides this, the weathering of the tills has produced a variety of widely developed soils. Cowichan clays and clay loams, Keating sandy loams and the Tolmie soils form the most important of these. Physiographic history of the region has also determined the distribution of these soils. The relatively flat coastal plain in the Victoria - Saanich area has been largely covered by drift and contains the greatest areas of arable land within the region. The steeply sloping and maturely dissected upland of the west and southwest is thinly covered with drift and in many places, extensive outcrops of bedrock occur. Consequently, agriculture in these areas is limited to scattered pockets and valley bottoms. A further consequence to physiographic history is the drowned coastline with abundant natural harbours. Several species of fish inhabit the coastal waters. The presence of these, combined with the numerous harbours has directed the activities of part of the regional population to fishing and seafaring.

Climate has imposed definite limitations on Southeastern Vancouver Island, yet has provided one of its greatest resources. The long summer drought has restricted some phases of agriculture such as dairying, but has been an advantage to seed production and poultry farming. The long frostless season has also been a stimulus to agriculture, permitting year round growth of hardy vegetables. The relatively sunny days and moderate temperatures of the summer months have favored tourism

while mild winter temperatures and low total precipitation add to the region's appeal as a residential area.

Natural vegetation has responded to climate and soils. Most of the region supports dense coniferous cover, with the broad-leaved species more prominent in bottom lands or in the drier eastern portions. Climatic conditions are optimum for the growth of Douglas fir, while hemlock and cedar also flourish.

Agriculture is well adapted to the climate and to the edaphic conditions. Small fruit culture is a particularly important phase of this industry. Acreages of suitable soils, principally Keating sandy loams and Cowichan clay loams provide the requisite soil conditions. These combine with the mild winter temperatures, long growing season and low summer precipitation to form optimum conditions for berry production. Unusually dry seasons and insect pests are problems, particularly on the lighter textured soils.

Bulbs and other specialty crops are also well adapted to climatic and soil conditions. Seed production, particularly, is suited to the summer drought and long frostless season, while Tolmie soils are very favorable to bulb growing. Again, the long frost-free season and the relatively large amount of summer sunshine favour the greenhouse and nursery industries.

Dairy farms are favoured by the mild winters and long growing season, but are hindered by the summer drought. In bottom lands and other areas where there is a continuous water table close to the surface, summer pasture remains lush, and dairy farms

have done well. The limitation of summer pasture has meant insufficient milk supplies to meet local demands. Consequently milk must be imported.

Truck farms, many of which are operated by orientals, are well adapted to the scattered peat soils near the urban market. These soils have a high moisture holding capacity and high organic content. Besides this, the location of peats, in low lying areas, ensures a water table close to the surface. Little irrigation is therefore required during the dry summer period.

Poultry farming is favored by the long frost free period and the cool Autumns. Turkey raising is particularly well adapted to the climate and to the coarse textured Qualicum soils. Cool Autumns encourage early feathering and the porous nature of these soils combined with summer drought, are conducive to healthy poults. The high cost of importing feed remains an unfavourable aspect of both poultry and dairy farming in the region.

The general farm is probably one of the most successful forms of agriculture in Southeastern Vancouver Island. A variety of crops are grown, all adjusted to local climatic and soil conditions. Vegetables can be raised in the bottom lands and on the heavier soils, while sheep can be grazed in areas of non-arable soils and rock outcrops. Besides this, the non-arable areas can be devoted to farm woodlots to provide fuel and fencing.

In addition to agriculture, forestry is a major primary industry. The factors of the natural environment

advantageous to this industry, are the luxuriant growth of coniferous vegetation and the numerous coastal indentations which provide facilities for water transport. While natural growth favours heavy stands, serious overcutting, fires and insect pests have depleted some areas. In the past sixty years, most of the region has been logged, so that second growth has not yet formed merchantable timber. Some well-developed stands still exist in the Sooke and Goldstream districts.

Mining contributes to complete utilization of resources, exploiting the Colwood sands and gravels, the Cordova sands and gravels and the Maywood clays - all a result of glacial deposition. Mining, however, is relatively insignificant in the region.

Fishing is in value, the third primary industry, following agriculture and forestry. A variety of fishes is taken, the Pacific salmons being the most important. Fishing, like forestry, has utilized the drowned coastline for the numerous sheltered bays and harbours which it provides.

