The University of British Columbia Press

Atlas of British Columbia

People, environment, and resource use

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Acknowledgements

The preparation and production of a regional atlas is a large and complex undertaking, involving the acquisition, assembly, and processing of various kinds of information from diverse sources and the rendering of it in map form. In this endeavour the author has received co-operation and encouragement from a great many individuals and from several funding agencies without whose support the project could not have succeeded.

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The gathering and processing of a suite of atlas maps and the rendering of that information in camera-ready form involves many hours of specialized cartographic work. Including casual labour, fifteen people were employed with project funds at one stage or another of the atlas project. Most of them were hired as student assistants to undertake a variety of tasks including data processing, drafting, scribing, and peel-coat processing. This had two advantages. It provided students with employment and gave them the opportunity to apply their formal training to practical cartographic problems.

It was a challenging task involving imagination, compromise, and a great deal of hard work. The effort will have been well rewarded if this atlas conveys to its readership the spatial insights to a better understanding of British Columbia.

Albert L. Farley

Atlas of British Columbia

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Foreword

In 1956, the first resources atlas of British Columbia was published by the British Columbia Natural Resources Conference. It was a remarkable achievement, representing the combined effort of the many people in industry, university, and government who comprised the conference. As a source of information about British Columbia, it was an outstanding reference and was widely consulted both at home and abroad by those who had a special interest in this province.

Over the years, rapid development of our resource-based industries brought many changes in the geography of the province, and the need for a new regional atlas became apparent. Although the British Columbia Natural Resources Conference is itself no longer active, the kind of interest in basic resources and resource industries of this province that it embodied is widespread.

The objective in providing a new atlas was to produce an effective and well-balanced statement about our people, our land, and our resource use. From planning stages to publication this new atlas, like its predecessor, is a fine example of co-operation; and it was with pleasure that the provincial government joined with industry and the university to help bring the atlas to completion. On behalf of all British Columbians, I wish to congratulate all those who had a part in the production of this new atlas which will be of lasting value for the people of the province.

William Richards Bennett
Premier, Province of British Columbia

Yachts gathered in Victoria's inner harbour prior to the start of the Swiftsure Race.

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Guide to Atlas Use

As its title indicates, this atlas is organized into three sections — people, their natural environment, and their use of resources. Within each, the individual maps deal with separate but related themes embracing a considerable array of information. In order to present the data in cartographic form, various symbols and colours are employed. To the extent practically possible, the range of symbols has been kept to a minimum. Nonetheless, any thematic map presents a complex set of visual stimuli. To aid comprehension, the reader should examine the maps in the following order: the title and legend, the map itself, then the text.

Title and Legend. The topical focus of the map is given by its title. The legend indicates the meaning of the individual symbols and therefore is the key to what the map shows and how to read it. In some instances the legend is short and direct, while in others it is longer and more complex. Depending upon its length and the need for visual balance, it may be in two separate groupings on the map. Where there is more than one map on a page, the individual maps usually have their own legends, but in a few instances they share a common one.

Map. The reader should note first the overall distribution of the symbols and the variation from one part of the province to another. Then he should examine the different areas in more detail, observing those that have high concentrations or low concentrations of the particular element or elements shown. The legend helps to refine the interpretation of detail. If an inset map is included with the main map, it will give greater resolution of detail for southwestern British Columbia, the most populous area of the province.

Text page. The text is designed to supplement the map by providing interpretational background, by emphasizing spatial patterns, and by providing detail. Appreciating the spatial interrelationships that exist between people, their environment, and their use of resources is central to the purpose of this atlas. Consequently, the text frequently includes cross-references to other maps. The reader should refer to other maps in the sequence in order to heighten the awareness of those inter-relationships. The brief list of references at the end of each text is not intended as a citation of the sources upon which the map is based, for in general these are far too numerous and diverse to be conveniently listed. Rather they indicate the basic data sources available and provide a guide to further reading. Finally, the reader should consult the Gazetteer map, the Gazetteer, and the Historical and Statistical Summary at the end of the atlas. For convenient reference, a copy of the Gazetteer map is also included at the end of the preliminary matter. The Gazetteer gives the names and locations of many natural features and places in British Columbia. Along with those shown on the maps or referred to in the texts, it includes a listing of major hydrologic, hydrographic, and landform features in the province, together with an extensive list of place names. The reader is encouraged to use the Gazetteer as a convenient means of checking locations and of building a comprehension of the geographic diversity of British Columbia. The Historical and Statistical Summary that follows the Gazetteer listings contains a selection of information concerning historical events, physical features, and economic data about the province. Its purpose is to provide a quick reference to commonly sought facts and to supplement the maps and texts.

Contents

Introduction

In many ways the *British Columbia Atlas of Resources* published by the British Columbia Natural Resources Conference in 1956 was a remarkable accomplishment. It was the first atlas of its kind to appear in Canada and it helped stimulate the preparation of other regional atlases – the *Atlas of Manitoba*, the *Atlas of Alberta*, and the *Atlas of Saskatchewan* being notable among them. It was also a remarkable embodiment of the spirit of co-operation between industry, university, and government that was the hallmark of the Resources Conference. Authorities in each of the resource sectors – people, soil, water, agriculture, fisheries, forestry, mining, energy, recreation, and wildlife – collaborated in the preparation of material for that statement about the province, and it became a basic reference for students, businessmen, government officers, and the general public.

Because of the wealth of useful information it portrayed, available stocks of the original British Columbia atlas were soon exhausted, but no replacement for it was available. Much information about the province continued to be generated, particularly by government agencies concerned with resource inventory. Relatively little, however, was in a form that would be easily accessible and readily comprehensible to the non-specialist. Further, much of it was of a highly particular sort that did not facilitate an integrated understanding of province-wide patterns and comparisons.

Over the years, considerable interest was expressed in the possibilities of revision of the 1956 atlas, but none was undertaken. A strong, ongoing interest in the location and spatial association of resources and resource development in the province continued to be expressed, however. Requests for basic resource information directed to the Department of Geography of the University of British Columbia from students, industrial consultants, librarians, and others was clear evidence of that interest and of the desirability of an up-to-date atlas.

With the encouragement of colleagues, and supported by a research grant from the Canada Council, I began work in 1975 on the concept, design, and preparation of a new *Atlas of British Columbia*. The general objective of my enquiries was to design a visually effective and physically manageable book that would present a composite view of British Columbia's resources and resource-based industries. It was understood from the beginning that recent developments would be emphasized, but an expression of past spatial patterns was judged to be important to an understanding of the present. By this means, the reader would more clearly appreciate that the present is merely a stage in a continuously evolving pattern, and in doing so he might obtain insights into the directions of future development.

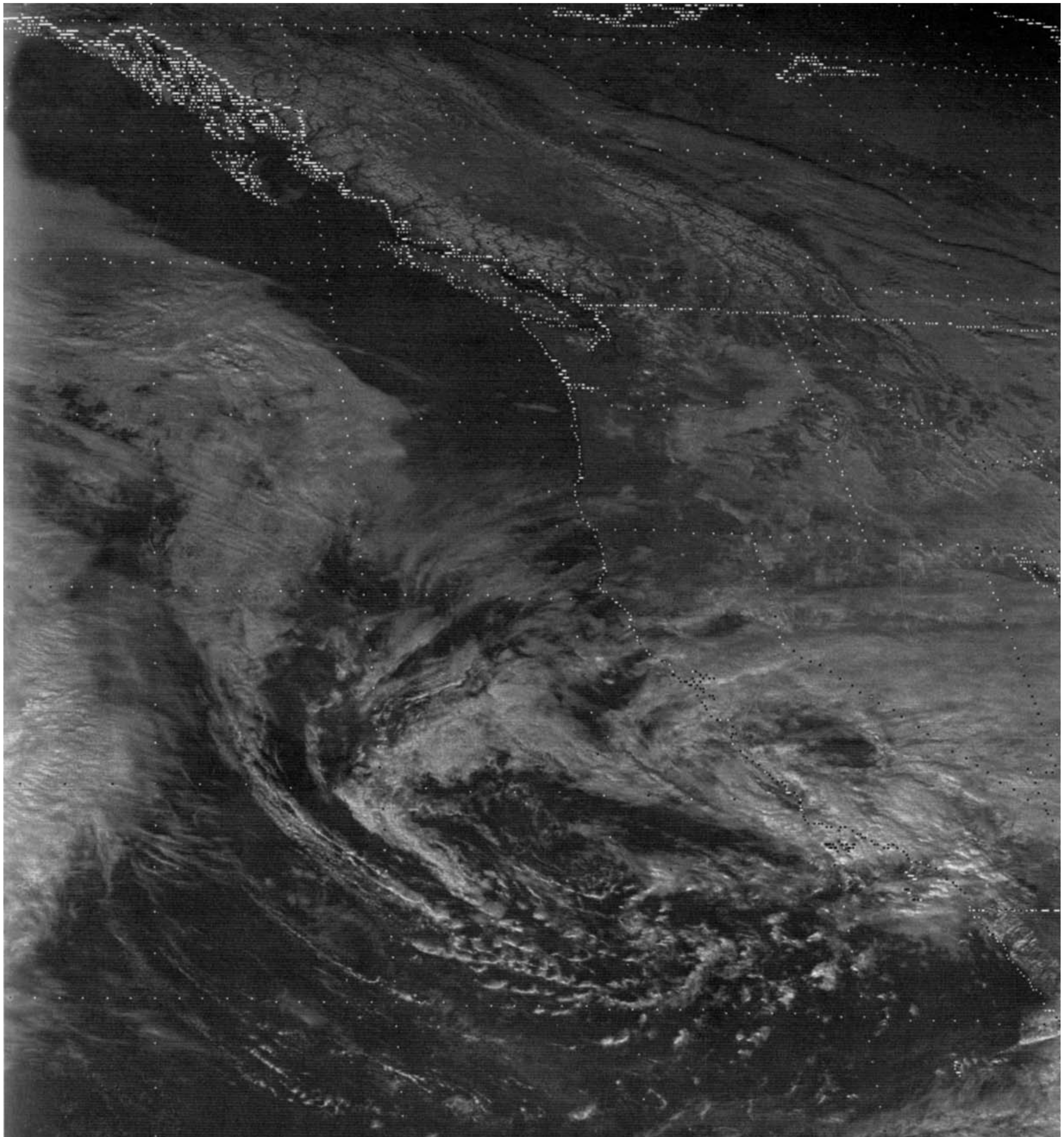
With these design objectives articulated, it was clear that the new atlas could not be limited to a mere up-dating of the 1956 production. Recognition of the proven advantages of many features of the old atlas, however, formed an important background against which to judge design alternatives for the new one. To be conveniently used, it had to be smaller in format. But a desirable size had to be coupled with maximum possible scale, and satisfactory colour reproduction had to be considered in terms of least-cost preparation procedures and processing techniques. The amount of information at hand also had to be reconciled with practical map scale, and design options with available equipment, time, and manpower.

Investigation toward the design and preparation of the atlas was begun in the summer of 1975. Experimental sketches were prepared for maps in a range of scales and in a number of possible layouts. The general objective was to find the largest scale reasonably possible within a page size that would fit an average bookshelf. Desire for maximum scale was necessarily tempered with other design considerations, including arrangement of maps on the page and overall appearance. To this end, preference testing of different page layouts was carried out with various student groups and with visitors to the 1976 "Open House" at the University of British Columbia. The results of these tests showed a remarkable diversity in the ways in which different individuals read maps and in the ways in which the intellectual content of those maps is perceived. The majority preferences for each of the components tested was an important guide to the selection of a relatively simple layout and design for the atlas, and it was decided to employ a minimum of different scales and to make extensive use of graduated circles to convey quantitative information. The final scales selected for all but one of the maps are: 1:3 million (southwestern B.C. inset map), 1:6 million (single map per page), 1:9 million (two-to-a-page layout), and 1:12 million (four-to-a-page maps). Partly in accordance with the adoption of metric standards, the chosen scales are in simple multiples. In addition, and through courtesy of the Surveys and Mapping Branch, Victoria, which provided co-ordinate positions, a new series of base maps was drawn up on the Transverse Mercator projection. These are centred on the 123rd meridian.

In the spring of 1976, supported by grants from industry, from the provincial government, and from the Vancouver Foundation, the second phase of the project was begun. Individual map sheets were compiled. Graduate and undergraduate geography students were employed to work with the author in assembling and processing data and preparing map manuscript in accordance with design requirements. The compilation phase was sufficiently advanced by the fall of 1976 to permit planning of the third phase, that of scribing the negatives and preparing colour separations.

This was made possible by a grant from the provincial government and by the opportunities to employ students under the provincial Youth Employment Program and the federal Young Canada Works project. Although technically involved, colour separation work was undertaken in the Department of Geography, U.B.C., and without elaborate and expensive equipment. Among the essential items were a vacuum frame for contact printing and an I.B.M. composer typewriter which was used for setting type for stripping onto the black plate film. The stable films necessary to avoid problems of colour registration in printing and the chemicals used in processing them made up a large part of the material costs at this stage.

Some technical difficulties emerged, especially from the limited choice of letter faces and sizes available on the I.B.M. composer and in the use of certain types of film in separation work. Further, it was not practicable to attempt colour proofing of the film separations or to apply screens to those separations before they were dispatched to the printing plant. Despite these



The west coast of North America as seen from a geosynchronous weather satellite positioned more than 30,000 kilometres above the equator. Boundary lines are computer generated.

limitations, the in-house processing of camera-ready copy offered certain advantages. Most importantly, it encouraged the use of a pool of cartographically trained students and provided them with the opportunity to gain practical experience in map-making.

One of the major decisions in atlas-making is the choice of elements to be represented. In this case the precedent of the original British Columbia atlas was helpful, since first-hand knowledge of which maps were most frequently used was available. Further, the information provided by librarians and others about the kinds of map information most frequently requested was of considerable value. These, however, could only be taken as broad indications of preference. Clearly it was necessary to structure the atlas to provide a cohesive unit with balanced informational content. The choice made was to devote approximately one-quarter of the content to a consideration of cultural elements (mainly population), one-quarter to environmental elements, and the remainder to resource use and transportation. Within each of these three sections, the selection of individual map topics was based upon four considerations – balance of atlas content, availability of information, the practical possibilities of rendering the data in map form, and observed demand for certain types of map. In all instances, the attempt was made to acquire and utilize the most reliable data and to express them in the most informative way commensurate with practical map scale. Because a central objective of the atlas is to appeal to a broad audience and to present the information on a province-wide scale, no special-purpose regional maps or maps of urban areas are included. The inset map of southwestern B.C. is used only to provide a larger scale for the most visually congested part of the map.

Especially in the section on resource use, the selection of dates for those maps showing change through time was largely based upon the information obtainable. Data for earlier periods in British Columbia's history is remarkably incomplete and the difficulties of rendering what is known in map form are compounded by the changes in administrative or statistical boundaries that have been made over the years. Challenging and interesting though this problem may be to the researcher, its pursuit had to be limited to what was realistically possible within the constraints of the overall schedule.

One of the most successful features of the 1956 resources atlas was its employment of text pages facing each page of maps. This feature was adopted for the present atlas because it provides another means of unifying the atlas and making it something more than an organized collection of maps. In addition to supplementing the maps, provision for text pages allows the inclusion of photographs. These have been carefully selected in order to emphasize the themes of the maps and to capture the mood of those themes as a reflection of regional character.

Metric units have been used in this atlas. In a few instances, where the data base is in non-metric units or where conversions would not be meaningful in context, the map data are expressed in conventional units. For those who are not yet "metric-minded," or who have difficulty with the nomenclature, a table of Imperial/metric unit conversions is included in the Historical and Statistical Summary.

Gazetteer Map
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
CASSIAR
OMINECA
PEACE
CARIBOO
PLATEAU
OKANAGAN
KOOTENAY
BOUNDARY
ROCKY MOUNTAIN TRENCH
INTERIOR
GREAT PLAINS
COAST MOUNTAINS
COASTAL TROUGH
QUEEN CHARLOTTE ISLANDS
Graham Island
Moresby Island
VANCOUVER ISLAND
Prince of Wales Island
Baranof Island
Princess Royal Island
Banks Island
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE SOUND
CROSS SOUND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
BARKLEY SOUND
Cape St. James
Cape Scott
Bowie Seamount
Fairweather Mtn.
Mt. Foster
White Pass
Skagway
Atlin
Atlin Lake
Teslin
Teslin Lake
Watson Lake
Lower Post
Mt. Nesselrode
Juneau
Sitka
Devils Thumb
Telegraph Creek
Mt. Edziza
Glacial Mtn.
Dease Lake
Cassiar
Muncho Lake
Fort Nelson
Churchill Pk.
Sifton Pass
Thomas Pk.
Mt. McCusker
Williston Lake
W.A.C. Bennett Dam
Hudson's Hope
Fort St. John
Dawson Creek
Pine Pass
Mackenzie
Stewart
Anyox
Ketchikan
Portland Canal
Kisgegas Pk.
Hazelton
Takla Lake
Smithers
Topley Landing
Babine Lake
Terrace
Prince Rupert
Masset
Queen Charlotte
Kitimat
Atna Pk.
Houston
Burns Lake
Fort St. James
Stuart Lake
Vanderhoof
Prince George
Kemano
Nechako Reservoir
Kenney Dam
Quintette Mtn.
Monkman Pass
Mt. Sir Alexander
Grande Prairie
Lesser Slave Lake
McBride
Mt. Robson
Valemount
Jasper
Yellowhead Pass
Hinton
Edmonton
Red Deer
Calgary
Banff
Lethbridge
Comet Mtn.
Quesnel
Quesnel Lake
Alexandria
Mt. Sir Wilfrid Laurier
Bella Coola
Ocean Falls
Monarch Mtn.
Alexis Creek
Williams Lake
Tallayoko Lake
Mt. Waddington
Waddington Canyon
Chilko Lake
Taseko Lakes
Monmouth Mtn.
100 Mile House
Chasm
Clinton
Athabasca Pass
Mt. Columbia
Thompson Pass
Kicking Horse Pass
Lake Louise
Vermilion Pass
Mt. Dawson
Mt. Assiniboine
Revelstoke
Mt. Sir Sandford
Golden
Invermere
Kamloops
Cache Creek
Ashcroft
Logan Lake
Marble Canyon
Lillooet
Moran
Seton
Shuswap Lake
Salmon Arm
Vernon
Kelowna
Penticton
Oliver
Osoyoos
Merritt
Princeton
Keremeos
Hope
Chilliwack
Lytton
Boston Bar
Skihist Mtn.
Whistler Mtn.
Mt. Garibaldi
Squamish
Grouse Mtn.
Mt. Seymour
Mt. Outram
VANCOUVER
Roberts Bank
VICTORIA
Saanich Peninsula
Port Hardy
Port McNeill
Port Alice
Tahsis
Gold River
Campbell River
Powell River
Comox
Courtenay
Golden Hinde
Victoria Pk.
Nootka
Sharp Point
Port Alberni
Ucluelet
Nanaimo
Big White Mtn.
Nelson
Castlegar
Trail
Grand Forks
Kokanee Pk.
Kaslo
Nakusp
Mt. Hamill
Kimberley
Cranbrook
Fernie
Sparwood
Crowsnest Pass
Creston
Lake Koocanusa
Libby Dam
Libby
Kalispell
Flathead Lake
Spokane
Coeur d'Alene
Bellingham
Mt. Vernon
Everett
Port Angeles
Roosevelt Lake
Coulee Dam
Liard River
Peace River
Fraser River
Skeena River
Nass River
Stikine River
Columbia River
Kootenay R.
Thompson River
Bow River
Red Deer River
Athabasca River
Smoky River
Wapiti R.
Hay River
Chinchaga River
Lake Athabasca
North Saskatchewan River
Oldman River
Chilcotin River
Okanogan R.
Pend Oreille R.
Dean R.
Trout Lake
Texada I.
Woodfibre
Squamish
Britannia
Madeira Park
Port Mellon
Sechelt
Gibsons
Langdale
Bowen I.
Horseshoe Bay
North Vancouver
Port Moody
Port Coquitlam
Burnaby
New Westminster
Port Mann
Langley
White Rock
Abbotsford
Harrison Lake
Harrison Hot Springs
Parksville
Nanaimo
Departure Bay
Ladysmith
Chemainus
Crofton
Galiano
Lake Cowichan
Duncan
Sidney
Swartz Bay
Tsawwassen
Port Renfrew
Sooke
Anacortes
20 0 25 50 Kilometres
10 0 25 Statute Miles

People

Map 1. Population: Historical, 1911–1931

Because people tend to congregate in areas with plentiful resources or areas to which the resources of other places can be readily transported, the distribution of population tells much about the relative abundance of raw materials and the efficiency of transport linkages. Alterations in the population pattern over time reflect changes in resource development and improvements in transportation and communication. The maps shown on the adjacent page illustrate the changes that occurred in British Columbia between 1911 and 1931.

Though trading posts had been built earlier, major European settlement in British Columbia dates from 1843, when the Hudson's Bay Company established Fort Victoria. The trading headquarters was relocated from Fort Vancouver on the Columbia in response to American claims to the Oregon country and in anticipation of the decision to extend the international boundary westward from the Rockies along the 49th parallel. For more than a decade, settlement was limited to the Saanich Peninsula north of Victoria and to a very few agricultural settlements along the east coast lowland of Vancouver Island. The population was supplied by sea, and communication between centres was by watercraft. The heavy growth of coniferous forest that originally mantled much of the lowland was at first a hindrance rather than an asset. Until external markets and transport connections were developed, forestry was insignificant and logging was confined to the immediate hinterland.

Discoveries of placer gold from the 1850's onward gave tremendous stimulus to the regional economy and a new orientation to settlement. By the mid-1860's the population was growing appreciably in the lower Fraser Valley. New Westminster, at the head of deep-sea shipping on the Fraser River, became a commercial and administrative centre for the mainland and began to compete with Victoria as the main urban area of the colony.

The growth in population in the last two decades of the nineteenth century was dramatic, with the numbers doubling between 1881 and 1891. However, the indefinite nature of the data for early censuses makes it difficult to reconstruct the actual distribution. The provincial totals for each decennial census and for the major urban concentrations from the time of British Columbia's entry into Confederation to 1931 are given in the table.

The increase between 1881 and 1891 was chiefly related to speculative development associated with C.P.R. construction and the extension of the line (in 1887) from Port Moody to Vancouver. The railway did not significantly change the existing pattern of settlement, but rather it followed the major natural routeway via the Fraser trench to the valley lands of the river's lower course. The track maintenance and service hamlets that came into existence along the rail line lacked the advantages of site and situation that had already become apparent in the established centres. Deepwater frontage on sheltered, natural harbours and enough flat land for industrial development were critical site factors. Within a decade of the railway's arrival, Vancouver, a small milltown on Burrard Inlet, was transformed from a collection of shacks to a city of over 13,000 people.

The equally striking growth in the 1891–1911 period reflected the longer-term impact of the railway on commercial and industrial development, on the articulation of land and sea transport links, and on an expanding overseas trade. In the decade 1901–1911 the population again doubled in response to expanding markets and an economy based on extracting and primary processing of timber, minerals, and fish. The rate of growth declined slightly in the period from 1911 to 1931. Economic and social disruptions associated with World War I and the onset of the depression years partially account for the slower increase, but, even so, the overall population grew by well over 75 per cent. By 1931, though the total was still modest, British Columbia had nearly 7 per cent of the Canadian total.

From well before the turn of this century, the population of the province has been heavily concentrated in the southwestern corner. By 1891 approximately half was contained within a small region embracing the southeastern fringe of Vancouver Island and the lower Fraser Valley, but there have been shifts within that area. By the turn of the century Vancouver had far outstripped New Westminster and was vying with Victoria as the major city of British Columbia. It eventually assumed supremacy as the industrial, commercial, trade, and transport centre of the province. With the railway and subsequent transport developments, a vast area of the interior was made tributary to Burrard Inlet. While resource industries continued to play a part in Victoria's economic development, the administrative role became and has remained its dominant function. Nevertheless, since 1900 Greater Victoria has consistently accounted for at least 10 per cent of British Columbia's population, and the southwestern region has represented nearly three-quarters of the total.

On these maps, dispersed population is shown by dots, but scale constraints are such that a considerable number of people is represented by a single dot. Caution should therefore be exercised in reading the maps because isolated dots represent centres of gravity in areas of very low population density rather than individual settlements.