Resources of forest, soil and ocean, together with a ready labour supply, contribute to the development of secondary industry in Southeastern Vancouver Island. Yet this industry is hindered by limited markets and energy supplies. The chief form of power is hydro-electric. The recent development at Campbell River has meant a certain regional increase which favours industrial expansion. Because the consuming population within the region and its hinterland is relatively small, local markets are limited.

Markets in the Canadian Prairies and in foreign countries are outlets for some of the agricultural and forestry production. The principal raw materials are logs, fruit and vegetables, and fish. Sawmills and processing plants convert these raw materials, but most of the manufacturing stops at simple processing.

Tertiary industry is well developed in the region. Service industries, retail stores, and similar establishments cater to the residential and the tourist population. Transportation and communications are well developed and assume patterns which reflect the basic topographic controls. Sinuous, rather poor roads are the rule in the upland areas of the west and southwest, while straight, well-surfaced roads serve the more level Victoria-Saanich area.

There is opportunity for expansion of some phases of industry in Southeastern Vancouver Island. Fishing is perhaps, an exception. Little increase is likely in the annual catch. At present there is no certainty of increased catches in the future, though biological research has opened possibilities in this line. Within the region, secondary industry based on fishing is limited to canning and curing. Though some fish oil is extracted from the offal, there is not enough of this waste product available from the fish processing to warrant further expansion. This phase remains a potential if the associated primary industry can be augmented.

Mining is limited to sand, gravel and clay production. Resources of these materials are large. Since they are exploited

for the local demand, it is likely that increased quarrying will keep pace with urban development and construction.

The region's greatest potential rests on its soil and forest resources. Adapting basic figures contained in Spilsbury's soil report, [1] there are approximately 40,000 acres of known arable soils in the region. Roughly 10,000 additional acres contain arable fractions or are cultivable under special practices. An estimated 102,000 acres is non-arable, containing unsuitable soils, rock outcrops and steep slopes. While the areas of more rugged topography, particularly along watersheds, stream banks, bluffs, etc., should be left in permanent forest, the great majority of this group now supports tree growth and could well be put to sustained yield forestry. Most of the area is accessible and in a conservative estimate, 78,000 acres of the non-arable acreage could be used for this purpose. Forest practices involving selective logging and reforestation of burned or clear cut timber would ensure continuous yields of about 16¼ million f.b.m. per year. [2] Nevertheless, part of this

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1 Spilsbury, R.H., Soil Survey of the Southeastern Portion of Vancouver Island, 1944, (unpublished), p.55a.

2 This figure was arrived at by applying a value obtained from the table of mean annual increment in immature stands shown on p.50 of Mulholland's "Forest Resources of British Columbia", to the estimated 78,000 acres available for sustained yield forestry.

potential forest land is privately owned. A programme of public education designed to indicate potentialities of such land, and to promote co-operation of the individual owners, would tend to offset this difficulty.

Roughly one half of the 40,000 acres in the agricultural group is now cultivated. Ultimately then, the crop area could be approximately doubled. Not all the potentially arable soil is available for new settlement however, since, like the forestry group, much of it represents privately owned land. Assuming that 5,000 acres of the potential are available, and an average farm size of 50 acres, about 100 new farms could be established. If this settlement were accomplished, probably part of the presently owned undeveloped land would be made productive. Over a period of fifteen or twenty years, it is possible that a gradual increase in the urban market and local processing plants would parallel the agricultural expansion.

The 10,000 acres of partially arable soils would likely not be required for agriculture until the arable area were settled. Ultimately this acreage would probably be suited to general farming, since the cultivable fractions would yield a crop while the non-arable portions would be suited to farm woodlots. Until required for settlement, it could be used for forestry.

Suitable portions of agricultural, intermediate and forestry classes, particularly the latter two, should be available for parks, tourist centres and other recreational uses, industrial

and commercial sites. The areas involved in these potential usages are relatively small, and the returns from them would be high.

Though changing economic conditions and markets affect industry, people will continue to be attracted to the region by its favorable climate, its recreational facilities and its scenery. As the cultural centre for Vancouver Island and as the political centre for British Columbia, it takes advantage of these natural factors, and its appeal to tourists remains one of the region's major assets.

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Canada, Department of National Defence, (Geographic Section, General Staff), Sooke Bay (1180), Goldstream (3286), Metchosin (2971), Malahat (3396), Victoria (5178) Saanich (5393), and Sidney (5508), scale 1:25,000,1935.

Canada, Department of National Defence, (Geographic Section, General Staff),

Victoria and Saanich sheets, scale 1mi/in, 1945.

PLATE I

SOILS OF SOUTHEASTERN VANCOUVER ISLAND

KEY

ARABLE SOILS

COWICHAN CLAY LOAM	C.CL
COWICHAN CLAY	C.C.
TOLMIE SANDY CLAY LOAM	T.SCL
KEATING SANDY LOAM	K.SL
DELTA SANDY LOAM	D.SL
DELTA LOAM	D.L
DELTA CLAY	D.C

SELECTED FRACTIONS ARABLE

QUALICUM LOAMY SAND (RESTRICTED DRAINAGE)	Q.LS

NON-ARABLE SOILS

SHAWNIGAN STONY SANDY LOAM	S.SL
QUALICUM STONY SAND	Q.ST
QUALICUM LOAMY SAND	Q.LS
DELTA STONY SAND	D.ST
MOSTLY ROCK OR ROCK OUTCROP	#

MISCELLANEOUS SOILS

PEAT	P
MIXED PROFILES (SURFACE AND SUBSOIL FAMILY NAMES INDICATED AS S-C, Q-C, K-C, ETC.	S-C
MIXED PROFILES (RESTRICTED DRAINAGE)	Q-C

2 1 0 2 4

Scale 2 miles to 1 inch.