The map showing population distribution in 1911 reveals a pattern that is essentially similar to today's. Aside from the southwest, the population is dispersed in small settlements on the coast and in a linear pattern along interior valleys. Except for isolated centres associated with resource extraction, the northern half of the province is essentially unpopulated. In large part these nodes are residual from the Klondike gold rush of 1898. Lineations along the Skeena and the upper Fraser River reflect the construction of the northern branch of the Grand Trunk Pacific (C.N.R.) line from the Yellowhead Pass to Prince Rupert. Southward along the mainland coast, on the Queen Charlottes, and on much of Vancouver Island the population is scattered in small clusters principally representing logging camps and salmon canneries.

The map of 1931 shows some changes, mainly attributable to extension of road and rail links and attendant resource development. In the south, completion in 1921 of the first link in the Pacific Great Eastern (B.C.R.) line from Squamish to the Quesnel area encouraged some new settlement, as had the construction of the Grand Trunk mainline from Yellowhead to Kamloops and Vancouver. By 1931, too, the road network in the interior and along the east coast of Vancouver Island was being upgraded, and the improvements had some impact on the settlement pattern. In the northern half of the province the most noticeable changes are the more continuous lineation along the northern Grand Trunk line and the prominent cluster in the Peace River country. That cluster in effect represented an extension from Alberta of the agricultural settlement fringe. Until transport linkages were established from the British Columbia side around mid-century, settlement in the area remained strongly oriented towards Alberta.

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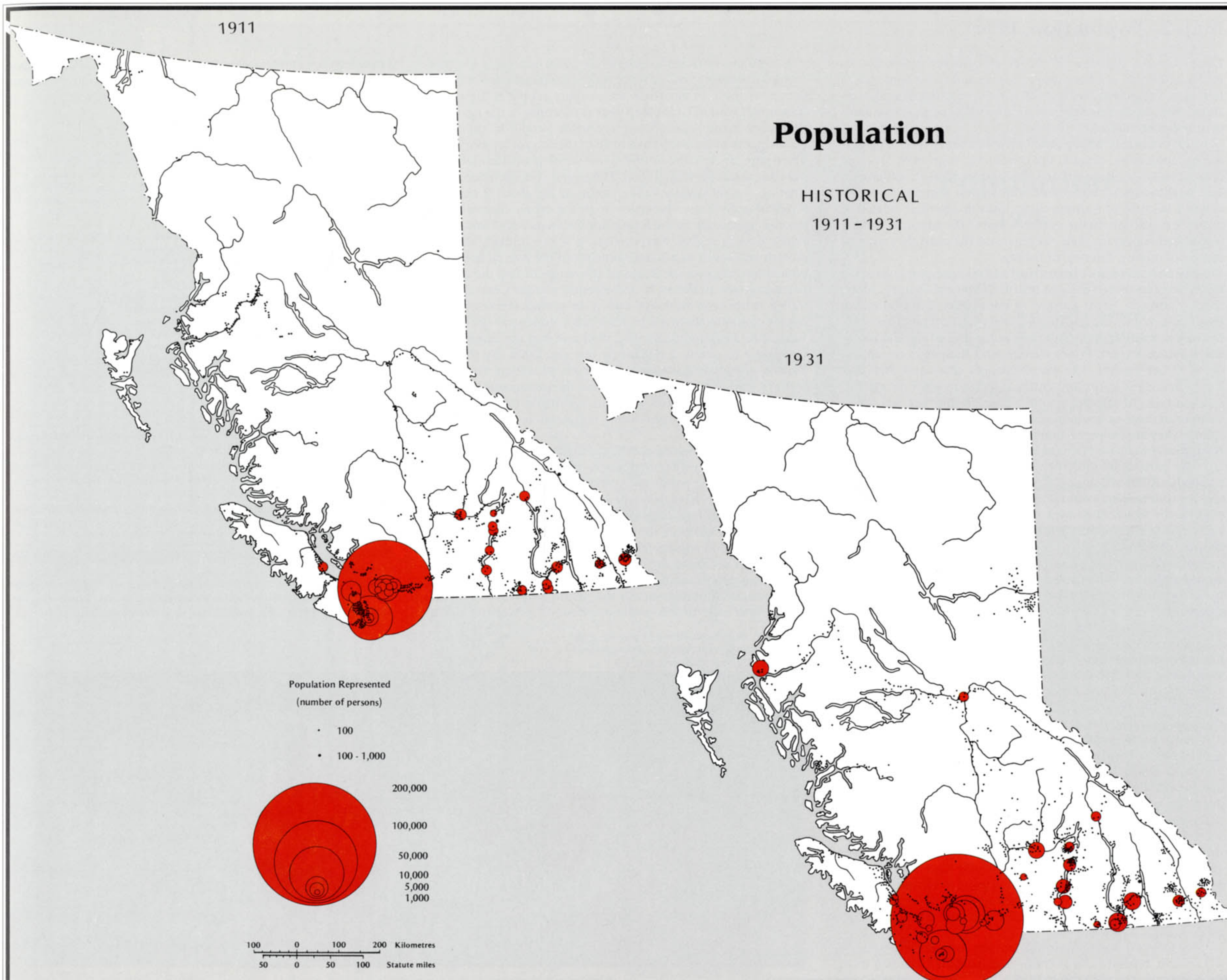
POPULATION 1870-1931 (NUMBERS AND PERCENTAGES)

	1870	1881	Per Cent Increase	1891	Per Cent Increase	1901	Per Cent Increase	1911	Per Cent Increase	1921	Per Cent Increase	1931	Per Cent Increase
Canada	(1871—3,689,257)	4,324,810	17.2	4,833,239	11.8	5,371,315	11.1	7,204,838	34.1	8,787,949	21.9	10,376,786	18.1
British Columbia % of Canadian total	36,200[1] (1871—1.0)	49,459 1.1	36.5	98,173 2.0	98.5	178,657 3.3	82.0	390,774 5.5	119.7	524,582 6.0	33.7	694,263 6.7	32.4
Victoria (city)	4,161[2]	7,301		18,538		23,688		31,660		38,727		39,082	
Greater Victoria	4,907[2]	8,075		22,753		25,999		43,605		59,003[3]		88,000[3]	
% of B.C. total	13.6[2]	16.3		23.2		14.6		11.2		11.2		12.7	
Vancouver (city)	(New Westminster approx. 1,356)	—		13,709		27,010		123,353		163,220		246,593	
Lower Fraser Valley	1,656[2]	1,750[3]		20,900[3]		58,891		179,581		256,579		379,858	
% of B.C. total	4.6[2]	3.5		21.3		33.0		46.0		48.9		54.7	

[1]This figure is based upon the Colonial census of white population (10,586) plus an estimate of Native Indian population derived from the 1881 census.
[2]These figures represent non-Indian population only.
[3]Figures are approximations based on interpretation of available data.

Population

HISTORICAL
1911 – 1931



Map 2. Population, 1976

Three features characterize the distribution of population in British Columbia — heavy concentration in the southern coastal lowlands, valley-oriented lines of settlement with larger clusters along them in the southern and central interior, and large areas of unpopulated land.

The essentially unpopulated areas are those which, by reason of topography, climate, soil conditions, vegetative cover, or relative isolation, have offered little inducement to settlement. The small nodes of settlement within their margins have developed because of transportation links or activities related to resource extraction. In the northern part of the province, mining is the chief reason for their existence; on the coast they may be centres of mining, forestry, or fishing.

The basic network of main road and rail transport lines in the south was established early in British Columbia's history. Along them a strongly linear pattern of population distribution has developed. Within the lineations distinct nodes of population are situated at transhipment points or at the foci of natural routeways. Prince Rupert, Prince George, and Kamloops are among them. Other centres, like the Okanagan cities and Trail and Kimberley grew up in immediate association with an agricultural, energy, or mineral resource base. Despite the fact that a number of these nodes individually contain many thousands of people, they are clustered along the valleys and flanked by large tracts that contain no permanent habitation.

The pattern of settlement in the Peace River country is somewhat different, since the population is more dispersed, as it is in the northern agricultural fringe of the Canadian prairies. But even in the Peace River area most of the land is unpopulated. Indeed, within a comparatively short distance of any population centre in British Columbia, one can easily reach essentially uninhabited wilderness. This fact has important consequences for the way in which the wilderness areas are utilized and managed, and it also has implications for the ways in which British Columbians perceive themselves and their natural environment.

The regional settlement pattern that developed after extension of the railway to Burrard Inlet made Vancouver dominant has persisted. Population growth has been especially rapid in Vancouver, and it has spread into the adjacent lower Fraser Valley. In this area and along the low, glaciated, southern margins of the coastal trough, the conflict of interest between urban and agricultural land uses is most apparent.

The accompanying map is based upon computer generated copy specially prepared by the Data Dissemination Division of Statistics Canada. Smaller communities and dispersed population are shown by dots; urban population by graduated circles. Mean dot value is 200 persons, but it ranges from 100 to 300. As plotted by computer, dots are positioned on centroids of population within Census enumeration areas and therefore do not always reflect the actual location of settlement. Accordingly, wherever statistically possible, dot positions on the map have been adjusted to conform to the known settlement pattern. Relatively few dots appear in the lower Fraser Valley because most of the population there resides in District Municipalities, and these are represented by graduated circles.

By 1976, the total provincial population had reached nearly 2.5 million, representing over one-eighth of the Canadian total. About 60 per cent of the people are concentrated in the metropolitan areas of Vancouver and the province's administrative centre, Victoria. In fact there are as many people in the area of Vancouver west of Granville Street as there are in the Kootenay Boundary country, and there are more people in the urban municipality of Burnaby than in all of the central interior. Combined population in the southern coastal lowlands amounts to 70 per cent of the provincial total. The largest concentration in the interior, the Okanagan Valley, accounts for about 7 per cent. Rates of growth are, however, high for urban centres in the interior, especially in the Kamloops-Okanagan area and in the Prince George region. Nevertheless, it seems unlikely that this growth will result in a significant shift in the overall pattern of population, because the Regional District recording the greatest percentage rise in the 1971–1976 period was the Central Fraser Valley. It has been estimated that, if the growth rates of the past decade continue, there will be 1.6 million residents in the Greater Vancouver Regional District by 1990 and that the number will have risen to nearly 2 million by the year 2000. By that date Canada's population is expected to reach 30 million. The southwestern lowlands are likely to remain the population heartland of British Columbia, and it seems inevitable that the Lower Mainland will be the province's megalopolitan region of the future.

The overall ethnic mix of the population of British Columbia has changed relatively little since the turn of the twentieth century. Although the proportions have been stable, significant regional differences have developed. The table indicates the figures for the various groups and provides the Canadian proportions for comparison. In addition, the net long-term result of the forces of change related to natural fertility, mortality, and immigration is likely to be a decline in the proportion of people of British origin. In the Greater Vancouver Regional District, for example, the ethnic origin of immigrants in the period 1966–1971 was less than 34 per cent British and more than 17 per cent Chinese. Though many immigrants subsequently move, G.V.R.D. officials recognize that foreign immigration has been a major component of population growth in the region, making up 40 to 45 per cent of the annual population increase.

Vancouver, British Columbia's largest city, is the industrial and commercial centre of the populous southwestern corner of the province.

PERCENTAGE POPULATION BY ETHNIC ORIGIN, 1971

British Columbia: Total 2,184,520		Canada: Total 21,568,310	
Ethnic origin	Percentage of B.C. total	Ethnic Origin	Percentage of Canadian total
British	57.9	British	44.6
German	9.1	French	27.8
French	4.4	German	6.1
Netherlander	3.3	Italian	3.4
Ukrainian	2.7	Ukrainian	2.7
Italian	2.5	Netherlander	2.0
Norwegian	2.4	Polish	1.5
Native Indian	2.4	Jewish	1.4
Chinese	2.0	Native Indian	1.4
Swedish	1.5	Norwegian	.8
Polish	1.4	Hungarian	.6
Russian	1.1	Greek	.6
Danish	1.0	Chinese	.6
East Indian	.9	Yugoslav	.5
Remainder	7.4	Remainder	6.0
Total	100	Total	100

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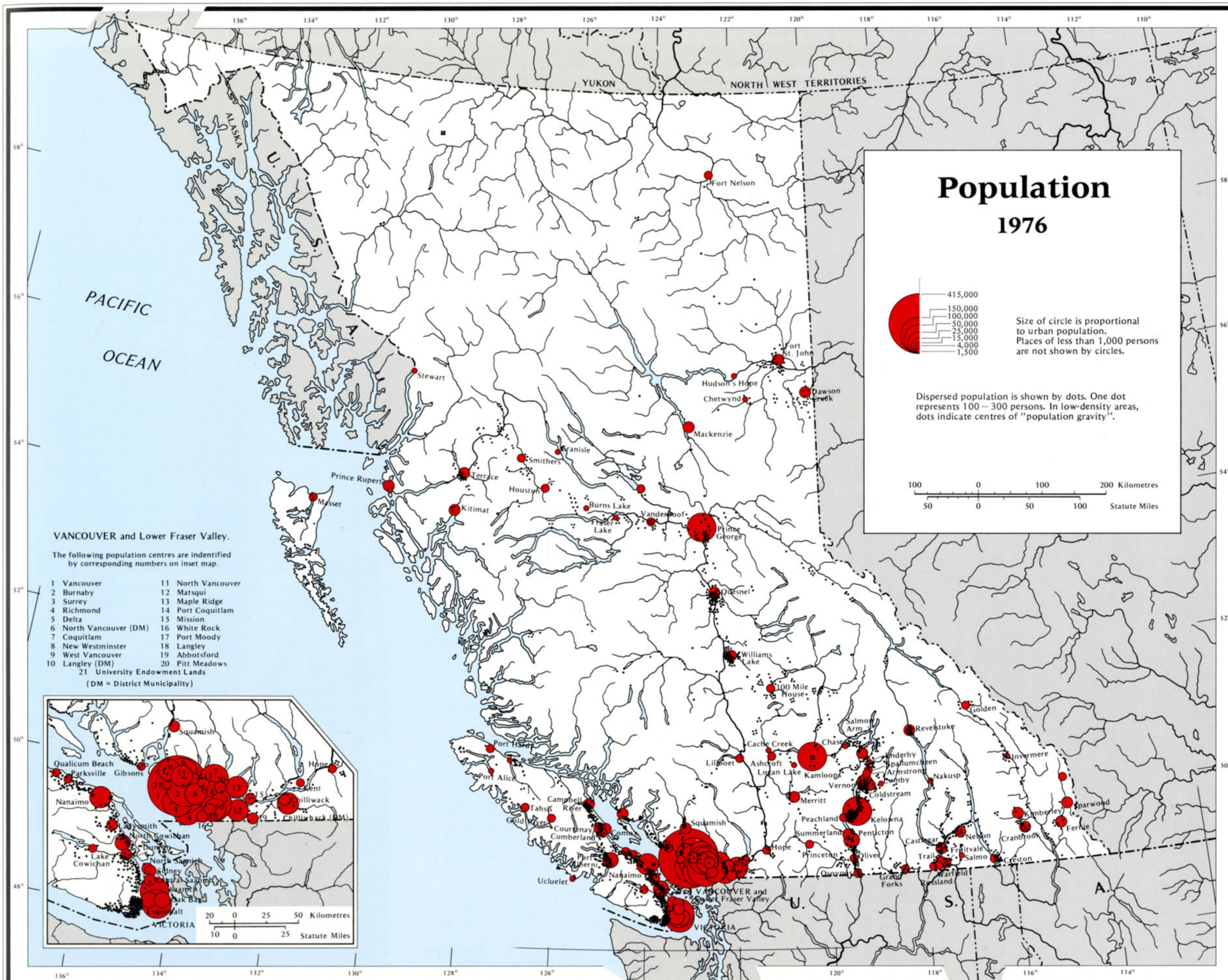

Population
1976
415,000
150,000
100,000
50,000
25,000
15,000
4,000
1,500
Size of circle is proportional to urban population. Places of less than 1,000 persons are not shown by circles.
Dispersed population is shown by dots. One dot represents 100 — 300 persons. In low-density areas, dots indicate centres of "population gravity".
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
VANCOUVER and Lower Fraser Valley.
The following population centres are indentified by corresponding numbers on inset map.
1 Vancouver
2 Burnaby
3 Surrey
4 Richmond
5 Delta
6 North Vancouver (DM)
7 Coquitlam
8 New Westminster
9 West Vancouver
10 Langley (DM)
11 North Vancouver
12 Matsqui
13 Maple Ridge
14 Port Coquitlam
15 Mission
16 White Rock
17 Port Moody
18 Langley
19 Abbotsford
20 Pitt Meadows
21 University Endowment Lands
(DM = District Municipality)
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
U. S. A.
Fort Nelson
Fort St. John
Hudson's Hope
Dawson Creek
Chetwynd
Mackenzie
Stewart
Fraser Lake
Burns Lake
Vanderhoof
Prince George
Smithers
Houston
Terrace
Kitimat
Prince Rupert
Masset
Quesnel
Williams Lake
100 Mile House
Golden
Revelstoke
Salmon Arm
Chase
Enderby
Spallumcheen
Armstrong
Lumby
Vernon
Coldstream
Nakusp
Invermere
Kamloops
Cache Creek
Ashcroft
Logan Lake
Lillooet
Merritt
Peachland
Kelowna
Summerland
Penticton
Princeton
Oliver
Osoyoos
Grand Forks
Castlegar
Nelson
Trail
Fruitvale
Salmo
Warfield
Rossland
Creston
Cranbrook
Kimberley
Fernie
Sparwood
Port Hardy
Port Alice
Tahsis
Gold River
Campbell River
Courtenay
Cumberland
Comox
Port Alberni
Ucluelet
Nanaimo
Squamish
Hope
VANCOUVER and Lower Fraser Valley
VICTORIA
Qualicum Beach
Parksville
Gibsons
Kent
Chilliwack
Chilliwack (DM)
Ladysmith
North Cowichan
Duncan
Lake Cowichan
North Saanich
Sidney
Central Saanich
Saanich
Oak Bay
Esquimalt
20 0 25 50 Kilometres
10 0 25 Statute Miles
136° 134° 132° 130° 128° 126° 124° 122° 120° 118° 116° 114° 112° 110°
58° 56° 54° 52° 50° 48°

Map 3. Native Indians: Distribution of Ethnic Groups, 1850

This map shows the distribution of native Indian language and dialect groups as they existed in 1850, comparatively early in the history of European culture contact with the peoples of the northwest coast. The aboriginal population was most abundant on the coast and along the lower reaches of the major salmon rivers. Even in the areas of population concentration, though, political organization was fragmented and limited to the local tribe or band, despite frequent contact between neighbouring tribes during travel or for trading and social purposes. The bonds of language, however, were enhanced by such contact. Over the millenia of Indian occupancy, the use of individual dialects became common over considerable areas. Thus it is possible to reconstruct the spatial pattern of cultural orientation on the basis of language.

The smallest units shown on the map are those of regional groups, which represent clusters of local tribes living within a well-defined area and having a common language or a common dialect. Such groups were generally identified as separate by surrounding tribes, for example, the Algatcho, Kluskotin, and Nazkoten Regional Groups (in this case not shown on the map), who spoke the Lower Carrier dialect of Carrier. Other examples are the Talio, Kimsquit, and Bella Coola Regional Groups, who spoke the Bella Coola language without dialect distinctions. Within the regional group each tribe was politically independent, occupied one or a number of village sites, and had its own territory.

As employed here, the term dialect is used to distinguish more or less mutually intelligible forms of a language. Some languages were spoken in more than one dialect. An example is the Okanagan language which, within British Columbia, is composed of the Lakes and Okanagan Proper dialects. The distinction between language and dialect is sometimes difficult to make. Some authorities, feel for instance, that Niska, Gitskan, and Tsimshian are dialects of a Tsimshian language, rather than independent languages in their own right.

Language families are groupings of related languages which can be shown to derive from a common historical ancestor language. Thus, all languages of the Salishan Family, for example, are descended from a single language spoken thousands of years ago, which is referred to as Proto-Salish. Linguistic divisions are major units within language families. Examples are the divisions of the Wakashan Language Family: the Kwakiutlan Division (composed of the Kwakiutl, Heiltsuk, and Haisla languages) and the Nootkan Division (that is, Nootka Proper and the British Columbia portion of the Nitinat language). The Salishan Language Family is separated into the Interior and Coast Salish divisions. Bella Coola is an outlier of the Salishan Family, and although it is technically another division of the Salishan languages, it is commonly referred to as a single language.

In most cases the language boundaries have remained stable, but in some areas changes had occurred or were occurring by the middle of the nineteenth century: The Sekani and Beaver, for example, originally lived together east of the Rockies, but they had been pushed westward up the Peace River during the eighteenth century. The Tagish and Taku were Athapaskans who became "Tlingitized" as a result of conflict and trade with the prestigious Tlingits of the Alaskan coast. Although the Tagish Language was long thought to be extinct and is shown as such on the map, researchers have recently (1978) located one remaining Tagish-speaker. A fifth Indian language, Pentlatch of eastern Vancouver Island, is also extinct. By the same process that brought Salishan-speakers of the Thompson and Okanagan languages into the area originally occupied by speakers of the Athapaskan Nicola Language, so Kwakiutl speakers came to occupy the area of the Pentlatch. However, within historic times, Comox speakers have resettled what was originally Pentlatch territory.

The names and spellings of the various languages and regional groups shown on the map have been kept as simple as possible. They are those that have become established in the anthropological literature or that have been used as geographical reference. Complex phonetic alphabets are required to indicate the sounds of Indian words accurately.

The peoples of the British Columbia coast were representative of the Northwest Coast cultural complex, typified by totem poles and the potlatch. The culture of interior groups differed significantly, based for the most part upon riverine economic patterns. Throughout the region, the native peoples followed a hunting and gathering economy. They had no crop or livestock agriculture, and consequently they depended upon locally available resources for food and shelter. Depending upon the season, a variety of vegetable foods such as berries, roots, and nuts, land animals such as deer and bear, wildfowl, marine mammals, and fish were utilized. The coastal environment was particularly bountiful because many kinds of fish and shellfish, including the seasonally abundant salmon, were available. The riverine orientation of interior groups was also related to the periodic salmon runs along the major streams. Because of the richness of the environment, the coastal people were semi-sedentary and developed elaborate cultures. The inhabitants of the interior were more or less nomadic, since they depended largely upon the hunting of deer, bear, beaver, and other animals. Because the food supply was less abundant, especially in winter, the life of the interior people was dominated by the search for game. Partly in consequence, their culture was much less elaborate than that of the coastal Indians.

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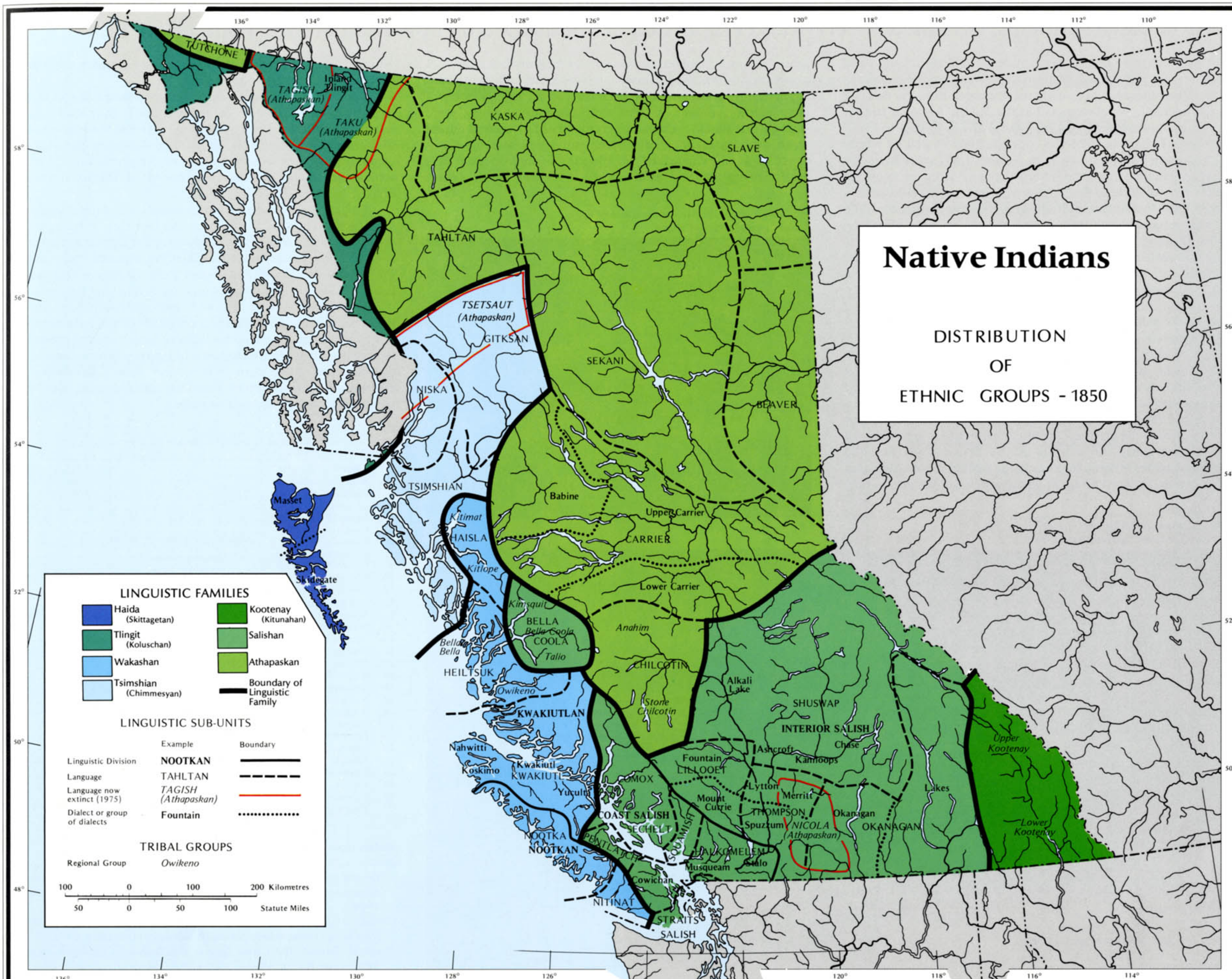
Haida house poles at Masset village, Queen Charlotte Islands, in 1888.