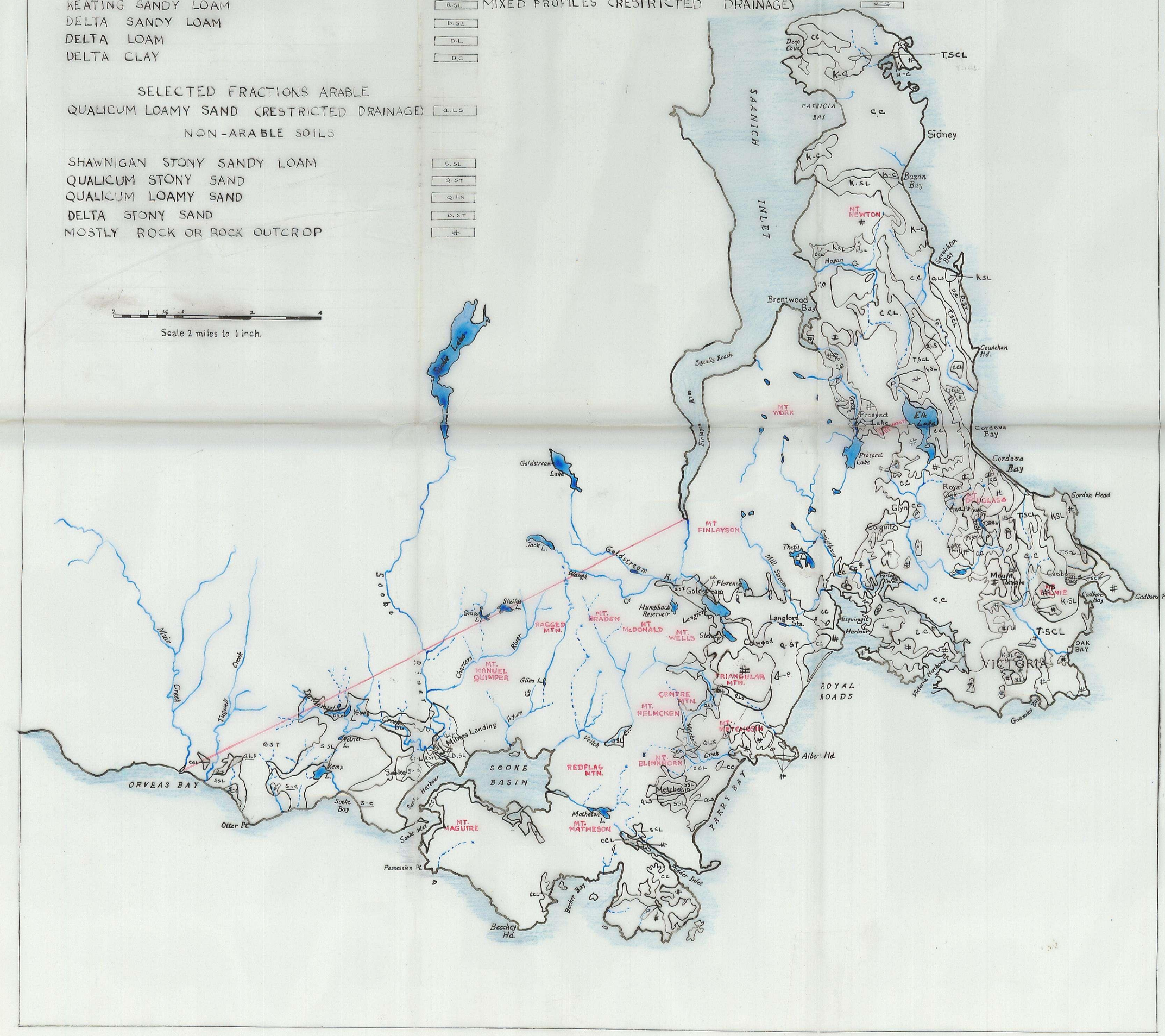
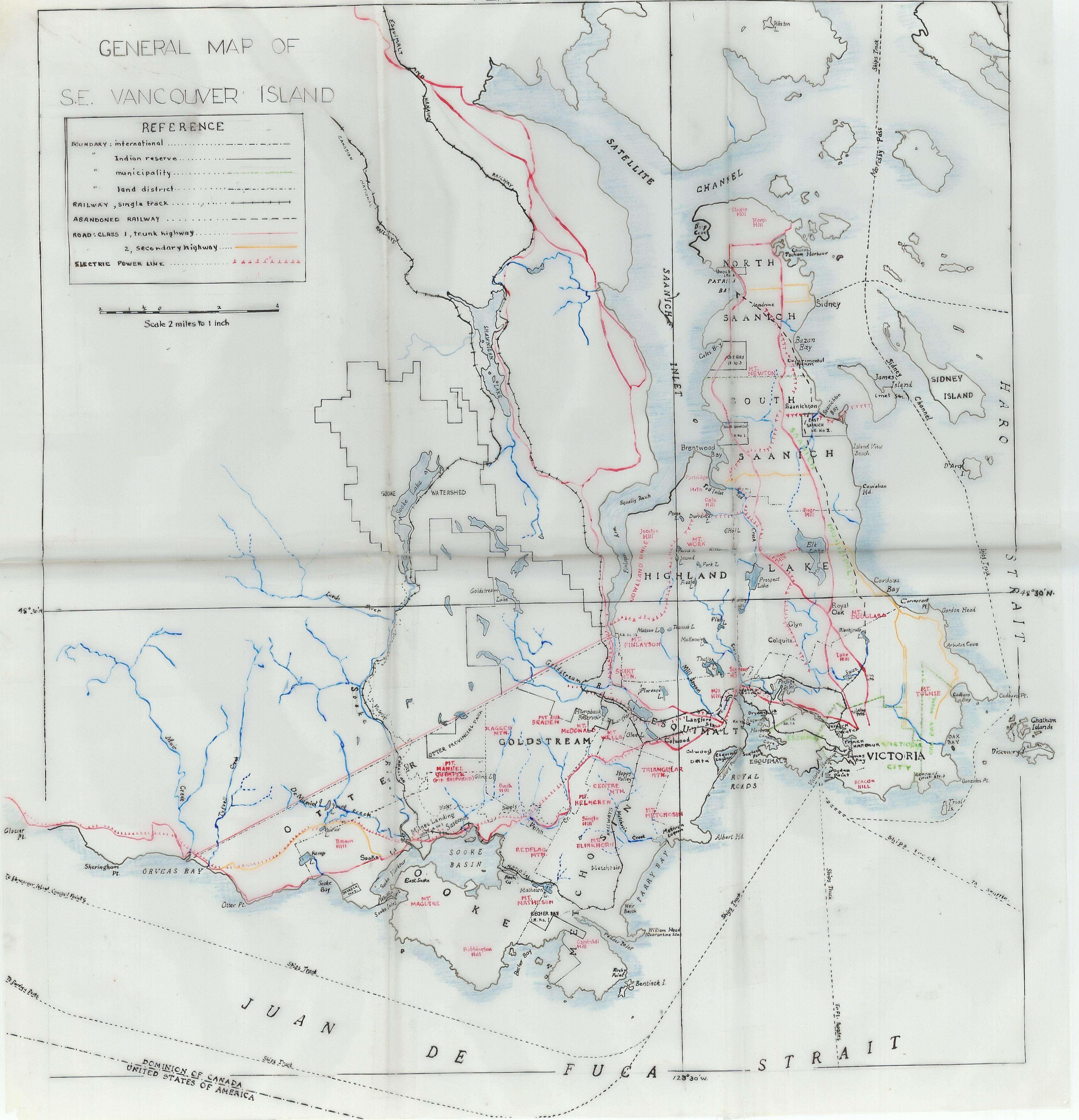