Native Indians
DISTRIBUTION
OF
ETHNIC GROUPS - 1850
LINGUISTIC FAMILIES
Haida (Skittagetan)
Tlingit (Koluschan)
Wakashan
Tsimshian (Chimmesyan)
Kootenay (Kitunahan)
Salishan
Athapaskan
Boundary of Linguistic Family
LINGUISTIC SUB-UNITS
Example
Boundary
Linguistic Division
NOOTKAN
Language
TAHLTAN
Language now extinct (1975)
TAGISH (Athapaskan)
Dialect or group of dialects
Fountain
TRIBAL GROUPS
Regional Group
Owikeno
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
TUTCHONE
TAGISH (Athapaskan)
Inland Tlingit
TAKU (Athapaskan)
KASKA
SLAVE
TAHLTAN
TSETSAUT (Athapaskan)
GITKSAN
SEKANI
NISKA
BEAVER
TSIMSHIAN
Masset
Skidegate
Babine
Upper Carrier
CARRIER
Kitimat
HAISLA
Kitlope
Lower Carrier
Kimsquit
BELLA COOLA
Bella Coola
Talio
Anahim
Bella Bella
HEILTSUK
CHILCOTIN
Alkali Lake
Owikeno
Stone Chilcotin
SHUSWAP
KWAKIUTLAN
INTERIOR SALISH
Chase
Nahwitti
Ashcroft
Kamloops
Fountain
LILLOOET
Koskimo
Kwakiutl
KWAKIUTL
Yuculta
COMOX
Lytton
Merritt
Upper Kootenay
Mount Currie
THOMPSON
Okanagan
Lakes
COAST SALISH
SECHELT
SQUAMISH
Spuzzum
NICOLA (Athapaskan)
OKANAGAN
NOOTKA
NOOTKAN
PENTLATCH
HALKOMELEM
Musqueam
Stalo
Lower Kootenay
Cowichan
NITINAT
STRAITS SALISH
136° 134° 132° 130° 128° 126° 124° 122° 120° 118° 116° 114° 112° 110°
58° 56° 54° 52° 50° 48°

Map 4. Native Indians: Occupied Reserves and Proportion of Status Indian Population in Total Population, 1974

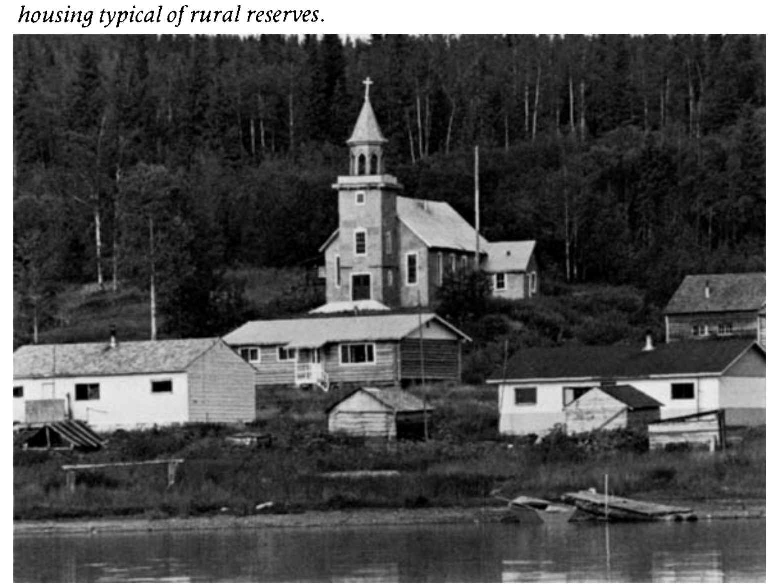
The data upon which this map is based are derived from band registers and include only those Indians living on the reserve to which their band has been assigned. Excluded from the data is a small, nomadic population within the Stikine Regional District which is administered from the Yukon. The total population of registered Indians in 1974 was approximately 51,000, of whom 31,966 were living on their own reserve, 1,651 were living on reserves assigned to a different band, and 17,365 were living off reserve. In addition to the Indians who come under the jurisdiction of the Indian Act and whose names are included on the official Indian register, there is an unknown number of people, who, although genetically and culturally Indian, are not registered as such and are therefore referred to as non-status. The estimates of the non-status population range from 25,000 to 50,000. Thus the available information suggests that Indian population constitutes 3 to 4 per cent of the provincial total and that status Indians represent about 2 per cent of British Columbia's population.

One indication of the distribution of native population is given by the pattern of occupied reserves. As the map shows, that distribution is non-uniform. Basically the reserves are clustered in the southwestern part of the province, with a few nodes and lineations on the coast, especially on Vancouver Island, and many more in the interior. The linear pattern of reserves is most prominent along the courses of the Fraser River and the Skeena-Bulkley system. In general, the pattern is not unlike that of total population (see Map 2), though there are proportionately more Indians in the west central part of the province. The 1974 distribution of occupied reserves is similar to that of Indian population as it is believed to have been early in the history of European culture contact. At that time the native people were strongly oriented to the bountiful resources of the coastal littoral and to the major salmon streams that provided a seasonal abundance of food. Evidence of the antiquity of that orientation is illustrated by archaeological sites in the lower Fraser Valley, where salmon vertebrae have been found in middens that have been dated at over 10,000 years old.

The major areas of difference between the earlier and latter day distribution are in the central and northern coastal regions where the number of occupied reserves is small in comparison to the former large size of the Indian population. In part this decrease reflects the gravitation of the native people toward white settlements and the gradual abandonment of traditional ways of life.

The ratio of Indian to white population within Regional Districts is shown on the map by the intensity of background colour. As can be seen, the areas showing the highest proportions lie in the western part of the province. The highest ratios occur in the Squamish-Lillooet and Ocean Falls districts where white population is relatively small. Conversely, ratios are low near the metropolitan areas of Victoria and Vancouver though, as shown in the accompanying table, the number of Indians in those areas is relatively large. The nadir for Indian population in all regions of the province was reached before mid-century, when it had dropped to a total of less than 23,000. Since then it has shown an increase that, in the more populous areas at least, has been comparable to the provincial average.

Fort Babine shows the mixture of old and new housing typical of rural reserves.



Urban apartment development in proximity to the Squamish Indians' Capilano reserve.

ESTIMATED POPULATION OF REGISTERED INDIANS ON OWN RESERVE, BY REGIONAL DISTRICT, 1974

1.	Alberni-Clayoquot	1,592
2.	Bulkley-Nechako	2,418
3.	Capital	925
4.	Cariboo	2,563
5.	Central Fraser Valley	16
6.	Central Kootenay	54
7.	Central Okanagan	114
8.	Columbia-Shuswap	277
9.	Comox-Strathcona	1,203
10.	Cowichan Valley	1,931
11.	Dewdney-Alouette	175
12.	East Kootenay	214
13.	Fraser-Cheam	1,427
14.	Fraser-Fort George	146
15.	Greater Vancouver	788
16.	Kitimat-Stikine	5,140
17.	Kootenay Boundary	—
18.	Mount Waddington	1,274
19.	Nanaimo	431
20.	North Okanagan	806
21.	Ocean Falls	1,446
22.	Okanagan-Similkameen	518
23.	Peace River-Liard	744
24.	Powell River	393
25.	Skeena	2,352
26.	Squamish-Lillooet	2,187
27.	Stikine	—
28.	Sunshine Coast	359
29.	Thompson-Nicola	2,919

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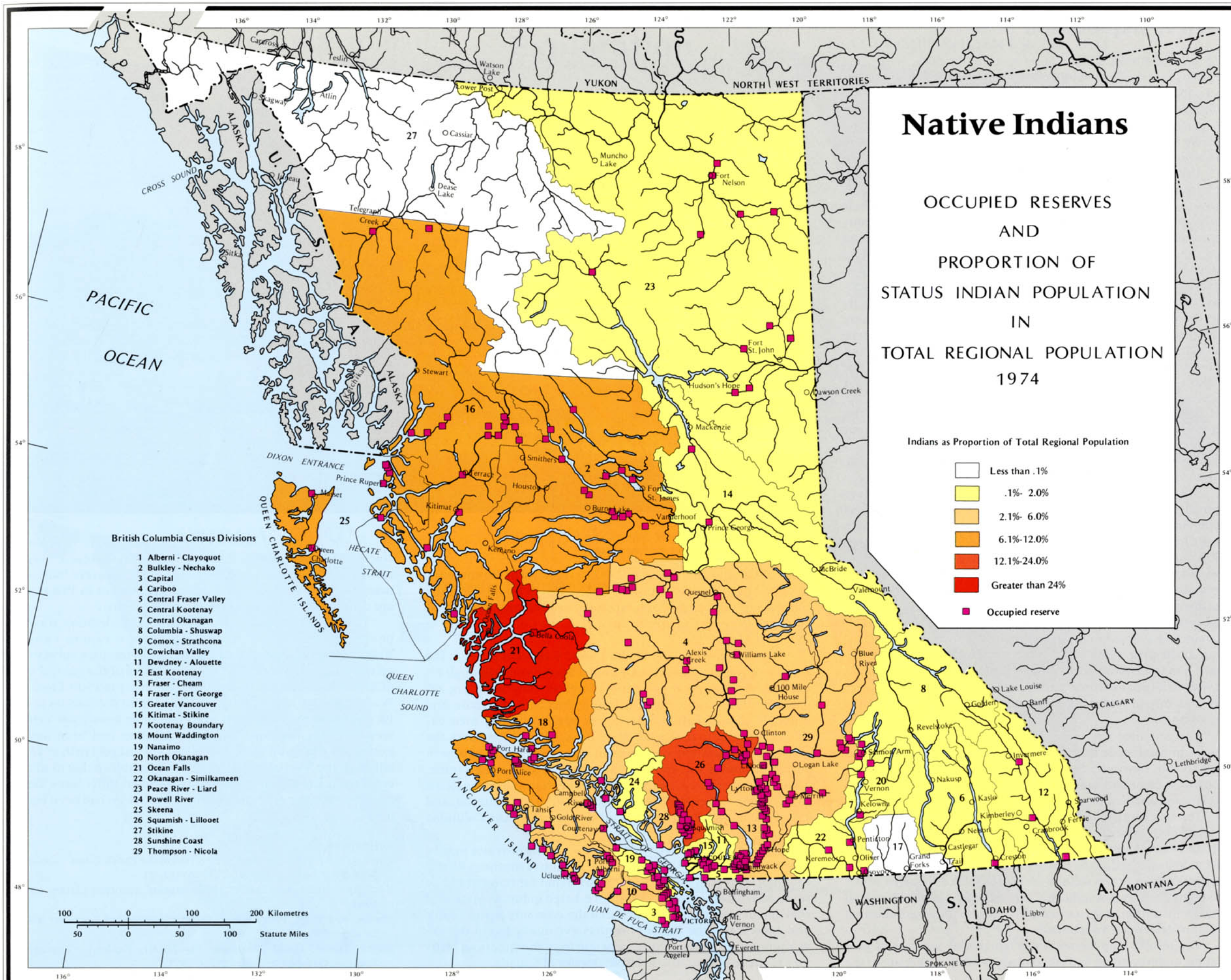

Native Indians
OCCUPIED RESERVES AND PROPORTION OF STATUS INDIAN POPULATION IN TOTAL REGIONAL POPULATION 1974
Indians as Proportion of Total Regional Population
Less than .1%
.1%- 2.0%
2.1%- 6.0%
6.1%-12.0%
12.1%-24.0%
Greater than 24%
Occupied reserve
British Columbia Census Divisions
1 Alberni - Clayoquot
2 Bulkley - Nechako
3 Capital
4 Cariboo
5 Central Fraser Valley
6 Central Kootenay
7 Central Okanagan
8 Columbia - Shuswap
9 Comox - Strathcona
10 Cowichan Valley
11 Dewdney - Alouette
12 East Kootenay
13 Fraser - Cheam
14 Fraser - Fort George
15 Greater Vancouver
16 Kitimat - Stikine
17 Kootenay Boundary
18 Mount Waddington
19 Nanaimo
20 North Okanagan
21 Ocean Falls
22 Okanagan - Similkameen
23 Peace River - Liard
24 Powell River
25 Skeena
26 Squamish - Lillooet
27 Stikine
28 Sunshine Coast
29 Thompson - Nicola
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U.S.A.
WASHINGTON
IDAHO
MONTANA
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
CROSS SOUND

Map 5. Exploration

The face of British Columbia as revealed in maps today is a complex mosaic. The evolution from unmapped Indian territory to a political unit with precisely surveyed boundaries, accurately measured altitudes, and carefully mapped positions has been gradual and is not yet complete. The detail is constantly changing as new instruments and techniques are introduced and as new maps replace the old.

Until as recently as 1774, British Columbia was *terra incognita* to Europeans, and it was among the last frontiers of discovery in North America. Even after Spanish mariners had reported their early explorations of the coast, fanciful representations continued to be circulated. Slowly, the mists of uncertainty dissolved and the coastline took shape. Later came explorer-traders who travelled westward, penetrating the hinterland in search of furs. From their journals, sometimes discursive and often fragmentary, map-makers pieced together the broad outlines of the territory west of the Rocky Mountains — a vast area stretching one-quarter the length of the continent. Gradually settlement came, its pace quickening as new resources were discovered and developed. The presence of settlers brought new knowledge, but it also expanded the need for maps of property holdings and access routes as well as maps for administration.

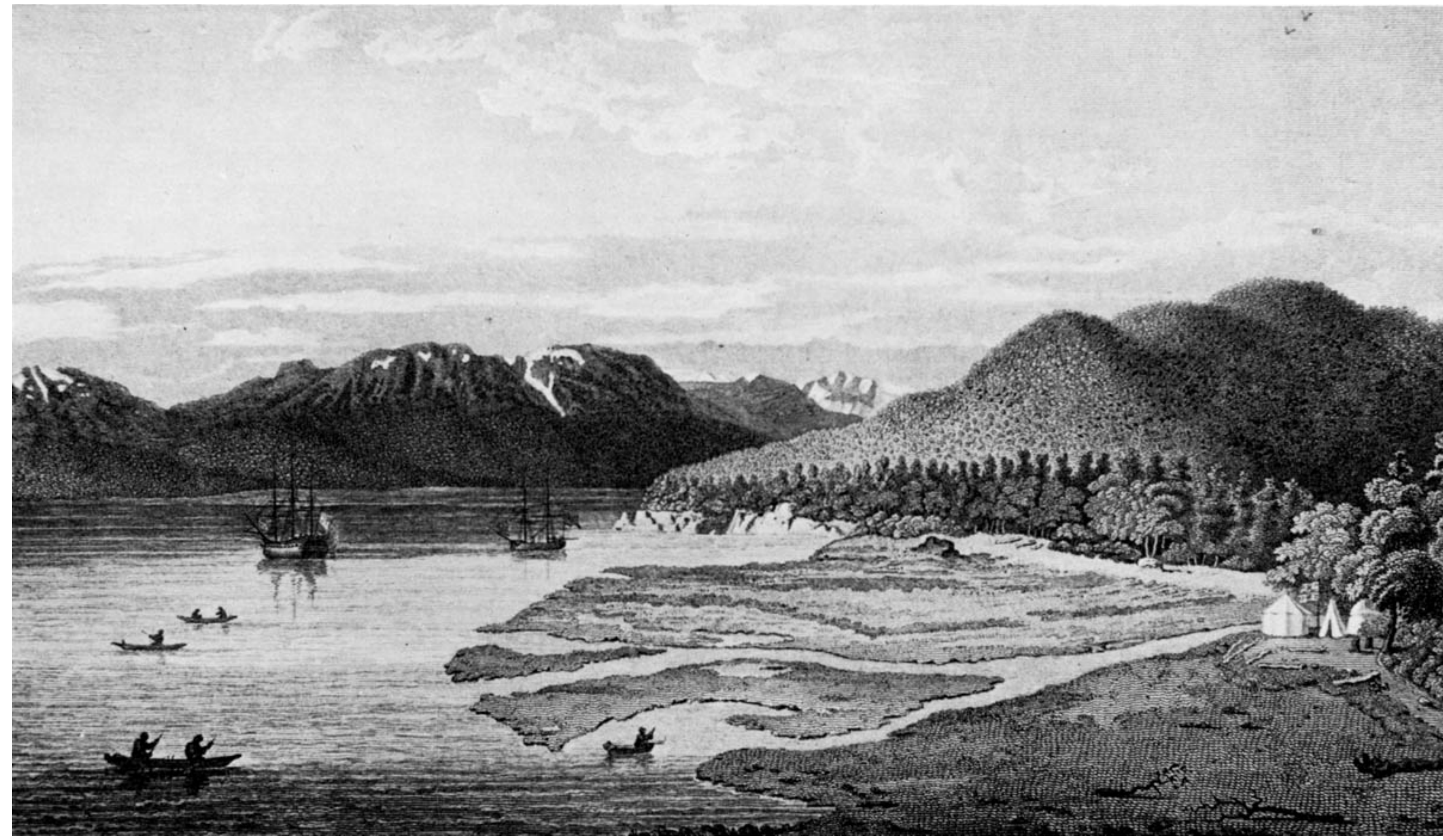
The four maps shown on the adjacent page represent the state of geographic knowledge of British Columbia at different periods. While these maps are based upon the record of exploration by white men, it is clear that some of this cartographic knowledge was derived from native Indians.

Spanish explorers were the first Europeans known to have sighted parts of what is now British Columbia, though members of the Bering Expedition of 1741 may have seen some of the high peaks in the extreme northwestern corner of the province. In 1774 and 1775, Spanish expeditions were sent northward from San Blas and made the first fleeting contact with the British Columbia coast. Four years later Captain James Cook arrived in northwest waters on his last great voyage of discovery. Although bad weather prevented him from seeing much of the coast, his voyage had a great impact on subsequent knowledge and mapping of the area. Cook's ships carried chronometers which enabled him to establish with considerable accuracy the longitudes of various locations visited, and the sea-otter pelts taken in barter subsequently provided a strong economic incentive for trading expeditions.

The maritime fur trade that followed the publication of Cook's journal made little direct addition to geographic knowledge. It did, however, focus attention on the resources of the northwest coast and indirectly led to the last flurry of Spanish exploration and mapping there.

The first component of that activity was an expedition despatched from Nootka, where the Spanish had established a small fort. In 1790 Manuel Quimper explored Juan de Fuca Strait as far east as Victoria, and in the following year José Narváez extended the exploration to the vicinity of Texada Island. The first of the accompanying maps indicates the general extent of coastal knowledge at that time, immediately prior to the explorations of Galiano-Valdés and Vancouver.

The second map shows that a remarkable increase in geographic understanding had taken place by 1813. As a result of the work of Galiano and Valdés in 1792, large parts of the southern coast had been mapped to a standard more than adequate for the purposes of their time. Contemporaneously, George Vancouver surveyed the entire mainland coast from the Columbia River to southern Alaska.



Engraving of Captain Vancouver's ships at Salmon Cove, Observatory Inlet, from a sketch by T. Heddington, a crew member on the voyage.

At the same time an overland route westward through the Cordillera was pioneered by Alexander Mackenzie. Although his exploits were of great geographic interest, they were not regarded as important to the practical conduct of the fur trade, and a decade elapsed before other North West Company men extended the trade to the Pacific slope. Then, within a few years, the general configuration of the main river systems in southern British Columbia was established. Following Mackenzie's route, Simon Fraser reached the river named after him and descended it to tidewater. Other Nor'Westers probed the central interior, and David Thompson explored and mapped much of the Columbia system.

The third map shows that by the time of the province's entry into Confederation in 1871, the main outline of southern British Columbia was well established. The overland fur trade had been replaced with other forms of resource-based industry. Mining of coal and of placer gold characterized the economy of the 1850's and 1860's, and the influx of settlers eventually led to the development of a political entity separate from the American territory to the south but isolated from the rest of Canada.

In the process of British Columbia's evolution to a crown colony and then province, townsites were surveyed, wagon roads connecting coast and interior settlements were built, and mapping was accelerated. Particularly important in this regard are the accomplishments of the Royal Engineers.

One of the incentives for entering Confederation was the promise of a transcontinental rail link with eastern Canada. Building such a system required route and resource surveys on an unprecedented scale. The results in terms of the general map of British Columbia are shown in the summary to 1900. From the Peace River gap to the 49th parallel and from the Rockies to the Pacific, substantial additions to cartographic knowledge can be seen. Even in the north much information had been added, principally as a result of the Klondike (Yukon) gold rush of 1898, although the level of detail was not comparable to that in southern British Columbia. Despite such regional differences, however, by 1900 the general figure of the province had been established.