PLATE II



GENERAL MAP OF
S.E. VANCOUVER ISLAND
REFERENCE
BOUNDARY: international
" Indian reserve
" municipality
" land district
RAILWAY, single track
ABANDONED RAILWAY
ROAD: CLASS 1, trunk highway
2, secondary highway
ELECTRIC POWER LINE
Scale 2 miles to 1 inch
123°30'W.
48°30'N.
SATELLITE CHANNEL
SAANICH INLET
HARO STRAIT
JUAN DE FUCA STRAIT
NORTH SAANICH
SOUTH SAANICH
HIGHLAND
LAKE
ESQUIMALT
GOLDSTREAM
SOOKE
METCHOSIN
VICTORIA
VICTORIA CITY
OAK BAY
ROYAL ROADS
SOOKE BASIN
SIDNEY ISLAND
Sidney
James Island
Bazan Bay
Brentwood Bay
Saanichton
Cordova Bay
Gordon Head
Cadboro Bay
Royal Oak
Colquitz
Langford
Colwood
Sooke
Otter Pt.
Orveas Bay
Sheringham Pt.
Glacier Pt.
Albert Hd.
Bentinck I.
Rocky Point
William Head
Becher Bay
PARRY BAY
Shawnigan Lake
Sooke Lake
WATERSHED
Elk L.
Prospect Lake
MT. NEWTON
MT. WORK
MT. DOUGLAS
MT. TOLMIE
MT. FINLAYSON
MT. McDONALD
MT. WELLS
MT. HELMCKEN
MT. BLINKHORN
MT. MATHESON
MT. MAGUIRE
MT. METCHOSIN
TRIANGULAR MTN.
CENTRE MTN.
RAGGED MTN.
REDFLAG MTN.
SKIRT MTN.
BEACON HILL
Ships Track
DOMINION OF CANADA
UNITED STATES OF AMERICA

AERIAL PHOTOGRAPHS

B. C. 249, photographs 12, 18, 25 (plates 3, 4 and 5), were taken in July, 1946 at an elevation of 15,000 feet. The natural scale is 1:20,000.

B. C. 587, photograph 43, (plate 6) and B. C. 588, photographs 9 and 39, (plates 7 and 8), were taken in June, 1948 at 5,000 feet. The approximate natural scale is 1:10,250.

The remaining photographs were taken in May, 1949, at 5,100 feet. The natural scale on these photographs is approximately 1:10,250.

PLATE III
(B. C. 249:12)

Sooke Bay with Broom Hill, upper centre, and part of the settlement at Sooke in the upper right. Retrogression of recent sediments and drift is evidenced by the wave cut cliffs in the centre and lower right.


BC 2

PLATE IV
(B. C. 249:18)

Whiffin Spit at the entrance to Sooke Harbour (upper left), and Mt. Maguire (upper right). Deposits of chalcopyrites have been prospected in this area. A fish weir is clearly seen above Possession Point, (left centre). The hard rocks, being resistant to wave action, tend to retain the initial irregularities of the drowned surface, except where marine erosion has produced wave chasms in the weaker zones, such as shear fractures.