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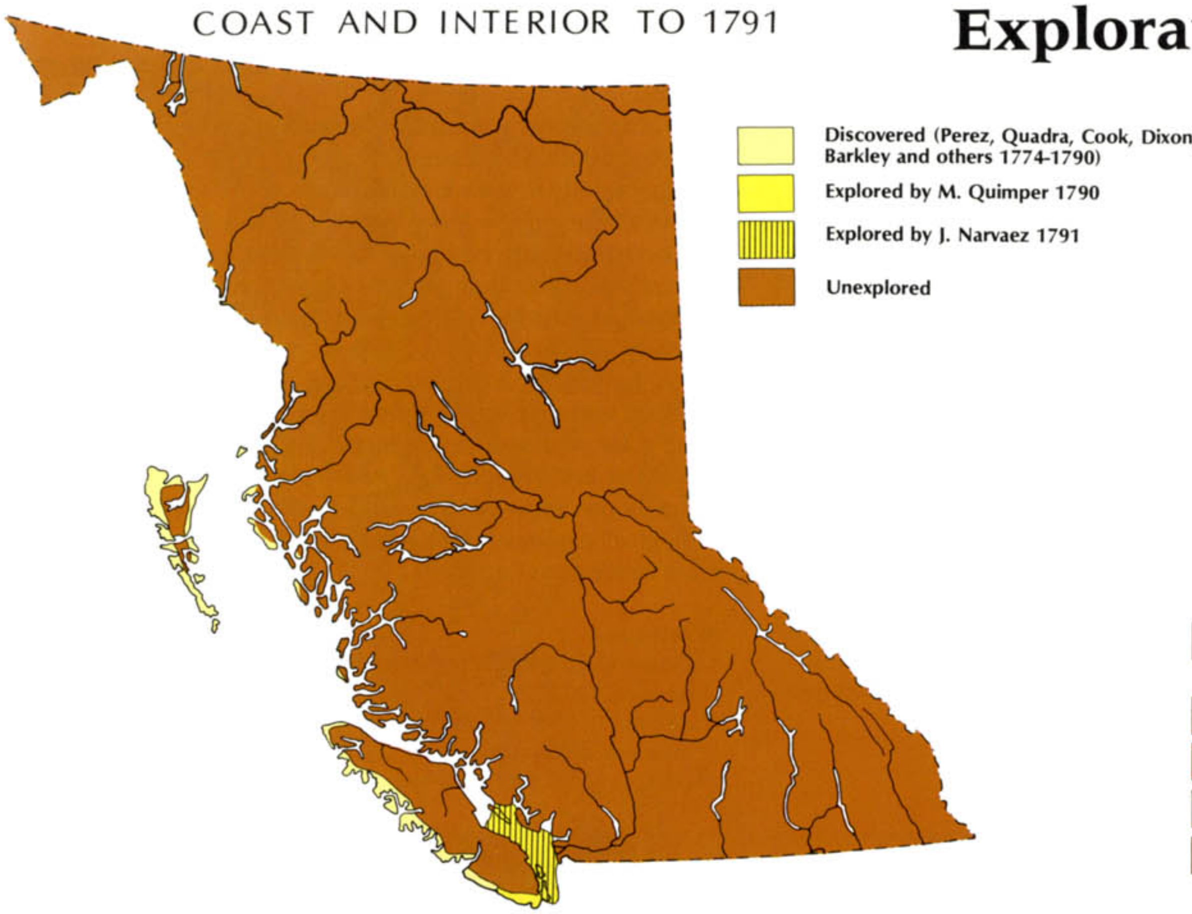
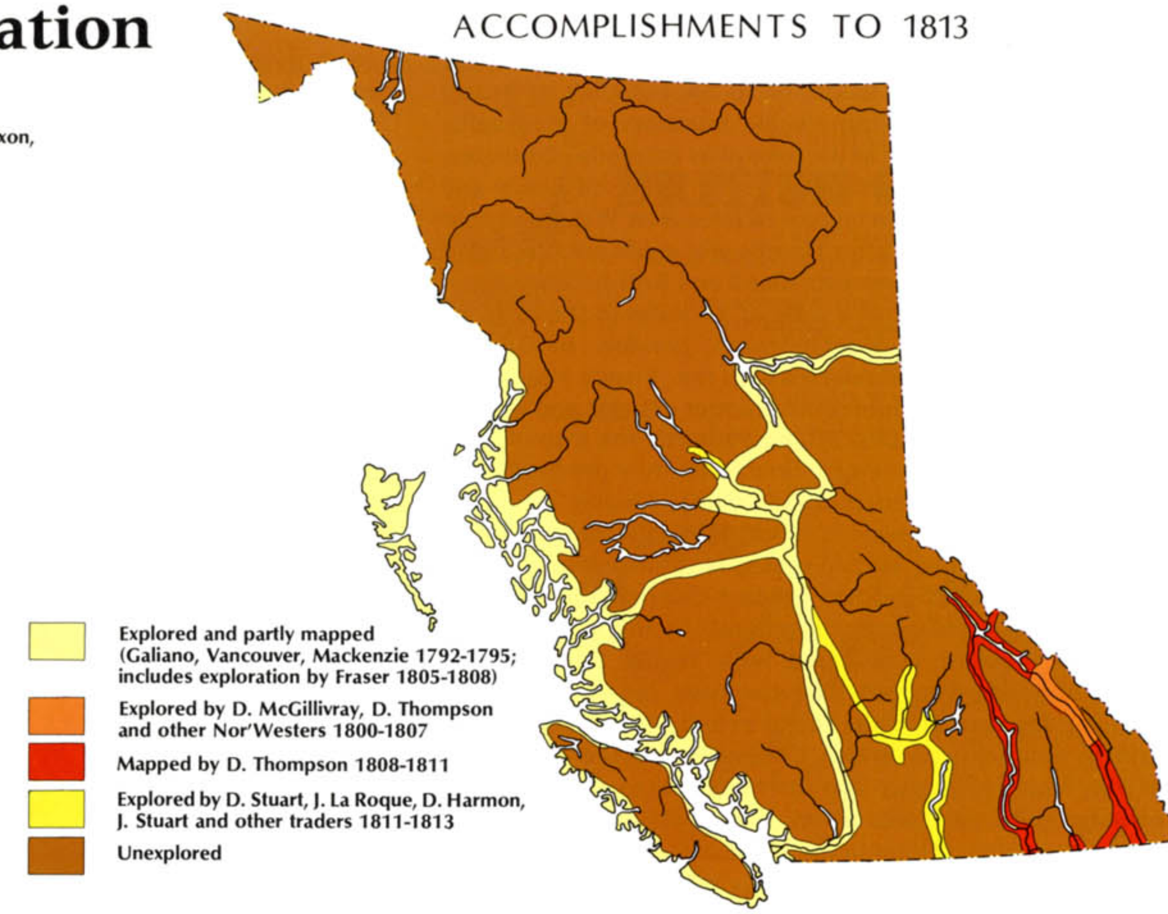
Exploration

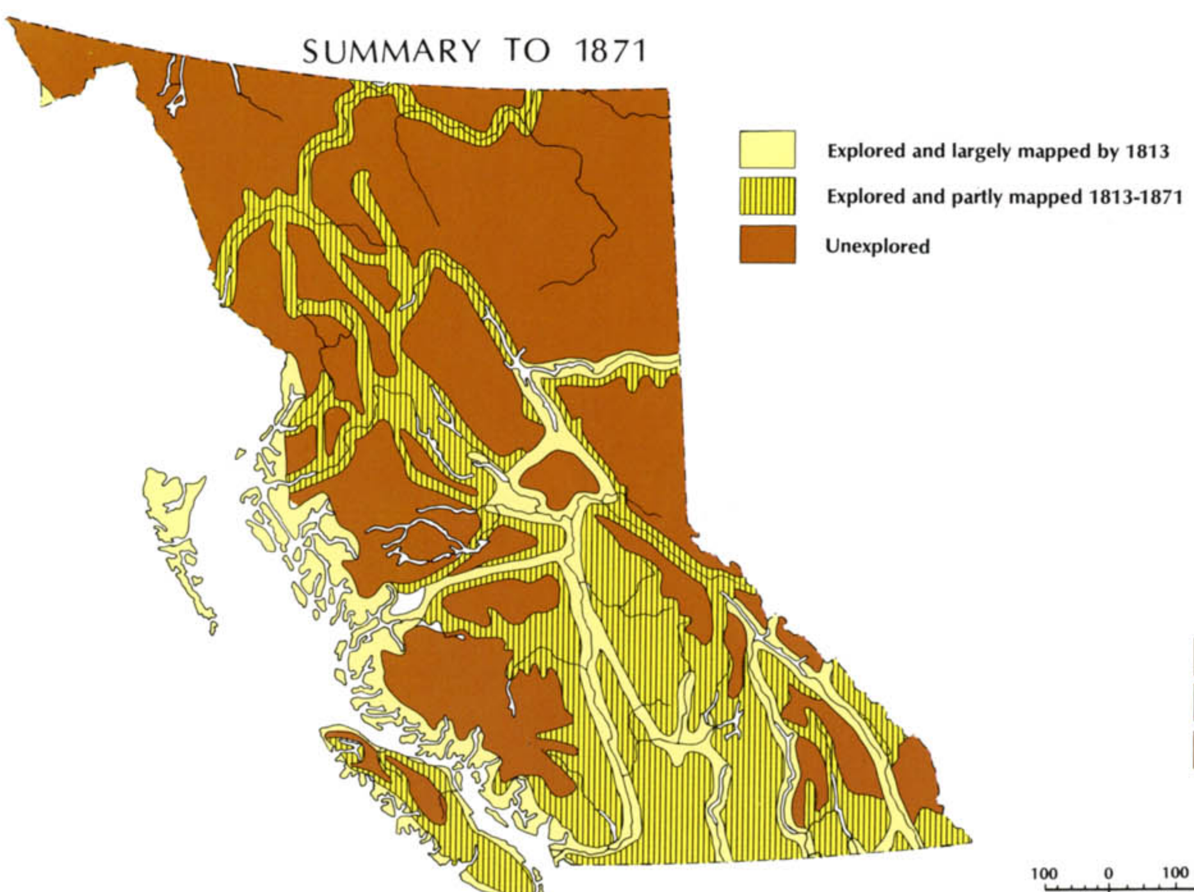
COAST AND INTERIOR TO 1791



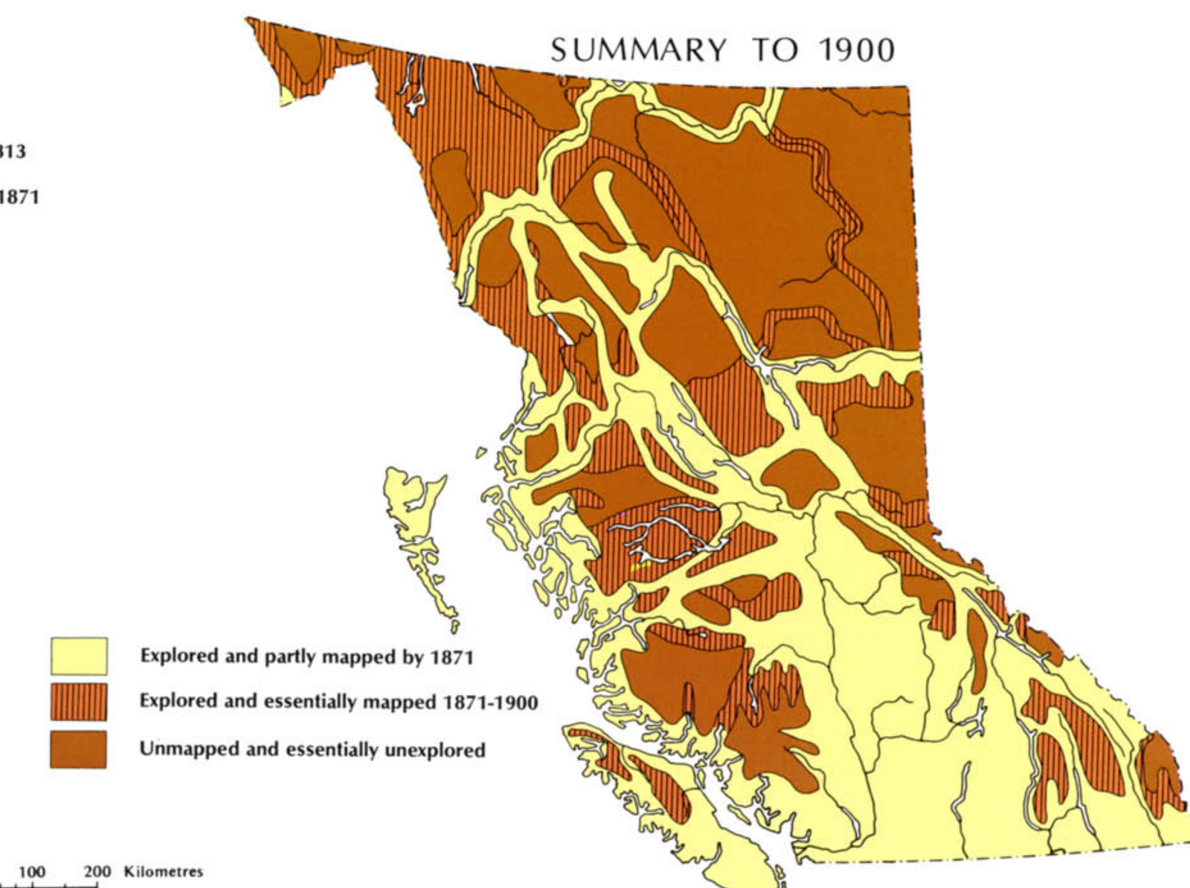
ACCOMPLISHMENTS TO 1813



SUMMARY TO 1871



SUMMARY TO 1900



100 0 100 200 Kilometres
50 0 50 100 Statute Miles

Map 6. The "Trutch Map," 1871

The map reproduced at much-reduced scale on the opposite page represents a cartographic milestone in the mapping of British Columbia. It stands as a remarkable summary of geographic knowledge of the province at the time of its entry into Confederation. It was compiled in Victoria at the Office of Lands and Works, that office having been moved from New Westminster to the island capital in 1868, after Victoria was made joint capital of the united colonies of Vancouver Island and British Columbia. It was originally published, at a scale of 25 miles to the inch, by Stanford's Geographical Establishment, London, in October 1871. For convenience it is referred to as the "Trutch Map" since it bears the name of the chief commissioner of lands and works.

Joseph W. Trutch, under whose authority the map of 1871 and an earlier *Guide Map to the Big Bend Mines* were produced, had had considerable experience in the colony, notably as an engineer and private contractor in connection with the building of the Cariboo wagon road. He had subsequently assumed an active role in political affairs and had become chief commissioner of lands and works and surveyor general. In the course of his activities he became acquainted with Walter Moberly, the explorer-surveyor who provided the basis for the first comprehensive delineation of that great extent of wild and rugged terrain in southeastern British Columbia referred to as "the Kootenay country." Trutch was therefore able to draw upon the knowledge of his associates as well as his own and undoubtedly took keen personal interest in the preparation of this great map. Aside from its incorporation of Moberly's work in the southeast, the Trutch map shows the results of other, more or less contemporary, surveys and explorations.

Geographic information stemming from the Palliser expedition of 1857 is clearly evident in the delineation and nomenclature of the Rocky Mountain area, while the Fraser-Harrison-Lillooet drainage, the Thompson-Nicola area, and the Boundary country all reflect the work of the Royal Engineers. Toward its western margin the map displays information derived from Lieutenant H.S. Palmer's Bella Coola-Alexandria reconnaissance and the later surveys from the head of Bute Inlet conducted by Alfred Waddington.

The main course of the Fraser River south of Fort George (Prince George) and the associated area of the Cariboo goldfields is reasonably well represented, largely as a result of the intensive mining activity in that vicinity. Improvements, too, are noticeable in North Thompson-Clearwater drainage. Presumably they draw upon Milton and Cheadle's exploits and, indirectly, upon gold prospecting in that vicinity. The representation of the upper Fraser-Canoe River area, however, perpetuates some misconceptions that had prevailed in earlier maps. Among these errors is a prominent "Whirlpool R." leading through Athabaska Pass to Boat Encampment. Despite such weaknesses and regardless of the details of antecedents incorporated within it, the Trutch map of 1871 is a remarkable achievement. In many ways it is a realization of the plans of Colonel R.C. Moody, Royal Engineers, for a general map of British Columbia, since it embraces all of the surveys undertaken by the Royal Engineers during their short sojourn in the colony, together with subsequent surveys and explorations by government authorities and private individuals. Not only is Vancouver Island included, but also the mainland coast to the Alaskan panhandle, acquired a scant four years earlier by the United States as part of the Alaskan purchase. The entire coast is shown in the greatest detail since Vancouver's day and reflects the work of Captain Richards and his associates in their hydrographic surveys. The north coast, however, lacks the degree of detail shown in the south, and the Queen Charlotte Islands appear to have received rather scant attention. In the north, the notations "Steamer Mumford 1866" and "Ft. Stager" on the Skeena River refer to activities associated with the Collins Overland Telegraph. The line itself, shown extending well beyond Ft. Stager, can be traced all the way from New Westminster. The northward spread of placer gold-mining is apparent from the representation of the Omineca district.

The map is an outstanding summary representing a straightforward portrayal of surveyed areas and, for the remainder, a bold attempt to convey what geographic knowledge was available. When it is compared with the general maps of a decade earlier, such as Bartholomew's map of British Columbia of 1860, Arrowsmith's comparable map of 1859, or even the Arrowsmith 1862, all three of which incorporate some information attributable to the gold rush, the tremendous impact that the gold discoveries had had upon the mapping of an embryo province is evident.

Cartographic accomplishments during the colonial period in British Columbia had been great. Out of a vast, thinly populated, and essentially undeveloped domain of the fur trade, a province had been forged. Its general outlines had been established, its southern boundary had been surveyed and monumented, and in several places its planimetry had been adequately surveyed and mapped, at least for contemporary purposes. North of 56°, however, lay a little-known wilderness. As the Trutch map suggests, much geographic information had yet to be gathered before it could be said that British Columbia had been mapped, even on a small scale. Much of that information was to be provided by the end of the first decade in the twentieth century. It came not only through the railway surveys but also as a result of the great geological explorations undertaken by the dominion government in western Canada.

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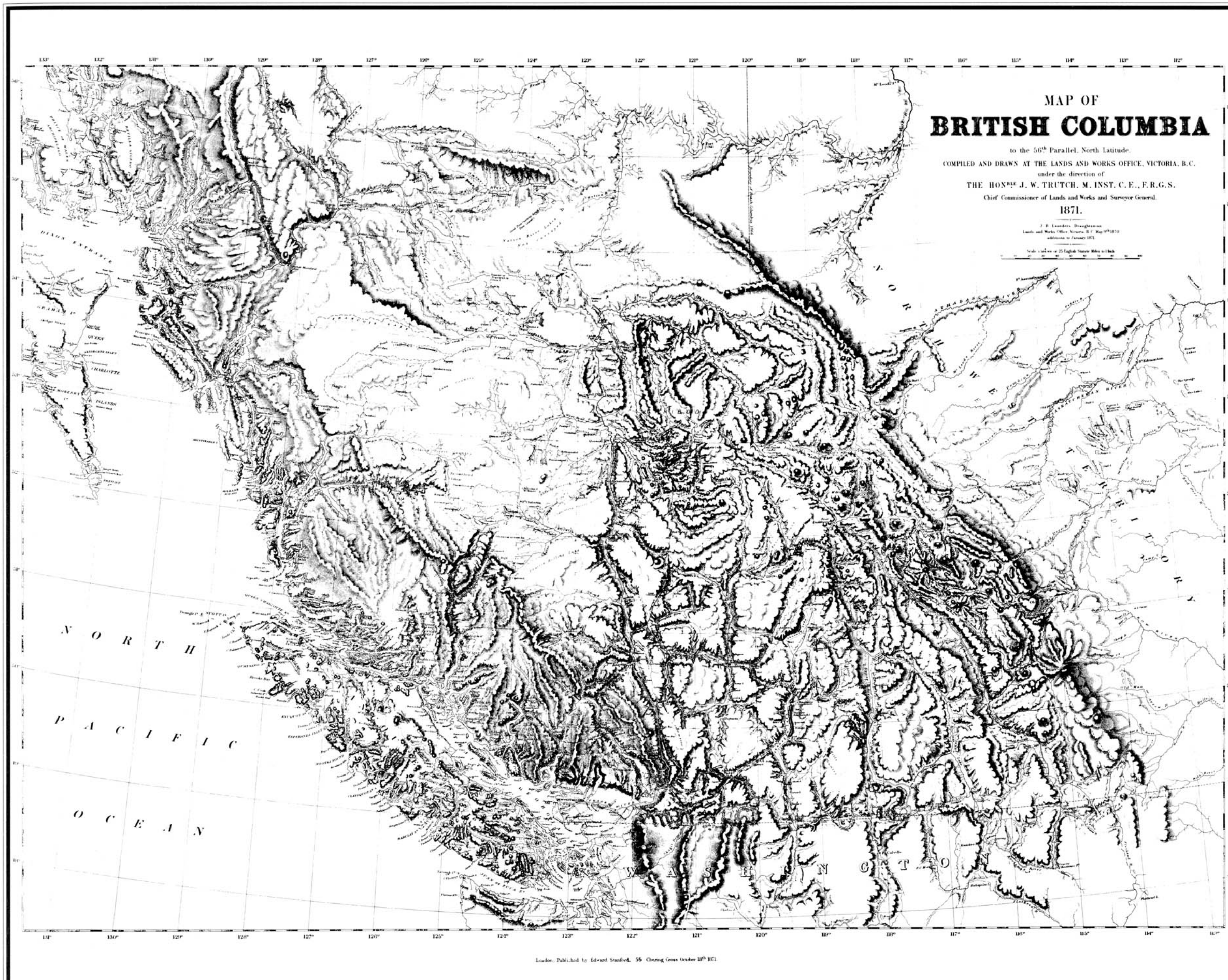
Cutting the 49th Parallel, on the right bank of the Moyie River, looking west, 1860-1861.


MAP OF
BRITISH COLUMBIA
to the 56th Parallel, North Latitude.
COMPILED AND DRAWN AT THE LANDS AND WORKS OFFICE, VICTORIA, B.C.
under the direction of
THE HONBLE J. W. TRUTCH, M. INST. C. E., F.R.G.S.
Chief Commissioner of Lands and Works and Surveyor General.
1871.
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
NORTH PACIFIC OCEAN
NORTH WEST TERRITORY
WASHINGTON
London: Published by Edward Stanford, 55 Charing Cross October 18th 1871.

Map 7. LANDSAT Mosaic, 1975

The accompanying map is made up of a number of individual satellite "pictures" of British Columbia carefully fitted together. It represents the current state-of-the-art in mapping the earth's surface and presents a convenient base for comparison with the Trutch map, compiled a century before. Gone are the uncertainties of location, of drainage features, and of basic configuration. Details of surface texturing are revealed for the northern as well as the southern regions of the province. Lines on the Trutch map that would have represented years of arduous reconnaissance and compilation work to establish with accuracy are here replaced by precision images generated from satellite-borne electronic scanners which are potentially available within hours of the satellite pass.

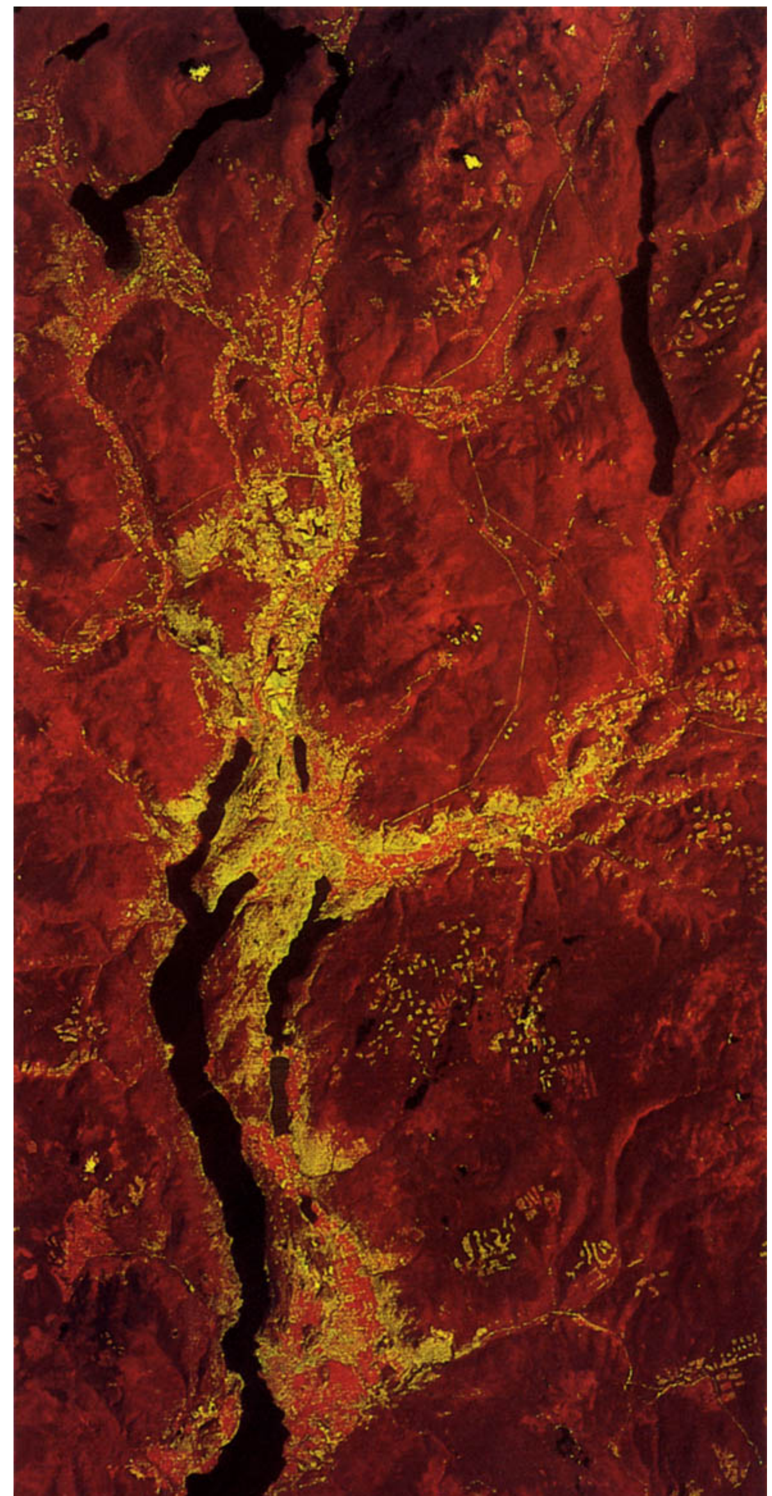
The original Earth Resources Technology Satellite (E.R.T.S.) was launched by the United States' National Aeronautics and Space Administration in July 1972. Like its predecessors, the present satellite, named LANDSAT, operates in a sun-synchronous, near-polar orbit at an elevation of about 800 km (orbital period 103 minutes). Thus it crosses the equator, following a nearly north-south path, at the same time each day. It completes fourteen orbits a day, and its trajectory is adjusted so that its ground trace repeats itself every eighteen days. Four of the daily orbits cross Canadian space.

LANDSAT carries two kinds of imaging sensors, a three-camera Return Beam Vidicon and a Multispectral Scanner. The former is comparable to a television camera. The latter is receptive to several distinct portions of the visible and near-visible spectrum. The mosaic reproduced here combines images derived from the Multispectral Scanner (M.S.S.) System. It scans across the orbital path of the satellite to generate a continuous image trace that is subsequently divided into individual images. Since the ground equivalent of the electronic scanning "spot" is about 60 metres across, that is the resolution limit of the system. Smaller ground objects may not be revealed.

In Canada, transmissions from the satellite are received at the Prince Albert, Saskatchewan, ground station and recorded on magnetic tape. The tapes are then flown to the Canada Centre for Remote Sensing in Ottawa for processing, and the information is converted from digital to image form. The filmed images are then sent to the National Air Photo Library for further photographic processing, duplication, and distribution. By careful selection of the transparencies from different bands, it is possible to enhance the images of some features and suppress others, making LANDSAT imagery potentially useful for the identification and inventory of earth resources.

LANDSAT digital printout of Vancouver harbour in image form.

Multispectral scanner colour composite of the Okanagan valley and surrounding area.



While LANDSAT imagery has immediate appeal because of its photo-like characteristics, the digital information is commonly used in certain kinds of work. The digital printout reproduced here covers the entrance to Vancouver Harbour in the vicinity of the First Narrows bridge. Although the information is much less graphic, it provides details not readily interpretable from the standard image form.

Also included is a colour-composite image derived from information recorded by the M.S.S. system. It shows Okanagan Lake, Kalamalka Lake, and adjacent urban and agricultural land. The upper part of the view includes Salmon Arm and Shuswap Lake. In processing, colours are assigned to each of the M.S.S. bands to create the composite image. The colours are selected to enhance the distinction between different kinds of surface cover and land use and are not the "true" colours that would be sensed by the human eye. Healthy vegetation, for instance, appears bright red in this view. For many applications, including mapping, colour composites facilitate the process of interpretation. LANDSAT imagery readily lends itself to small-scale mapping because the geometric displacements common to aerial photographs are virtually eliminated.

The mosaic, then, gives us a satellite view of the entire province, the surface texture of which is revealed at a level of detail and accuracy far surpassing a conventional terrain model. Early traveller's impressions of British Columbia as a "sea of mountains" are clearly justified; range upon range of mountains ranked in a general northwest-southeast alignment impart a distinct "grain" to the topography. Yet, there are broad areas of plateau set between the mountain flanks, and prominent valleys separate the mountain masses. In the northeast the extensive areas of lowland represent the northwesterly extension of the Great Interior Plains. The most striking feature of the mosaic, though, is the complex configuration of the mainland coastline and the flanking islands. The deep fjords, sheltered waterways, and exposed western coasts illustrate characteristics of the coastal area that imply a cultural orientation quite different from that of the interior. They, and the other surface features revealed in the mosaic, make British Columbia unique among the provinces of Canada.

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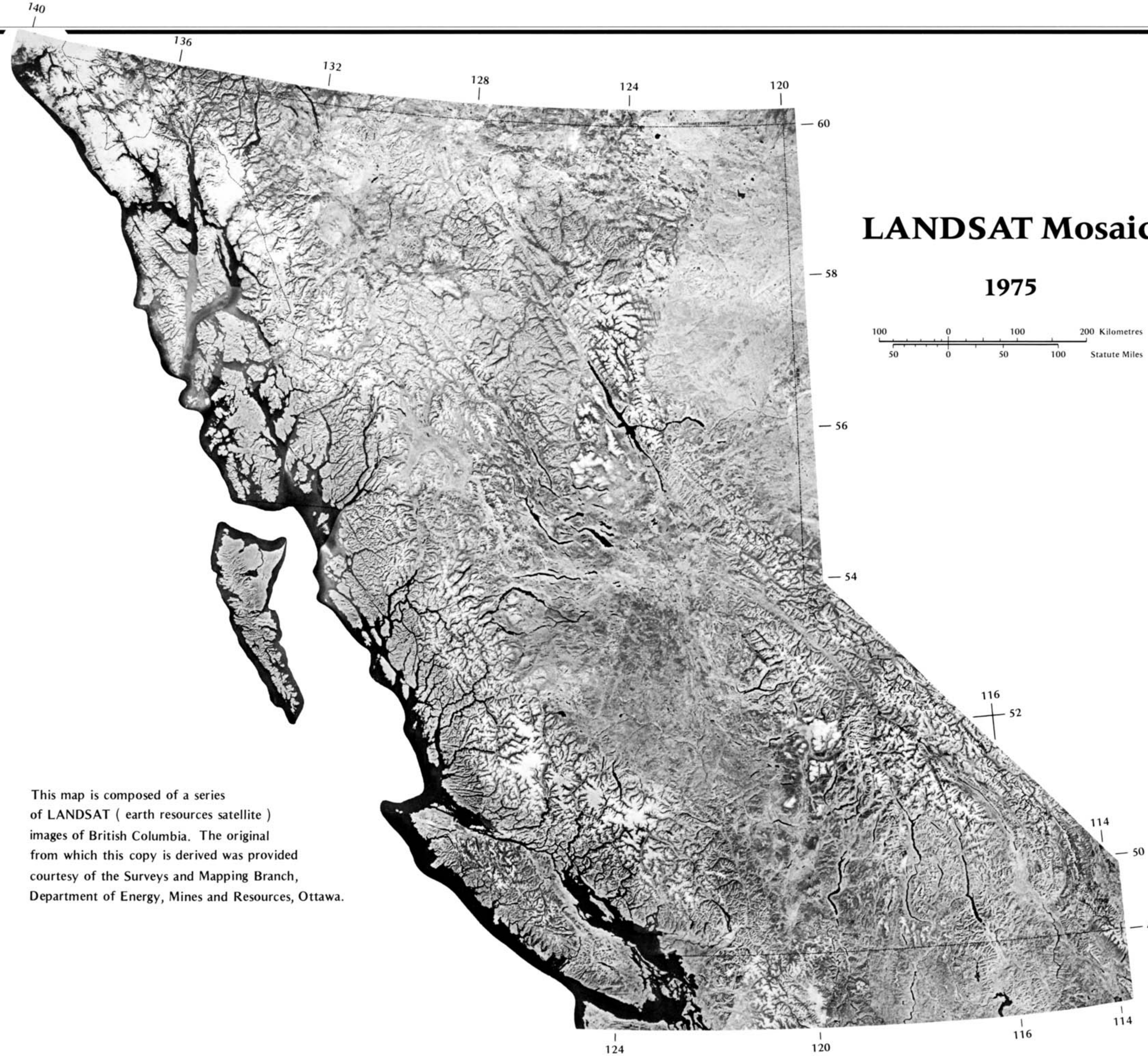
LANDSAT Mosaic

1975



This map is composed of a series of LANDSAT (earth resources satellite) images of British Columbia. The original from which this copy is derived was provided courtesy of the Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa.

Map 8. Migration, 1966–1971

The four maps on the facing page illustrate the spatial pattern of in-migration to British Columbia. The population is in a continuous state of flux, and at any one time it represents a balance between in-migration, natural fertility and mortality, and out-migration.

In the period 1966–1971, British Columbia experienced a considerable inflow of migrants, some of whom came from other provinces and some from abroad. At the same time there was an appreciable, but substantially lower, flow out of the province, mainly to other provinces, but also to areas outside Canada. At both the national and the provincial levels, these migration flows have been the main source of regional differences in population growth.

Along with these inflows and outflows there was considerable internal migration, indicating a high population mobility. In fact, the 1971 census data show that about one-fifth of the total population had changed municipality of residence within the preceding five years and almost 50 per cent had changed dwelling place within their municipality. These figures may be underestimates, because the census lists only a single move by persons who moved more than once during the five-year period, and the data refer only to persons five years of age and older.

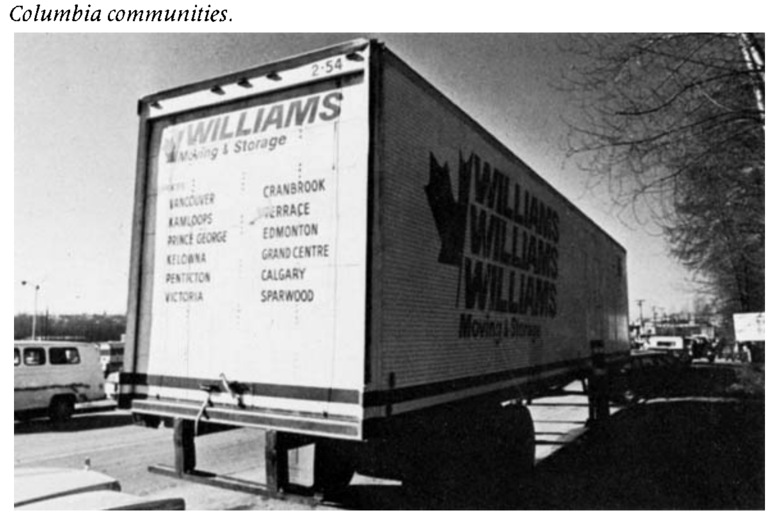
Migrants are mostly in the younger age groups and have relatively high levels of education in comparison to non-migrants, and they tend to move to the urban areas. Nineteen per cent of the interprovincial migrants in Canada had university level education.

In British Columbia the net inflow of migrants from other provinces has consistently been of overriding importance, though foreign migration has also been significant in the total population growth. Reasons for migration are varied, but employment opportunity appears to have been a major incentive. Climate and location may also be important, for southwestern British Columbia enjoys warmer winter weather than the rest of the country, and the proximity to the sea provides opportunities for recreation. Evidence suggests that these factors are important in the decisions of many Canadians who choose British Columbia as a place of retirement.

The most direct impact of migration has been on the relative population growth of British Columbia with respect to other provinces. British Columbia shares with Ontario the distinction of having a generally consistent rise in its proportion of the Canadian total. British Columbia accounted for nearly 9 per cent of the national total in 1961 and about 10 per cent in 1971, and it approached 11 per cent in 1976.

There were approximately 600,000 in-migrants to British Columbia in the period 1966–1971. The first map compares the proportionate increase in Regional District population resulting from in-migration with the provincial average in-migration during the period. Thus, while statistics show that by far the greatest number of in-migrants moved to the populous southwestern fringe of the province, the relative increase was greatest in the Mount Waddington and Stikine districts where total population is small. Relatively high proportionate growth also occurred in the Central Okanagan, Comox-Strathcona, Central Fraser Valley, Thompson-Nicola, and Fraser-Fort George districts. Those areas individually contain significant populations. On the other hand, the Kootenay Boundary and Alberni-Clayoquot districts were appreciably below the provincial average.

Fleets of modern semi-trailers now link most British Columbia communities.



Horse-drawn stagecoach was the primary mode of commercial transport in the interior during frontier times.

From 1966 to 1971, about 215,000 persons (one-third of the total migrants) changed residence from one Regional District to another within the province. This internal migration is shown on the second map as the percentage of migrants originating from other Regional Districts (the boundaries of which are coincident with federal Census Divisions in British Columbia). It illustrates that, for half of the Regional Districts, migration from other districts within British Columbia accounted for over 50 per cent of the migrant population in the five-year period. For the Central Fraser Valley, the Dewdney-Alouette District, Squamish-Lillooet, and the Sunshine Coast, internal migration accounted for 60 per cent or more of the district total. For reasons previously noted, the figures on which the map portrayal is based are likely to be underestimates of the true number of migrants. Further, no account is given here of the number of relocations within a given district. Clearly, in common with other parts of the Anglo-American realm, British Columbia experiences high population mobility.

The pattern shown on the map representing migration from other provinces complements the preceding one. It portrays the percentage of the total migration to each Regional District that is comprised of immigrants from other provinces. There was a total of about 200,000 persons in this category during the quinquennium. The Capital, Central Okanagan, and Peace River-Liard districts were outstanding as destinations for interprovincial migrants. In part this movement reflects the popularity of the Victoria area and the central Okanagan as retirement centres.

The last map deals with foreign immigration. Over half of the 115,000 foreign immigrants to British Columbia in the 1966–1971 period came to the Greater Vancouver District. Regionally, foreign immigration to the Bulkley-Nechako and Stikine districts was significant, accounting for over 21 per cent of the regional in-migration. But the total number moving to those areas was only about 2,100 persons, most of whom were attracted by employment opportunities in the extractive industries there. Most of the immigrants to Greater Vancouver came from the British Isles and the United States. The highest single proportion of the remainder were Chinese, mostly of Hong Kong origin, who accounted for about 17 per cent of the total.

References

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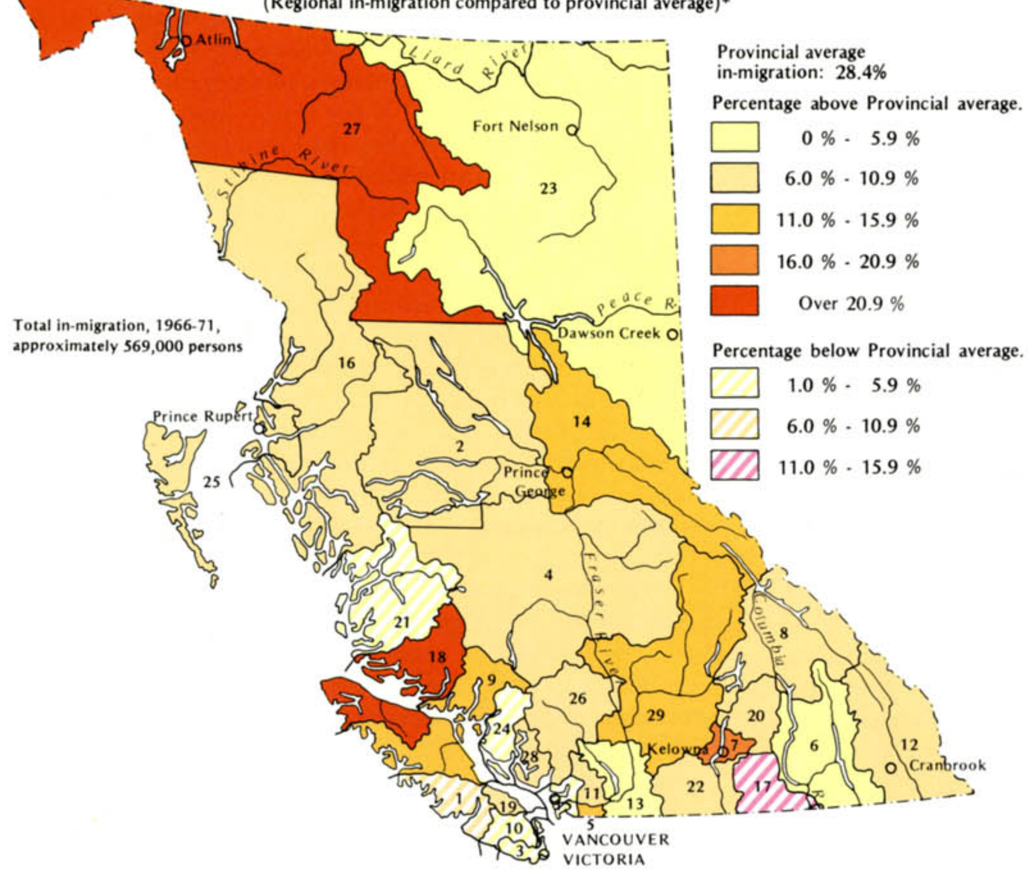
Migration

1966-1971

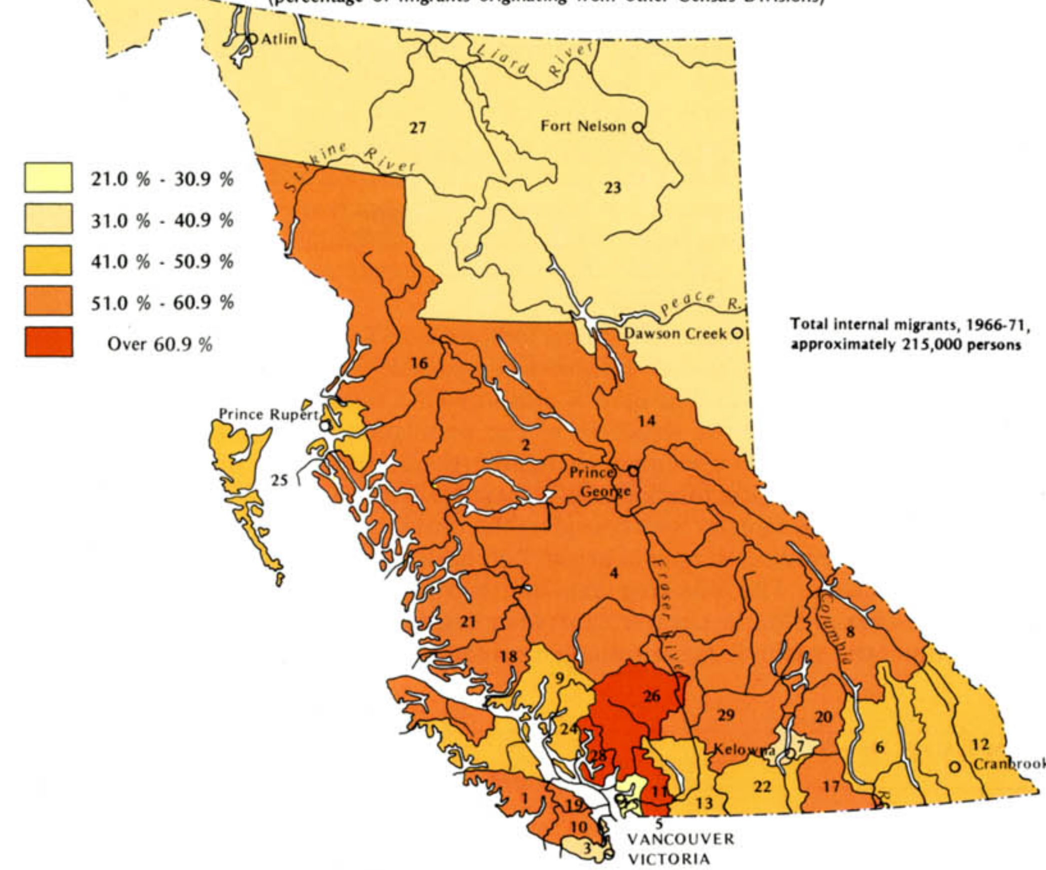
IN-MIGRATION

(Regional in-migration compared to provincial average)*



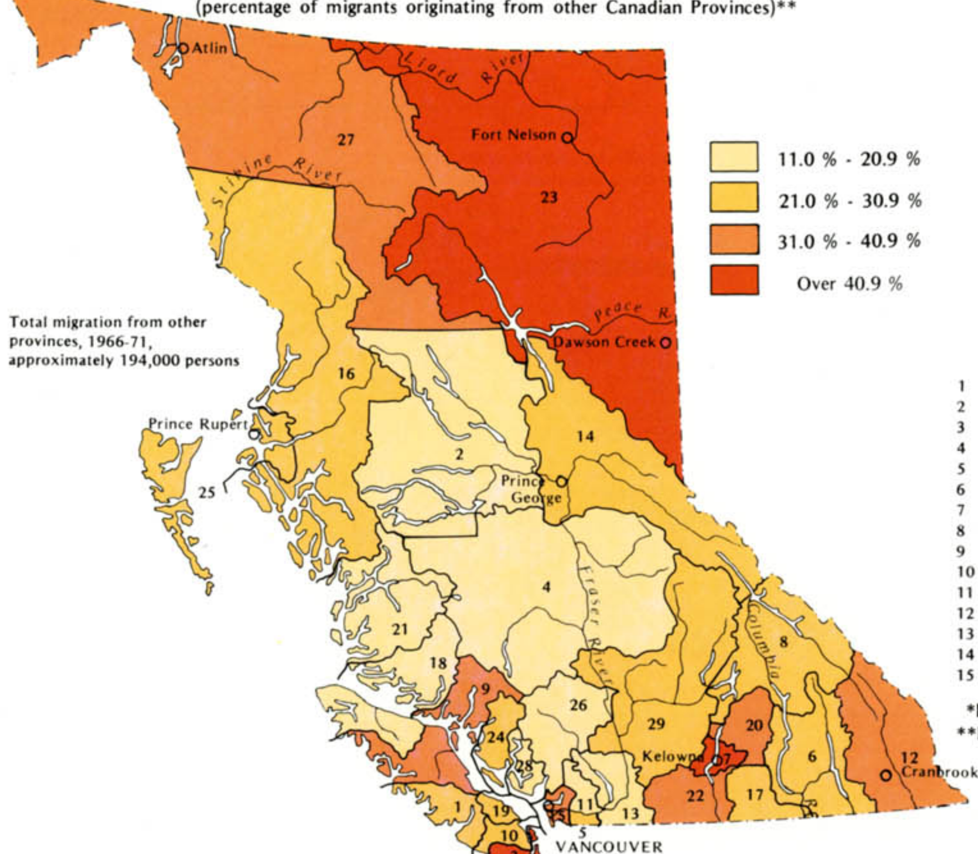
INTERNAL MIGRATION

(percentage of migrants originating from other Census Divisions)**



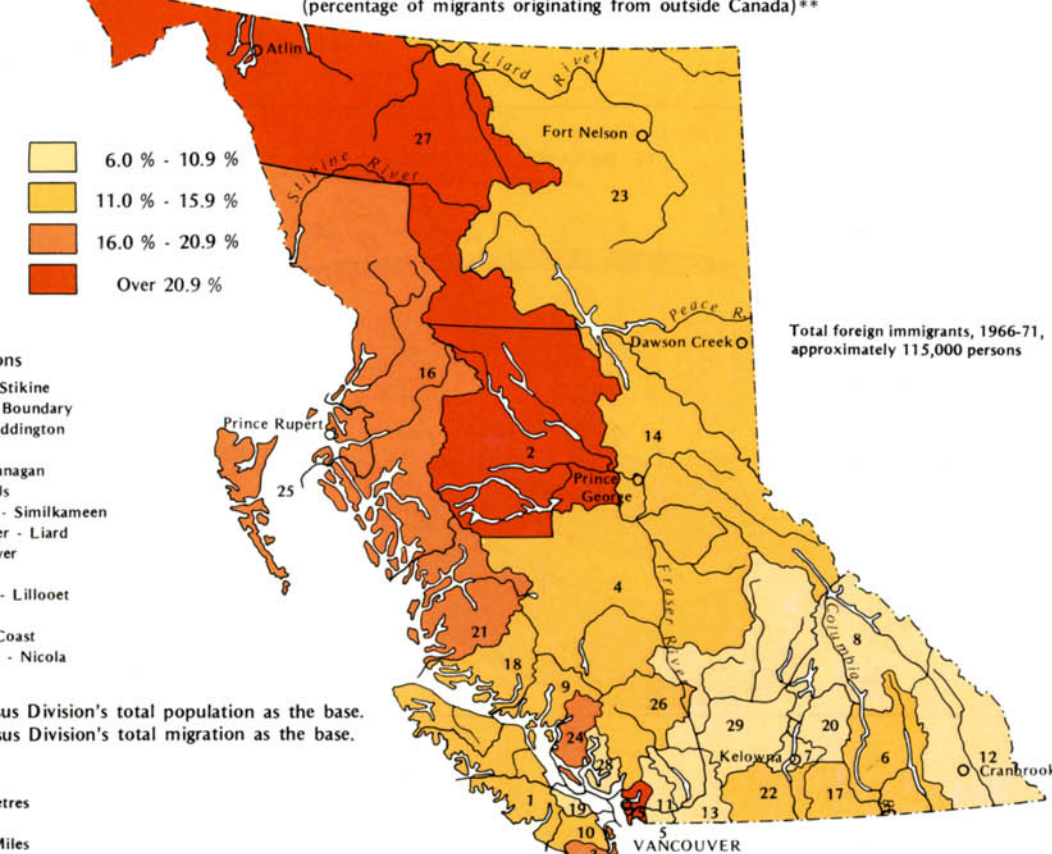
MIGRATION FROM OTHER PROVINCES

(percentage of migrants originating from other Canadian Provinces)**



FOREIGN IMMIGRATION

(percentage of migrants originating from outside Canada)**



British Columbia Census Divisions

1 Alberni - Clayoquot
2 Bulkley - Nechako
3 Capital
4 Cariboo
5 Central Fraser Valley
6 Central Kootenay
7 Central Okanagan
8 Columbia - Shuswap
9 Comox - Strathcona
10 Cowichan Valley
11 Dewdney - Alouette
12 East Kootenay
13 Fraser - Cheam
14 Fraser - Fort George
15 Greater Vancouver
16 Kitimat - Stikine
17 Kootenay Boundary
18 Mount Waddington
19 Nanaimo
20 North Okanagan
21 Ocean Falls
22 Okanagan - Similkameen
23 Peace River - Liard
24 Powell River
25 Skeena
26 Squamish - Lillooet
27 Stikine
28 Sunshine Coast
29 Thompson - Nicola

*Percentages calculated using each Census Division's total population as the base.
**Percentages calculated using each Census Division's total migration as the base.