PLATE V
(B. C. 249:25)

Bentinck Island (lower centre), Pedder Inlet and William Head. The settlement near Rocky Point, on one of the scattered "pockets" of agricultural land in the southern part of the region, is seen in the left centre. A tug with a log boom in tow, is visible, (upper right), proceeding to Victoria.


9:25

PLATE VI
(B. C. 587:43)

Victoria Harbour, and part of Victoria city, looking east. The Breakwater, Ogden Point Piers, (with grain elevator and cold storage plant), and Outer Wharves are seen in the centre foreground. One of Victoria's ship yards appears above the ship berthed on Outer Wharf. Several log booms awaiting delivery to the lumber mills can be seen in the left foreground. Victoria's industrial area lines the waterfront of the Outer Harbour, (through which the vessel is steaming), James Bay and Inner Harbour (left centre). Part of the industrial area lines Selkirk Water, (out of the picture to the left.) Fort Victoria was located to the right of the cantilever bridge, (toward the centre of the photograph). Beacon Hill Park, (right centre), and Cadboro Bay, (upper left.), are also visible

V1

PLATE VII
(B. C. 588:9)

Looking W.S.W. from Cadboro Bay and Yacht Club (centre foreground). The monadnock of Mt. Tolmie can be distinguished toward the centre of the photograph, to the right of the race track oval. The flat coastal plain over which the city has spread is clearly visible, with the more broken topography of the western and southwestern portions of the region in the background. Sooke Basin is just visible in the left background beyond Esquimalt Harbour.


X 166
BC:588:9

PLATE VIII
(B. C. 588:39)

Looking S.W. from Victoria Arm, (centre foreground), and Portage Inlet, (right foreground), Esquimalt Harbour is in the left centre, with part of the naval base and the Dominion Government drydock shown. Esquimalt Lagoon, almost sealed by Coburg Peninsula, is seen beyond the harbour mouth, with Sooke Basin and Harbour and the Strait of Juan de Fuca in the left background. Mount Finlayson is the knob-like monadnock in the near background, (right).


BC-5PA-39

PLATE IX
(B. C. 805:73)

Looking toward Sooke Basin from the Colwood delta. Sand and gravel quarries are prominent in the centre foreground. The transporting action of the northward setting, longshore currents is evidenced in the right foreground. The settlement of Metchosin (left centre), and Happy Valley and Luxton (right centre), show as scattered "patches" in the more broken topography.


B.C. 805: 73

PLATE X
(B. C. 805:79)

Upper portion of the Colwood delta, looking west. Mill Hill occupies the right foreground, while Glen, Langford and Florence lakes, (centre), can be seen. Skirt Mountain, location of several gold claims, is shown flanked by Langford and Florence lakes, (centre right). A long, transverse valley, partially occupied by Goldstream River, can be traced from the vicinity of Langford Lake into the centre background of the photograph.


B.C.805 : 79

PLATE XI
(B. C. 805:86)

Looking W. across the Highland District from the vicinity of Scafe Hill, toward Mt. Finlayson, (left centre). Fiord of Saanich Inlet extends from behind Mt. Finlayson, out of the photograph to the right. Fizzle Lake can be seen (centre right), along with Teenook and Matson lakes, partially obscured by smoke, (left centre). The hydro-electric transmission line from the Campbell River development to Victoria will follow the swath clearly seen extending from the left foreground to the centre background.