100 0 100 200 Kilometres
50 0 50 100 Statute Miles

Map 9. Net Migration and Change, 1966–1971

Net migration represents the difference between immigration and emigration within a given period. Because statistics concerning emigration are incomplete, net migration is determined as the difference between the actual population increase for a given region and natural increase attributable to fertility/mortality rates. Arithmetically expressed, net migration = [(population at the end of time period −population at beginning of time period) −(births −deaths)]. The concept of net migration is commonly employed in attempts to estimate future housing needs and labour supply within a given region.

Statistics on birth rates (fertility rates) indicate a decline for British Columbia over the past two decades comparable to that for the whole nation. The decline may be attributed to a number of factors, including age-sex structure of the population, increased job opportunities for women, changing attitudes toward child-rearing and changing lifestyles. In contrast to birth rates, mortality rates can be forecast with considerable reliability. Over the past decade overall death rates in British Columbia have been more or less constant. The following tabulation provides data for British Columbia and for the Greater Vancouver Regional District and illustrates the method of determining net migration.

NET MIGRATION, 1966–71

	British Columbia total	Greater Vancouver
Population change	+310,947	+135,480
Total births	172,507	75,276
Total deaths	85,705	42,795
Natural increase	86,802	32,480
Net migration	+224,145	+103,000

The pattern of net migration is shown on the first of the two maps on the page opposite. In order to bring out the regional significance of net migration, it is represented as a percentage of the 1966 population for each Regional District. Total net migration to the Lower Mainland is so large that it might otherwise completely dominate the pattern.

Assuming fertility and mortality rates to be more or less uniform for the province and assuming a general similarity of population age-sex structure from region to region, the relative attractiveness of the Central Okanagan is immediately apparent. Net migration to that district exceeded 15,000 persons, representing nearly 44 per cent of the 1966 population. The Central Fraser Valley Regional District experienced almost as many net migrants, but because the 1966 base population there was considerably greater, the relative proportion is less. Similarly, the Greater Vancouver Region, accounting for more than 100,000 net migrants, shows a proportionate increase of 11 per cent.

In contrast to the portrayal of in-migration (see Map 8), the Stikine country and the Central Coast (Ocean Falls) region show a strongly negative net migration. For Stikine this is partly related to the somewhat ephemeral nature of employment in construction and resource-based industry in the area. In the case of the Central Coast, the net out-migration reflects economic difficulties experienced by the pulp-milling industry at Ocean Falls.

The second map shows net population change in the 1966–1971 period. As might be expected, the pattern is basically similar to that shown in the first. Though it embodies a less dynamic concept than net migration, it is useful in illustrating some differences. The Dewdney-Alouette region, for example, shows an increase in regional population growth in the range of 23 per cent, but a net in-migration of 18 per cent. The Skeena-Queen Charlotte District shows an increase of 4 per cent in population, but a net out-migration of 8 per cent. These differences have many distinct sources, but they may well reflect regional differences in the age-sex structure of the population.

The accompanying diagrams illustrate the flow of in-migrants and out-migrants during the quinquennium. Line widths are proportionate to the number of migrants in each case. A comparison of the diagrams shows that the number of in-migrants greatly exceeded the out-migrants. Most of the population moving to British Columbia came from other Canadian provinces, though over one-third of the total came from outside Canada, principally continental Europe, the United Kingdom, and Southeast Asia. Most of the out-migration went to other provinces, but noticeable differences in proportion are apparent between the origins and destinations of British Columbia's share of Canadian migrants.

The Canadian population is highly mobile, and the diagrams suggest the kind of population flows that characterized the late 1960's. But depending upon job opportunities, personal preferences, and lifestyles, the population flux can change significantly from one time period to the next.

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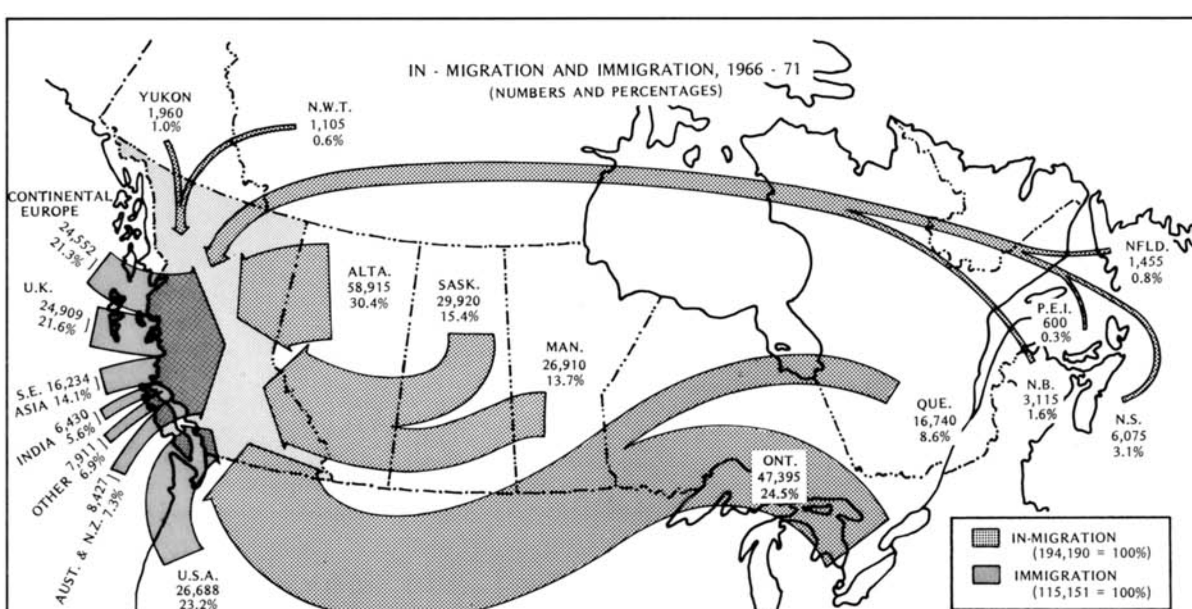
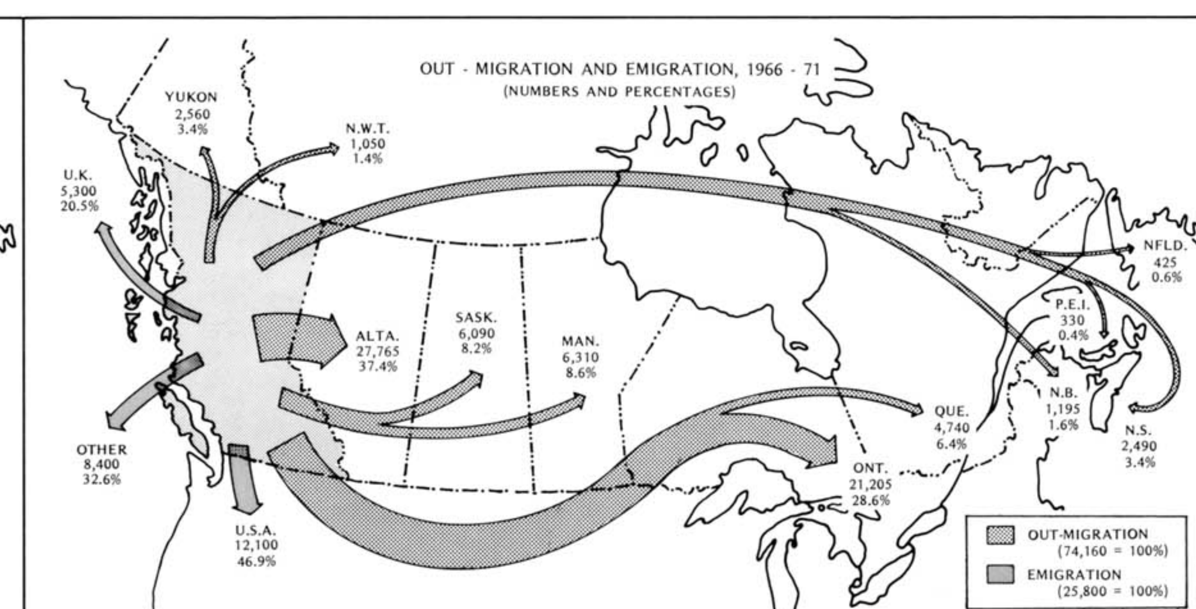
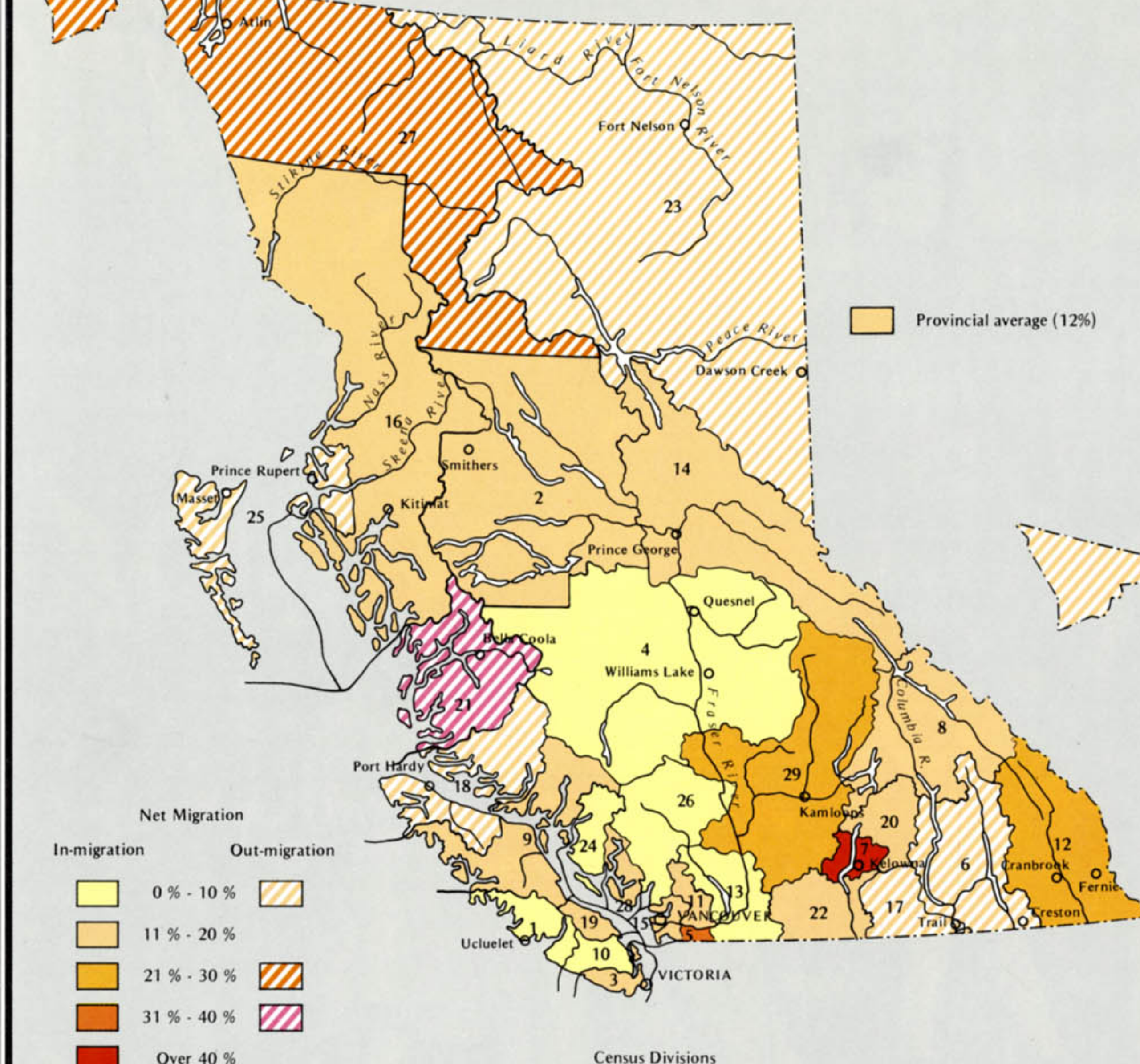




Net Migration and Change
1966-1971

REGIONAL NET MIGRATION
(as a percentage of the Census Division's 1966 population)



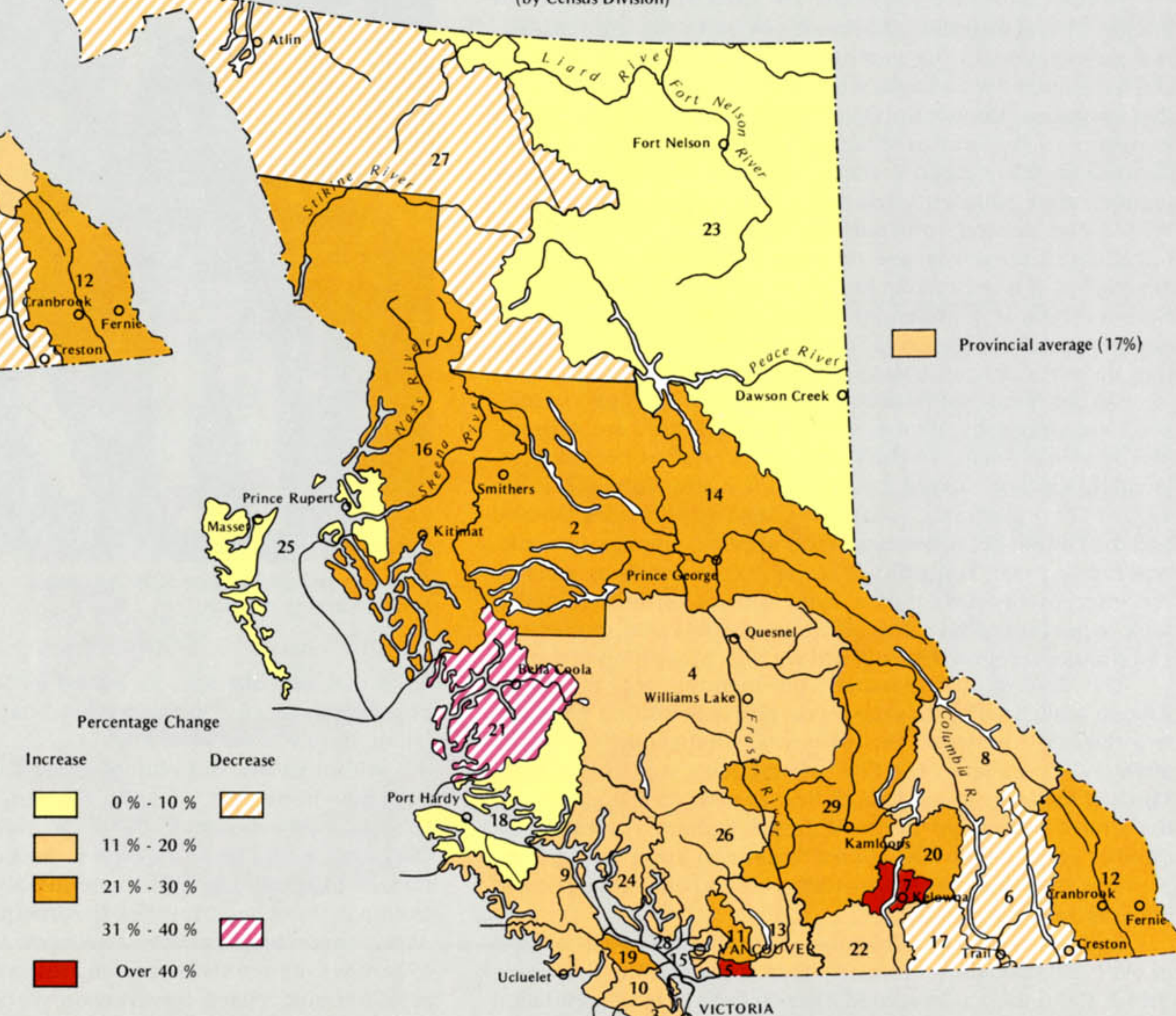
Census Divisions

1 Alberni - Clayoquot	16 Kitimat - Stikine
2 Bulkley - Nechako	17 Kootenay Boundary
3 Capital	18 Mount Waddington
4 Cariboo	19 Nanaimo
5 Central Fraser Valley	20 North Okanagan
6 Central Kootenay	21 Ocean Falls
7 Central Okanagan	22 Okanagan - Similkameen
8 Columbia - Shuswap	23 Peace River - Liard
9 Comox - Strathcona	24 Powell River
10 Cowichan Valley	25 Skeena
11 Dewdney - Alouette	26 Squamish - Lillooet
12 East Kootenay	27 Stikine Region
13 Fraser - Cheam	28 Sunshine Coast
14 Fraser - Fort George	29 Thompson - Nicola
15 Greater Vancouver	

Census Division boundaries coincide with Regional District boundaries.

100 0 100 200 Kilometres
50 0 50 100 Statute miles

PER CENT POPULATION CHANGE
(by Census Division)



Map 10. Migration, 1971–1976

Population change within a given time period is the combined result of birth rates, death rates, immigration, and emigration. The two preceding maps are based on decennial census data that represent the best available record of migration. Even then, the number of international emigrants and the number of interprovincial migrants must be estimated, because Canada has no permanent population register.

For the 1971–1976 period, a different data-base was employed. It is derived from an analysis of family allowance payments, immigration statistics compiled by the federal Department of Manpower and Immigration, immigration statistics from the United States and the United Kingdom which indicate Canada as the previous country of residence, and from an estimate of emigration from Canada to other countries. The only statement a Canadian resident may be required to file on leaving the country is his income tax return. Thus, the actual number of Canadian residents who emigrate from Canada and the province of last residence cannot be known. In this respect, the data base for the accompanying maps parallels that for the 1966–1971 period.

Family allowance payments are used as the measure of interprovincial migration. These are payments made by the federal government to the parents or guardians on behalf of all children under age eighteen who are attending school. A family that moves must notify the Department of Health and Welfare if it wishes to continue receiving payments. The data base for interprovincial migration, then, includes only those migrant families with children eligible to receive family allowances. Within the general constraints indicated, the families of all Canadian citizens or landed immigrants of one year's standing are eligible. It is reasonable to assume, therefore, that while the statistics exclude considerable numbers of interprovincial migrants, especially single people and those in the older age-groups, they do give a clear indication of interprovincial flows.

On the maps, the respective in-flows and out-flows of migrants are shown by arrows, the widths of which are approximately proportionate to the flow volume. As has been characteristic in the past, most of the migrants to British Columbia in the 1971–1976 period came from other Canadian provinces, Ontario and the Prairies being the main areas of origin. Immigration was, however, a major contributor, amounting to nearly as much as the interprovincial migration from Alberta. British Columbia took 16 per cent of the national total of over 841,000 immigrants, and Asiatics accounted for a relatively high proportion of them.

The flow of interprovincial out-migrants was mainly to Alberta and Ontario, these two provinces accounting for about two-thirds of the total. This pattern is comparable to that for 1966–1971; similarly, the flow of emigrants was also modest. Much of the latter group in both time periods were emigrants to the United States and to the United Kingdom. The estimated number emigrating to the United States was lower than for the previous five-year period, chiefly because of changes in United States immigration policy.

In the period British Columbia showed a net population gain of over 100,000, almost as many as in the preceding five years. British Columbia ranks second after Ontario in total population flow within Canada and has a higher migration rate. In 1971–1976 that rate averaged in excess of 50 persons per 1,000 of population. Because of Ontario's substantially larger base population, its rate is relatively low.

Choir performing on the steps of the Parliament Buildings during Victorian Days, 1977.

Although British Columbia's net migration has varied considerably from year to year, the long-term trend has been strongly positive. Given the high mobility of contemporary Canadian population, however, outflows from one part of Canada to another may fluctuate sharply, especially in response to employment opportunities. In consequence, it is reasonable to expect that substantial flows to Alberta and the Yukon as well as to British Columbia will occur in association with the building of pipelines and related construction work. The decline in interprovincial flows in British Columbia from 88,000 persons in 1973–1974 to 58,000 in 1975–1976 illustrates the short-term variations. In fact, the province experienced a net loss of about 4,400 people in 1975–1976. For reasons noted, such year to year differences are unlikely to affect the long-term trend of strong net gain significantly.

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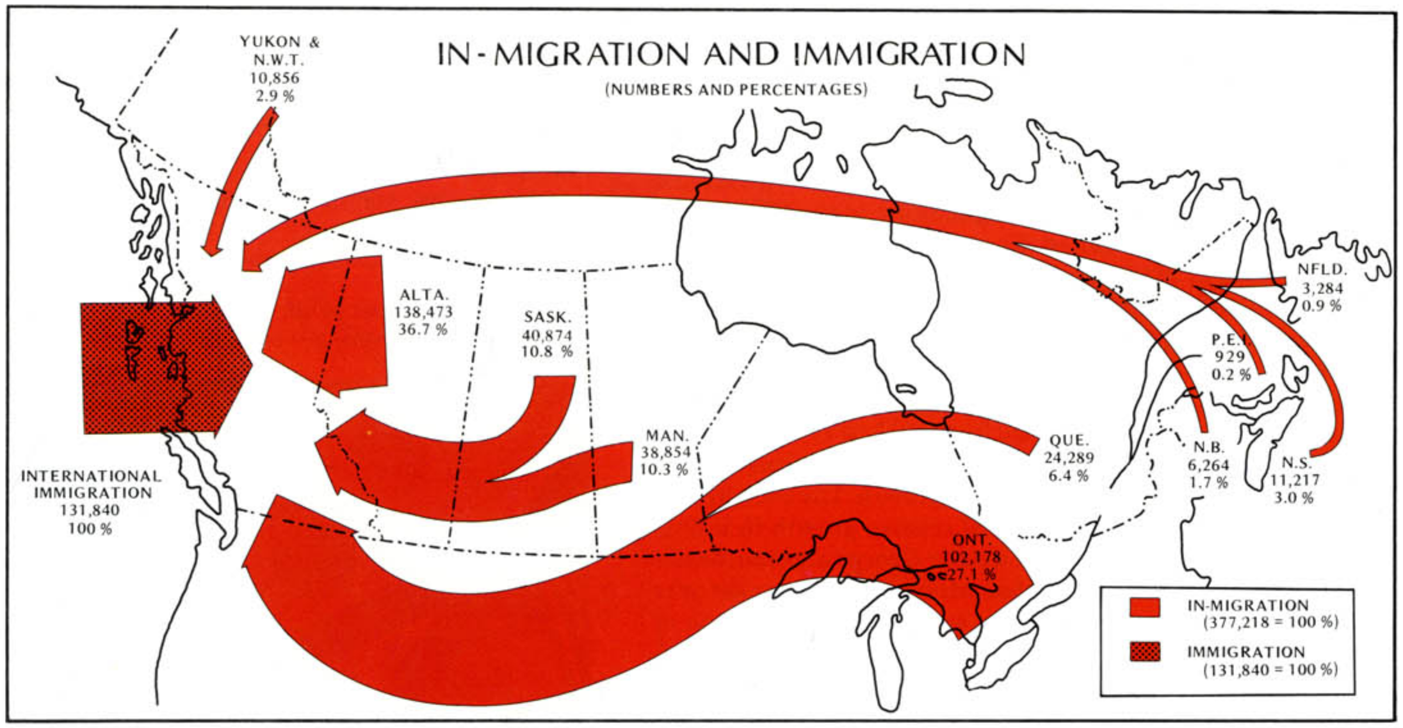
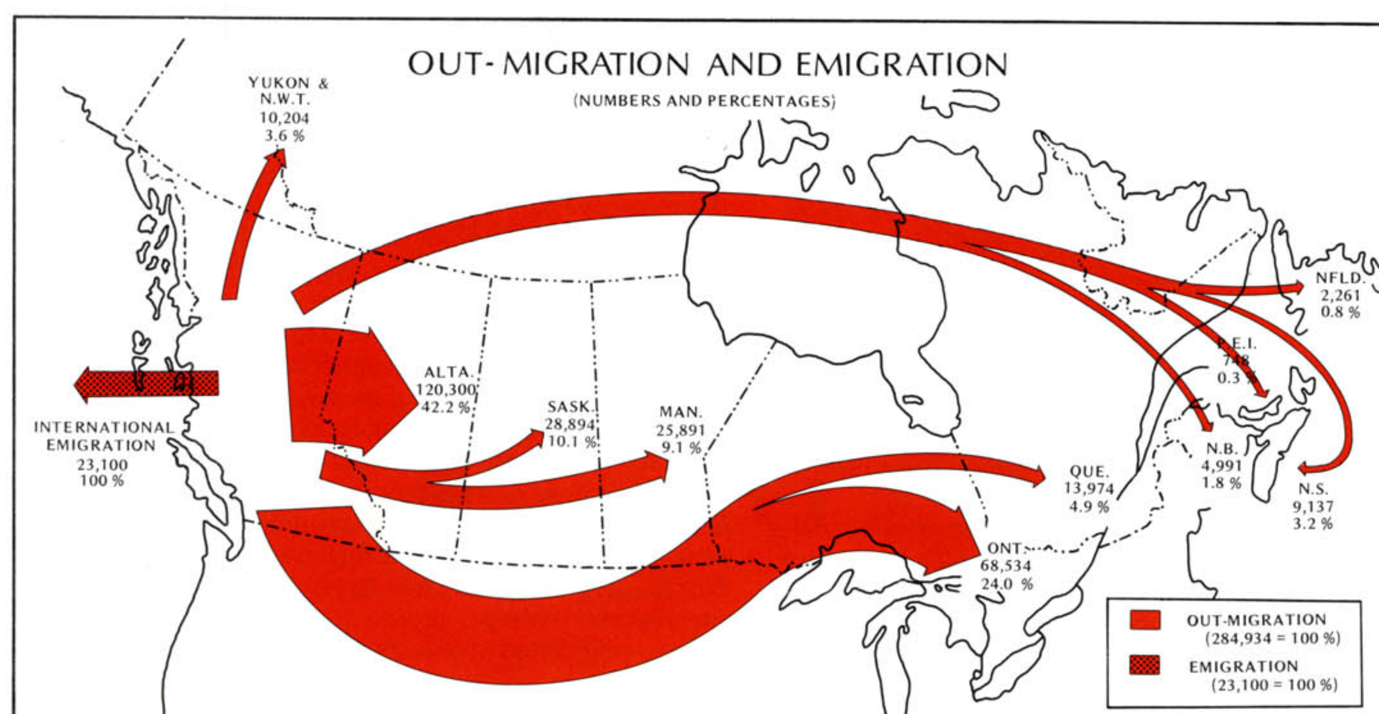
Migration

1971-1976





Map 11. Labour Force, 1951–1971

Labour force constitutes the most important element in the resource endowment of any area. Its quantity and its quality to a large extent determine the use to which natural resources are put and the productivity that results. In this sense, productivity refers not only to the creation of economic wealth but also to the fulfilment of society's broader objectives.

In its broadest definition, the labour force is that part of the population that contributes to the extraction, processing, marketing, or distribution of resources or administers to the needs of the society it represents. Specifically, it refers to all persons fifteen to sixty-four years of age who, in a given period, were employed and working, employed but not working because of illness, vacation, or other cause, or who were unemployed and looking for work. The number of persons in the labour force varies from season to season and from industry to industry. The fishing industry exemplifies highly seasonal employment.

The potential labour force constituted a little more than one-half of British Columbia's population in 1951 and a little less than two-thirds in 1971. Although the previous trend had been toward a decline in the proportion of persons in the labour force, changing lifestyles and an increasing proportion of women entering the labour force have offset it.

The first three maps on the accompanying page show the distribution of the labour force, by industry, in 1951, 1961, and 1971. The final map represents the changes that have taken place, provincially and regionally, in the twenty-year period. The labour force is classified by the industry in which it is engaged and not by the type of work done. Thus all employees of a firm that produces a manufactured product are classed as being in "secondary industry" whether or not they are directly engaged in the manufacturing process. In this classification, all employees in the extractive phases of agriculture, forestry (logging), fishing, and mining are grouped as "primary." Persons employed in manufacturing and construction are classed as "secondary," and those in transportation, trade, finance, commerce, and professional and public service are grouped as "tertiary." Despite the difficulties inherent in the classification, the result provides a reasonably consistent means of interregional comparison of labour force and industrial mix.

The maps of 1951, 1961, and 1971 show, by intensity of background colour, the regional proportion of the total labour force. For ease of comparison, data are compiled on the basis of the pre-1971 census regions. As might have been expected from an examination of total population distribution in the province, the labour force is heavily concentrated in southwestern British Columbia (see Maps 1 and 2).

With the exception of those representing the provincial total for each year, the pie-graphs are of constant size. They indicate by segment size and colour the regional industrial mix. Those showing the provincial totals illustrate the importance of the tertiary activities as an employment sector. Despite the overall increase in the labour force, the tertiary sector had grown from 52 per cent in 1951 to 62 per cent in 1961 and 1971. The primary sector was the smallest, declining from 16 per cent to 10 per cent in 1961 and to less than 8 per cent in 1971. Nevertheless, British Columbia's economy, like that of the rest of Canada, is strongly oriented toward the extraction and processing of basic resources. In a real sense, the labour force engaged in the primary sector is the base upon which employment in the rest of the economy depends. Increased industrial productivity and expansion of processing industry account for the relative decline in the primary sector labour force.

Predictably, the pie-graphs for Census Divisions 4 and 5 reflect the provincial mix. For other regions the local importance of single industries or industrial complexes is evident. This is most apparent on the 1951 map, where agriculture in the Peace River region and mining in the East Kootenay area account for the large proportion of the labour force engaged in primary activity. Elsewhere, mineral and wood processing account for substantial employment in secondary industry. It is interesting to note, however, that by 1971 all but one of the Census Divisions showed tertiary activity as the greatest employment sector.

The map indicating the change from 1951 to 1971 shows the relative growth in industrial labour force for each Census Division compared to the provincial average growth. The background colour highlights the very substantial relative growth in industrial employment recorded in the Prince George and northeastern regions over the two decades. Much of the increase was attributable to construction activities and the rapid expansion of forest industry in those areas.

The East and West Kootenay regions were, respectively, 38 per cent and 59 per cent below the overall provincial average of 105 per cent growth in the labour force. In absolute terms, however, employment in the West Kootenay area expanded by nearly 50 per cent during the two decades. Employment in the Central Coast region expanded very little over the period, and it is shown to be far below the provincial average.

The bar graphs show two things — the percentage growth in total labour force for each region from 1951 to 1971 and the relative growth in each employment sector compared to the regional average. The former is indicated by the bracketed number opposite the base-line position of each graph on its vertical scale. The latter is shown by the colour and position of the ends of the respective bars on the graph scale. For comparison, the provincial average is shown in the separate bar scale to the lower left of the map. To illustrate, the increase in *total* labour force in Census Region 10 (Northeast) over the twenty-year period was 220 per cent. This was 115 per cent more than the total *provincial* increase. As already seen in connection with the other maps on the page, however, the total for any region represents a mix of primary, secondary, and tertiary components in differing proportions. Region 10 experienced a remarkable growth in the tertiary sector of 123 per cent above the regional average. Similarly, the labour force in secondary industry increased by 24 per cent above the average for the region and is graphed accordingly. Finally, the primary sector in Region 10 was 193 per cent below the regional average, representing an actual growth in the twenty-year period of only 27 per cent.

The graphs permit interregional comparisons to be made for each of the three sectors of the labour force. In the East Kootenay region, for example, overall increase in the labour force was 67 per cent — substantially less than the provincial average. However, the secondary sector increase was about 40 per cent greater than the East Kootenay regional average in all sectors, and over 50 per cent more than the provincial average increase for secondary industry. As the respective graph profiles indicate, the East Kootenay region was one of only three areas within which the secondary sector grew faster than the regional average. For all regions, employment in the tertiary sector was above, and that in the primary sector below, the respective regional averages.

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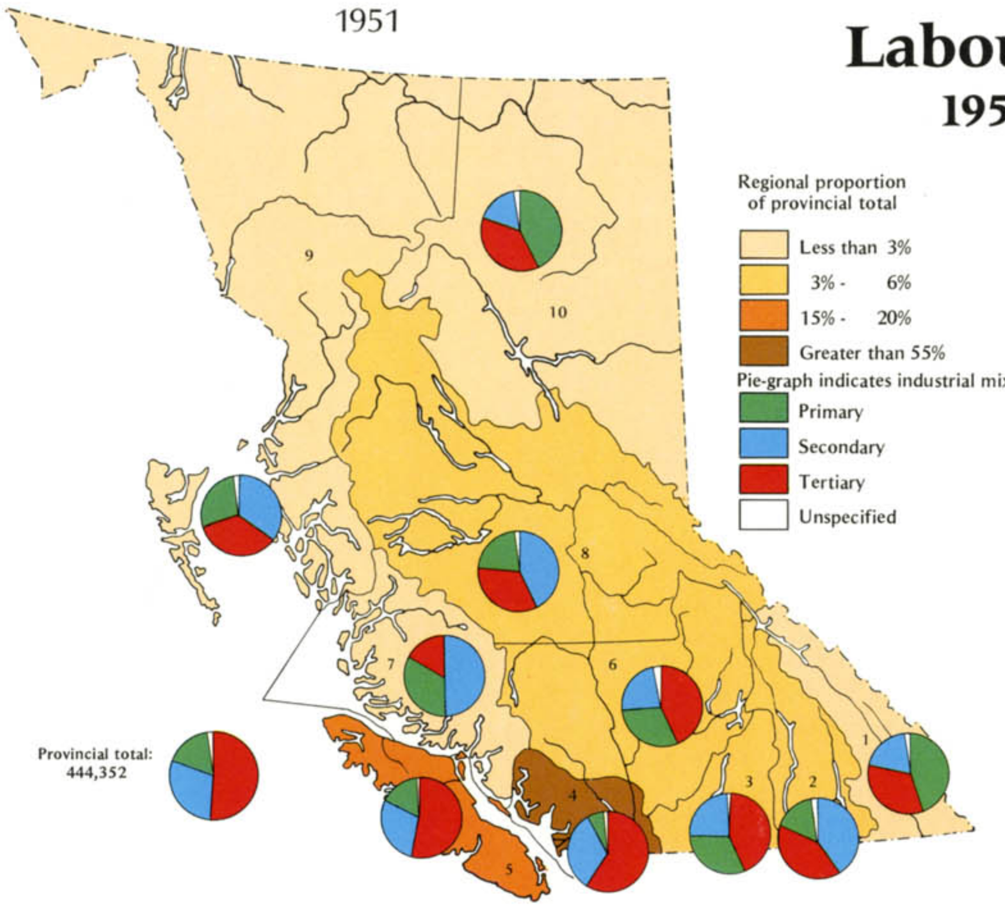
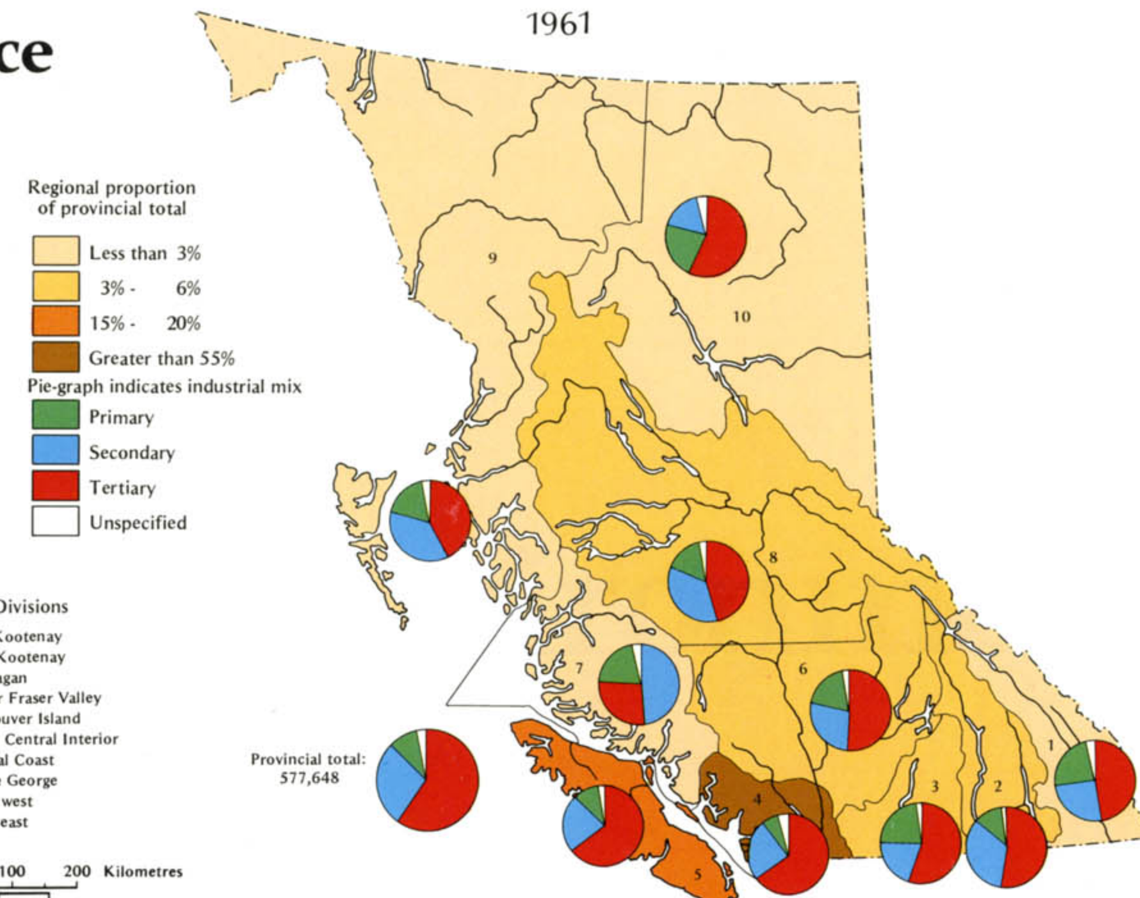
A web of steel dwarfs this worker during construction of the Asian Centre at the University of British Columbia.

Labour Force
1951-1971



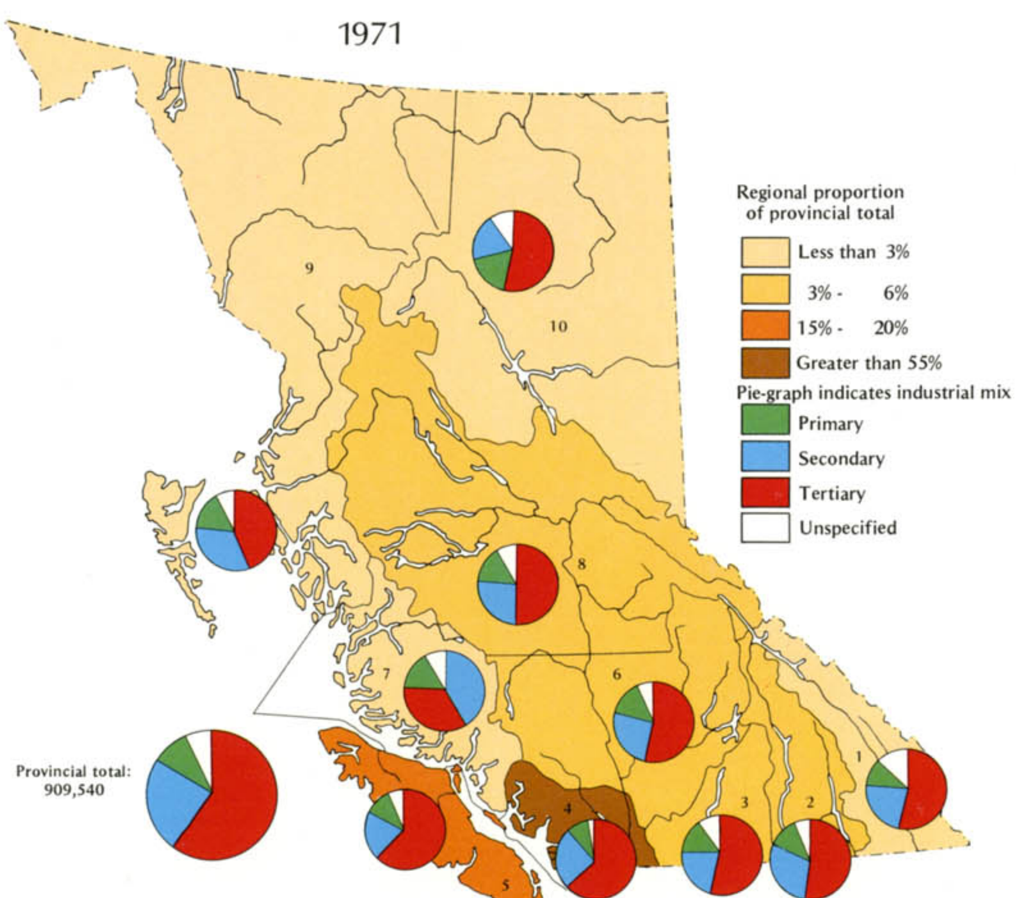


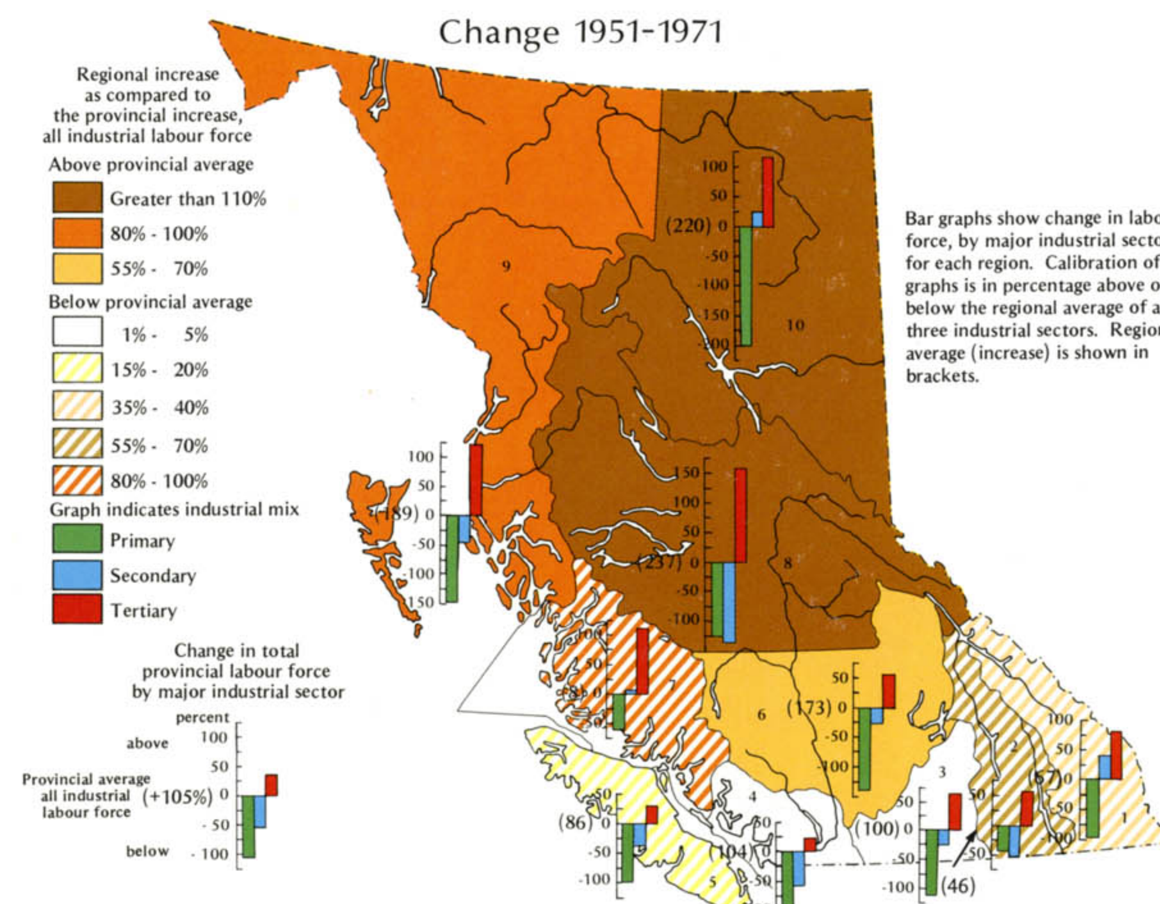
Census Divisions

1 East Kootenay
2 West Kootenay
3 Okanagan
4 Lower Fraser Valley
5 Vancouver Island
6 South Central Interior
7 Central Coast
8 Prince George
9 Northwest
10 Northeast

100 0 100 200 Kilometres

50 0 50 100 Statute Miles





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Environment

Map 12. Relief and Bathymetry

British Columbia occupies part of the vast belt of mountainous terrain that flanks the western margins of the Americas. In some sections of the belt the terrain rises steeply from the ocean floor to summit elevations in excess of 5,000 metres, representing a total relief of more than 9,000 metres. Elsewhere the relief is less and the ascent is broken by the presence of a continental shelf. In British Columbia, the continental slope begins to rise from the ocean floor at a depth of about −3,600 m (2,000 fathoms), rises abruptly from around −2,500 to −200 m, and then levels off to form a continental shelf. The shelf is far from uniform in width or in surface configuration, but it forms a large area of relatively shallow water where conditions are favourable to the development of populations of groundfish. It is, therefore, of considerable economic importance. As the map shows, the "200-mile" (320 km) fishing limit claimed by Canada includes both the continental shelf and the continental slope.

Offshore from the continental shelf are many submarine features that rival the terrestrial surface in topographic diversity. Bathymetric (seabed) mapping carried out in recent years by various government agencies, including the Geological Survey of Canada, has revealed many offshore trenches, ridges, basins, and canyons. Directly or indirectly they are related to tectonic events in the area (see Map 14). Among the most remarkable of these features are seamounts — all of them rise steeply from great depths, and some extend to well within 500 metres of sea level. Union Seamount, for example, rises from a depth of −3,200 m and has a summit elevation of −238 m. Bowie Seamount, lying about 200 km west of the Queen Charlotte Islands reaches to −30 metres. Its total height is approximately 3,300 m, which is comparable to that of some of British Columbia's best-known terrestrial mountain peaks. Golden Hinde, the highest summit on Vancouver Island, for example, has an elevation of 2,200 m; Mount Garibaldi stands at 2,678 m; Mt. Assiniboine is 3,618 m; and Mt. Robson 3,954 m.

The terrestrial surface is characterized by mountainous topography, but it includes substantial areas of lowland and plateau country (see Maps 7 and 14). There are three basic units — a northwesterly trending mountain system on the west, a similar mountain system on the east, and an extensive area of plateau and mountain country between the two. The northeastern corner of the province is lowland — a segment of the Great Interior Plains.

The western system averages some 300 km in width and extends for about 1,600 km along the entire B.C. coast and the Alaska Panhandle. Within it, the highest elevations are to be found in the southern and northern portions. At 4,663 m, Fairweather Mountain on the Alaskan border is the tallest mountain in British Columbia. Beyond the 60th parallel the western system includes the largest group of great peaks in North America, including Mount Logan (5,950 m), Canada's highest. In the vicinity of 54°N, summit elevations decline somewhat, averaging about 2,700 m, but on the mainland east of Vancouver Island they increase again in a wild and rugged zone that represents the topographic heart of the Coast Mountains. Monmouth Mountain, for example, attains a height of 3,194 m. Nearby Mount Waddington, at 4,016 m, is the tallest peak in southern British Columbia and exceeds Mount Robson, the highest mountain in the Canadian Rockies. The western system also includes a number of islands and island groups, which form a bulwark against the wind and wave action of the open Pacific and create a relatively sheltered "Inside Passage" for coastal watercraft. This passage in fact consists of a maze of waterways that provides access to resources and links coastal settlements. Despite strong tidal currents, these waterways are heavily used by a variety of marine traffic, including log booms, chip scows, and fish boats, along with an increasing number and diversity of pleasure craft (see Maps 53 and 57).

The mainland coast is deeply indented by fjords, a number of which extend beyond the summit line of the mountains. Consequently, within a horizontal distance of a few kilometres, it is possible to climb from sea level to elevations above 2,500 metres. The summit areas contain both considerable amounts of perennial snow and icefields which bear important hydrological relationships not only to the smaller, coastal streams, but more particularly to the larger rivers, especially the Fraser, the Skeena, the Nass, and the Stikine (see Map 18).