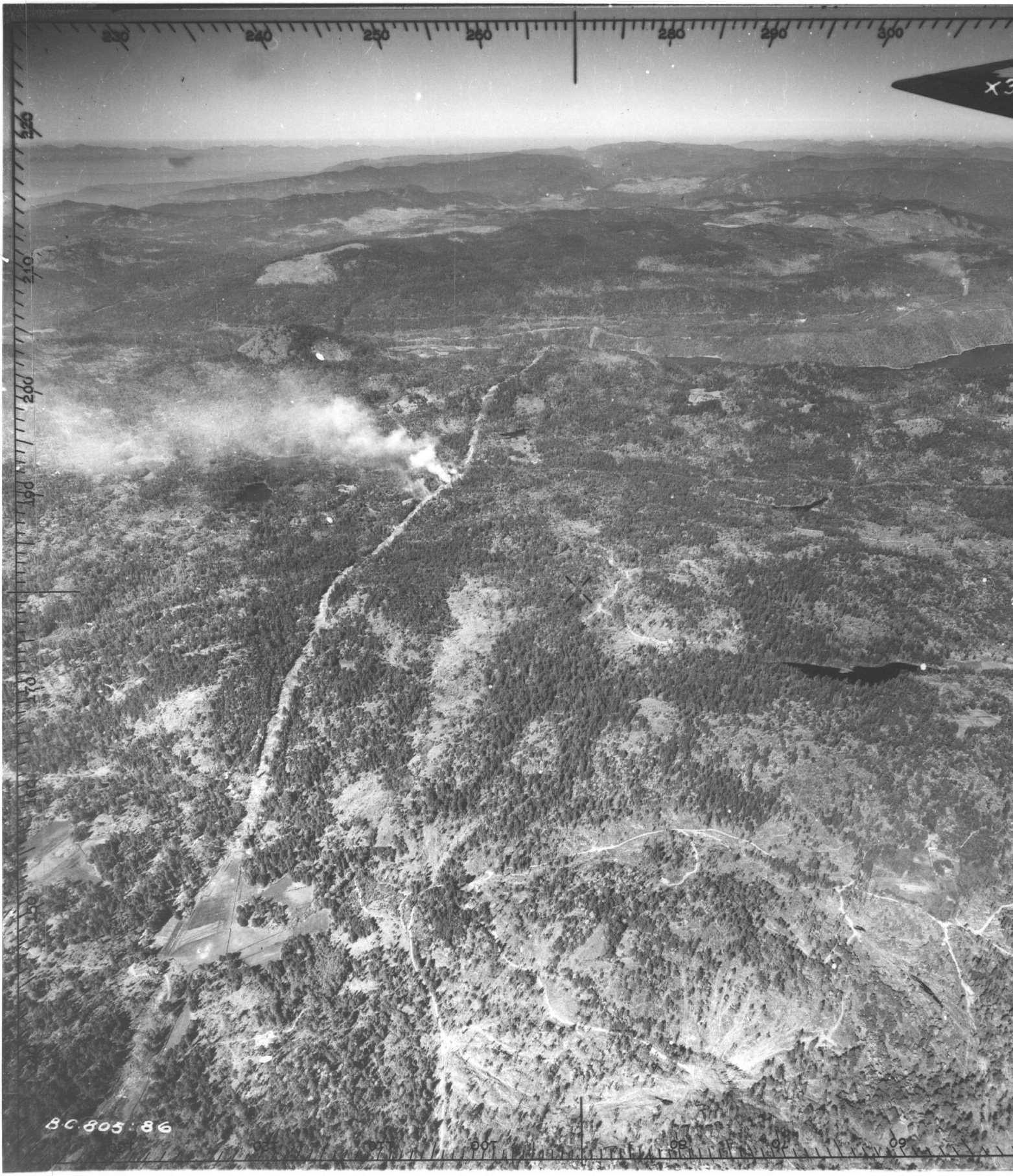

BC 805 : 86

PLATE XII
(B. C. 806:84)

Looking W. from Sidney, across North Saanich to Patricia Bay. The airport is clearly visible in the left centre. The uplifted Tertiary erosion surface of southern Vancouver Island is illustrated by the concordance of summit levels in the far background.


BC 806:84

PLATE XIII
(B. C. 806:95)

View from the Keating area, west to Brentwood Bay and Tod Inlet. The Keating sandy loams and Cowichan clay loams are well developed for agriculture, while the thin, gravelly soils of the Highland District, (left background), remain undeveloped.


BC 806:95

PLATE XIV
(B. C. 808:32)

Looking east from Christmas (Lake) Hill, across Gordon Head and San Juan Island to Mt. Baker, (far background). Swan Lake shows in the right foreground and Blenkinsop (Lost) Lake in the left centre, both occupying eroded hollows in the drift mantle. The monadnock of Mt. Douglas, (left centre), with the tree covered drift train extending south from it, is seen beyond Lost Lake. Cadboro Bay, Oak Bay, Chatham and Discovery Islands appear in the upper right. This photograph indicates the rural — urban transition.


BC 808:32