While the fjord channels are natural routeways from coast to interior, they are little used for interconnecting transport. Part of the reason is that the westward-flowing streams, their courses interrupted by falls and rapids, have very strong gradients and form narrow defiles through the mountains. With the exception of the Fraser and Skeena River valleys, the only such route developed is the one followed by the road from Bella Coola to Williams Lake. Although steep in its western portions, this route was long utilized by coastal Indians in their trade with interior tribes, and it was also used by Alexander Mackenzie when he travelled from the Peace River to the Pacific in 1793.

From 1,500 metres above Qualicum Beach, the variation in colour shows differences in water depth.

The interior system contains a series of plateaus, the largest of which extends through the central part of the province. It attains a maximum width of about 300 km at latitude 54°N and a maximum length of about 650 km from near the 49th parallel to the Peace River Reservoir. Between 56° and 58°N the plateau is interrupted by extensive mountainous areas, but north of 58° it is again the principal terrain feature. Lying at an average elevation of 600–1,200 m, the plateau consists of a rolling upland, dotted with lakes and mantled with varying thicknesses of glacial deposits (see Map 16). In many places the disrupted drainage pattern reflects past glacial action, but the major streams have well-established courses and are, for the most part, deeply entrenched. Although climatically unsuited for sedentary agriculture, the plateau system supports considerable areas of natural grassland as well as forest. The grassland areas have long been associated with livestock ranching (see Maps 23, 27, and 38).

The eastern system is made up of several mountain groups and included valleys. The highest elevations occur in the south, where many summits reach 3,300 metres above sea level. Between latitudes 54° and 56°N, the topography is more subdued, and even the highest peaks are generally less than 2,100 m. The lower elevations in these latitudes are of some climatological significance, for they exercise comparatively little blockading effect upon air mass movement. They also present a less formidable barrier to transportation than the southern part. However, throughout their extent, the mountain ranges of the eastern system are broken by passes, and several have been utilized by road and rail lines. Among the better known are Crowsnest Pass (1,357 m), Kicking Horse Pass (1,622 m), and Yellowhead Pass (1,131 m).

Northward of the 56th parallel, the mountains of the eastern system increase in elevation, creating a large node of rugged terrain that forms a distinct topographic boundary with the lowland of northeastern British Columbia. Except for the Alaska Highway this extension of the Rocky Mountains lacks ground access, and, like much of the northern part of the province, it is remote and unknown to most British Columbians. By contrast, the mountain areas south of the 54th parallel, especially those in the southeast, are readily accessible and are visited by increasing numbers of summer and winter recreationists.

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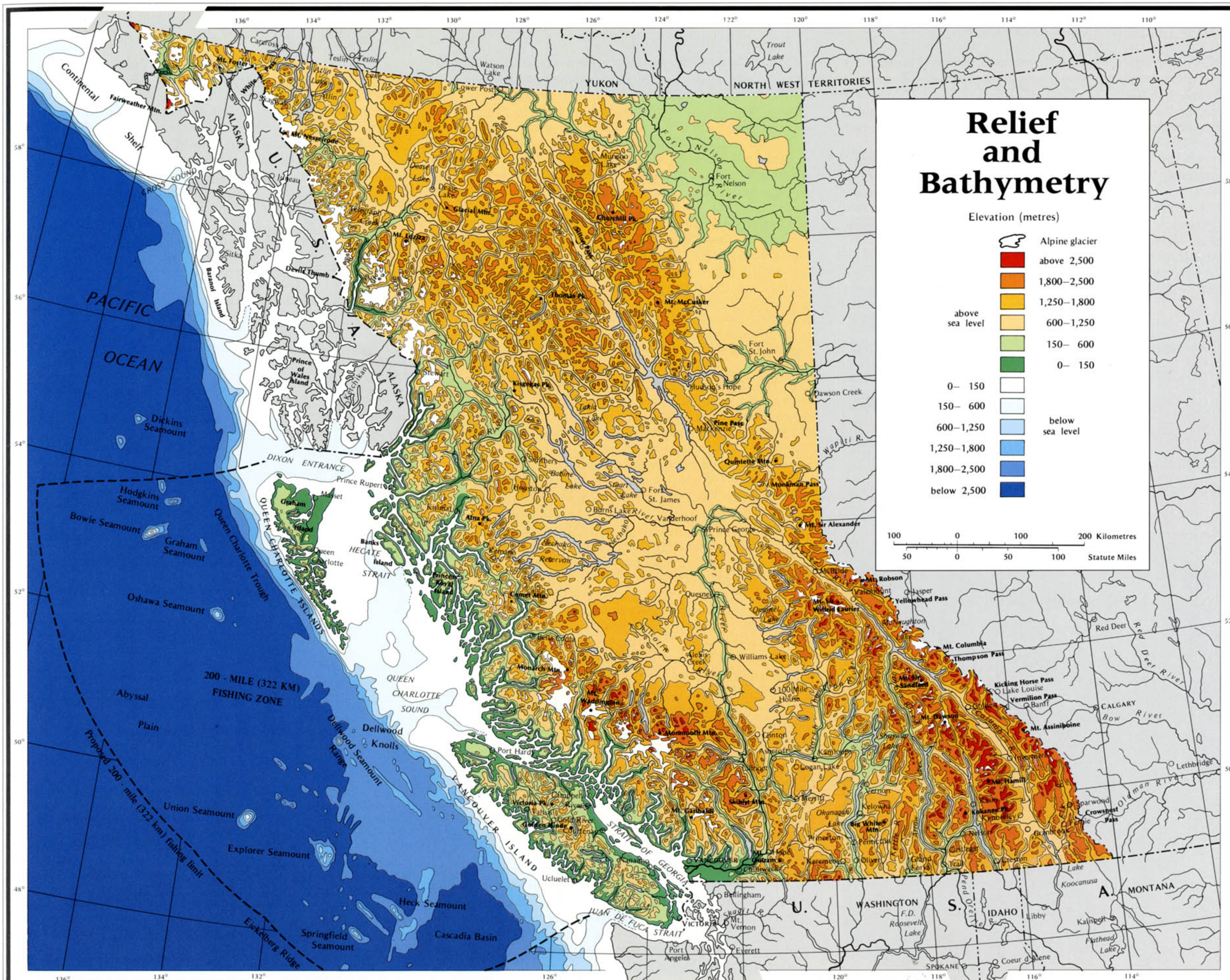
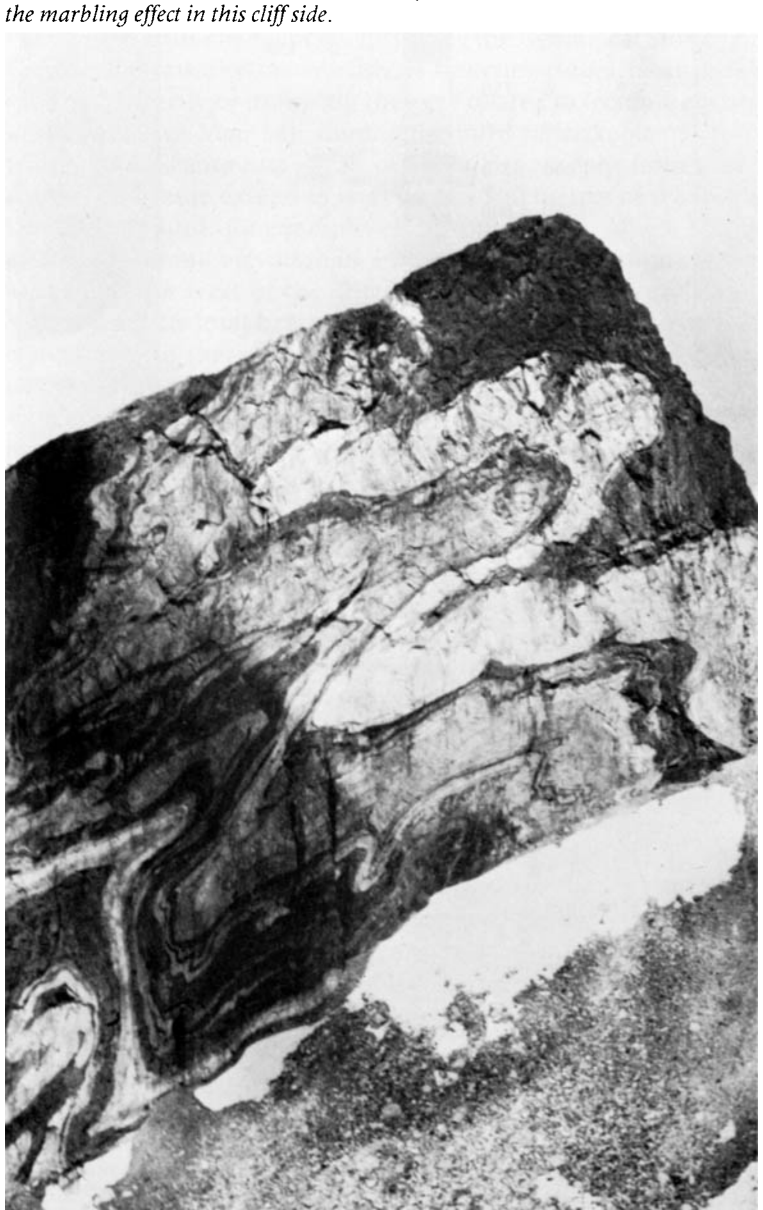

Relief and Bathymetry
Elevation (metres)
Alpine glacier
above sea level
above 2,500
1,800–2,500
1,250–1,800
600–1,250
150– 600
0– 150
below sea level
0– 150
150– 600
600–1,250
1,250–1,800
1,800–2,500
below 2,500
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
PACIFIC OCEAN
Continental Shelf
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
Queen Charlotte Trough
HECATE STRAIT
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
200 - MILE (322 KM) FISHING ZONE
Proposed 200 - mile (322 km) fishing limit
Abyssal Plain
Dickins Seamount
Hodgkins Seamount
Bowie Seamount
Graham Seamount
Oshawa Seamount
Union Seamount
Explorer Seamount
Heck Seamount
Springfield Seamount
Cascadia Basin
Eickelberg Ridge
Dellwood Knolls
Dellwood Seamount Range
Fort Nelson
Fort St. John
Dawson Creek
Prince Rupert
Prince George
Williams Lake
Kamloops
Vernon
Kelowna
Vancouver
Victoria
Nanaimo
Port Hardy
Ucluelet
Calgary
Lethbridge
Red Deer
WASHINGTON
IDAHO
MONTANA
Mt. Robson
Mt. Waddington
Fairweather Mtn.
Yellowhead Pass
Kicking Horse Pass
Crowsnest Pass

Map 13. Bedrock Geology

Bedrock geology is importantly related to potential mineral development and to other components of the natural environment. Though in detail its distributional pattern in British Columbia is complex, it can be described within six main physiographic units, each with a prominent northwest-southeast alignment (see Map 14).

On the west is the Insular belt (part of the Western System) comprising Vancouver Island and the Queen Charlotte Islands. This unit is composed mainly of heavily faulted, unmetamorphosed volcanic and sedimentary rocks ranging in age from Tertiary to Paleozoic. Vulcanism on Vancouver Island and in interior British Columbia was extensive during the Mesozoic age, and volcanic rocks on the Island occur in thick sequences. Vulcanism that gave rise to the Cascade Mountains and such features as the Black Tusk (Garibaldi Park area) and Mount Edziza (see Map 12) was much more recent, contemporaneous with the Great Ice Age. Included with the sedimentaries are sandstones, shales, and conglomerates of Cretaceous age forming the east coast lowland. Associated coal deposits figured prominently in the early development (1850's) of British Columbia's mineral industry and were more or less continuously worked for over a century. The economically recoverable reserves have now been exhausted, but both Vancouver Island and the Queen Charlotte Islands are producers of metallic minerals, notably copper and iron ore (see Maps 35 and 36).

Immense crustal forces which contort strata produced the marbling effect in this cliff side.



Forming a broad swath along the mainland coast is a crystalline belt (Coastal Mountain System) comprised of intrusives of late Cretaceous to early Tertiary age. It is a complex sequence of batholithic intrusions consisting mainly of granitic rocks and crystalline gneisses. The contact zones between these intrusions and adjacent rock formations are associated with conditions favourable for the emplacement of the ores of metals.

The third unit, the Intermontane belt, consists mainly of unmetamorphosed sedimentary and volcanic rocks that lie in a broad zone extending through the interior of the province. In the southern and northern parts of this zone is volcanic rock which represents a succession of basaltic lava flows of Late Tertiary age that in some places have an accumulated thickness of hundreds of metres. Especially where they have been cut by streams, they form rather striking landscape features. While the volcanic rocks are not, in themselves, sources of economic mineralization, the Intermontane belt includes many fault and contact zones with which are associated the province's most important deposits of copper and molybdenum. Included in this unit are several areas of intrusive rocks of ferromagnesian (ultramafic) nature. These occur along major sutures in the earth's crust and are economically important because they are generally associated with deposits of asbestos, chromite, and nickel.

Flanking the Intermontane belt and bounded on the east by the Rocky Mountains (Eastern System) is a zone consisting mainly of very old sedimentary rocks, somewhat younger intrusives, and large areas of metamorphic rocks. This is the Omineca crystalline belt (Cassiar-Columbia Mountains), and with it is associated an important part of British Columbia's lode metal industry. It includes the Boundary area, historically important for extraction of the ores of copper, and the Kootenay country. The latter has long been associated with the production and separation of complex ores of silver, lead, and zinc. The Sullivan ore body, in the southeastern part of the zone, has been in production since 1910 and was for many years the economic mainstay of the entire British Columbia mining industry (see Map 34).

The Rocky Mountain belt (Eastern System) is also made up of ancient rocks which are mostly of the sedimentary carbonate type. Unlike the zone to the west, relatively little volcanic rock is present and thrust faulting is evident throughout. Economic mineralization is associated only with the southern and central margins of this zone where coal deposits of metallurgical quality occur in association with younger sedimentary rocks. In the south, these coal deposits have long been utilized, and in recent years substantial amounts have been exported to trans-Pacific markets (see Maps 35 and 59).

The final geologic unit, and one that readily can be distinguished on the map, is in the northeast (Great Interior Plains). Here the bedrock geology consists almost exclusively of sandstones and shales of Cretaceous and the Early Tertiary age. These rocks are little disturbed and are associated with deposits of natural gas and petroleum. Since the 1950's these have been commercially developed and make significant contributions to British Columbia's energy supply (see Map 47).

The accompanying tabulation is intended to give the reader an indication of the geologic time scale as an aid to the interpretation of the map.

TIME SCALE OF EARTH HISTORY

Era	Period	Epoch	Approximate Age before Present (thousands of yrs.)
		Holocene (Recent)	10
	Quaternary		15
		Pleistocene	
Cenozoic			1,000
			2,000
		Pliocene	5,000
		Miocene	23,000
	Tertiary	Oligocene	38,000
		Eocene	55,000
		Paleocene	65,000
	Cretaceous		
			140,000
Mesozoic	Jurassic		
			195,000
	Triassic		
			230,000
	Permian		
			280,000
	Pennsylvanian	Carboniferous	300,000
	Mississippian		350,000
Paleozoic	Devonian		
			395,000
	Silurian		
			435,000
	Ordovician		
			500,000
	Cambrian		
			570,000
Proterozoic			
			2,600,000
Archaean			4,000,000+

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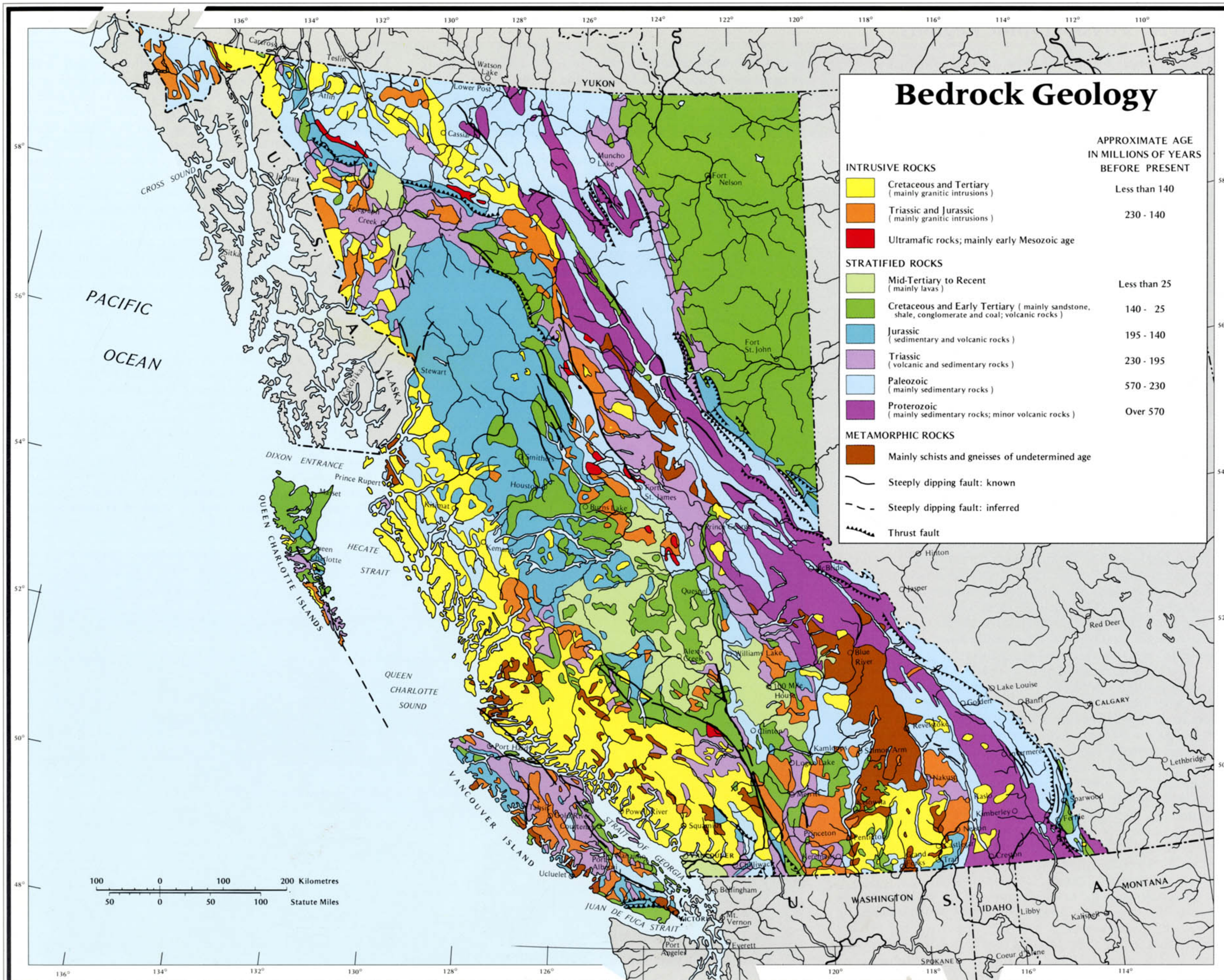

Bedrock Geology
APPROXIMATE AGE IN MILLIONS OF YEARS BEFORE PRESENT
INTRUSIVE ROCKS
Cretaceous and Tertiary (mainly granitic intrusions) Less than 140
Triassic and Jurassic (mainly granitic intrusions) 230 - 140
Ultramafic rocks; mainly early Mesozoic age
STRATIFIED ROCKS
Mid-Tertiary to Recent (mainly lavas) Less than 25
Cretaceous and Early Tertiary (mainly sandstone, shale, conglomerate and coal; volcanic rocks) 140 - 25
Jurassic (sedimentary and volcanic rocks) 195 - 140
Triassic (volcanic and sedimentary rocks) 230 - 195
Paleozoic (mainly sedimentary rocks) 570 - 230
Proterozoic (mainly sedimentary rocks; minor volcanic rocks) Over 570
METAMORPHIC ROCKS
Mainly schists and gneisses of undetermined age
Steeply dipping fault: known
Steeply dipping fault: inferred
Thrust fault
PACIFIC
OCEAN
YUKON
ALASKA
U. S. A.
CROSS SOUND
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
Carcross
Teslin
Watson Lake
Lower Post
Atlin
Cassiar
Muncho Lake
Fort Nelson
Juneau
Sitka
Telegraph Creek
Stewart
Fort St. John
Prince Rupert
Masset
Smithers
Houston
Kitimat
Burns Lake
Fort St. James
Prince George
Kemano
Hinton
Jasper
Quesnel
Red Deer
Alexis Creek
Williams Lake
Blue River
100 Mile House
Lake Louise
Golden
Banff
CALGARY
Clinton
Revelstoke
Kamloops
Salmon Arm
Logan Lake
Nakusp
Lethbridge
Port Hardy
Merritt
Vernon
Kaslo
Sparwood
Powell River
Squamish
Kimberley
Fernie
Courtenay
Nelson
Princeton
Penticton
Cranbrook
Port Alberni
Nanaimo
VANCOUVER
Chilliwack
Grand Forks
Trail
Creston
Ucluelet
Bellingham
VICTORIA
Mt. Vernon
Port Angeles
Everett
Libby
Kalispell
SPOKANE
Coeur d'Alene
100 0 100 200 Kilometres
50 0 50 100 Statute Miles

Map 14. Physiographic Regions

British Columbia has greater physiographic diversity than any other Canadian province. This diversity finds indirect expression in the many physical and biotic differences that are found from place to place (see Maps 13, 20, and 23).

The recently developed concept of plate tectonics provides background for the regionalization of physiography. Plate tectonics envisions the lithosphere as consisting of several rigid plates that are in constant relative motion, so that both the continents and ocean basins are gradually moved on the deeper portion of earth's mantle as though by a series of giant conveyor belts. The continental masses are considered to be imbedded in their respective plates, which may diverge from each other, slide past each other, or impinge upon each other. Boundaries between the plates are therefore considered to be of three types — oceanic ridge axes, where sea-floor spreading occurs and where volcanic material rises from the earth's mantle forming new oceanic crust; transforms (shear boundaries), where the plates slide past each other; and subduction zones, where plates converge and where one slides beneath the leading edge of the other.

Because there is no evidence of appreciable expansion of the earth's surface, it is hypothesized that the conveyor belt system must link zones of surface production with one of surface consumption. Creation occurs along the mid-ocean ridges; destruction occurs in areas of convergence. In terms of human experience, plate movement is very slow, perhaps up to 10 cm per year, but from the perspective of geologic time, relative motions of hundreds of kilometres are easily possible if the velocity of motion is sustained.

In common with the general pattern of bedrock geology, that of physiography can be divided into six major units — a portion of the Great Interior Plains in the northeast; an Eastern System containing the Rocky Mountains; the Cassiar-Columbia Mountains embracing the Cassiar, Omineca, and Columbia Mountains; an Intermontane System containing the Interior Plateau; the Coastal Mountain System; and a Western System that includes the Insular Mountain Area. The boundaries of these units reflect their tectonic origins, and in many places they are marked by major faults (see Maps 13 and 15).

The six physiographic regions reflect a long and complex geologic and tectonic history. The eastern units are believed to have originated in Precambrian time from a zone of sedimentation along the western side of the ancient continental landmass (North American craton). Somewhat later (in early Cambrian times), presumably as a result of relative movement of the crustal plates, a period of active mountain-building (orogeny) took place in the southeast, evidenced in the rocks of the Kootenay area. Still later, subduction activity increased and gave rise to a sequence of zones marked by steeply dipping faults. The most easterly of these is expressed in the present landscape by the Rocky Mountain Trench, a great, flat-floored rift valley that separates lower Paleozoic sedimentary rocks on the east from Proterozoic rocks of different types on the west.

The physiographic units lying west of the Rocky Mountain Trench have a complex history. They were much affected by events that took place later, from the Jurassic to early Tertiary period, notably the Coast Mountains orogeny. These events involved widespread folding and faulting and the intrusion of granitic batholiths (plutons) in the Insular Mountain Area, Coast Mountains, and Cassiar-Columbia region. Extensive metamorphism was an associated event in the Cassiar-Columbia region. A long interval of erosion ensued, sufficient to remove the cover of sedimentary rocks overlying the granitic intrusions. The eroded materials were deposited in each of two major basins, one along the coast, in the area now occupied by Vancouver Island and the Queen Charlotte Islands, the other in a geosyncline now occupied by the Rocky Mountains. Those mountains, while consisting of old sediments, are in fact relatively young, having been uplifted in Paleocene times (Laramide orogeny) as a result of plate activity and crustal shortening. As evidence of these processes, the western flanks of the Rocky Mountains are marked by the presence of shallow thrust faults.

During the Tertiary period, virtually all of the Cordilleran region was subjected to a long interval of erosion that resulted in a landscape of moderate relief. Erosion continued until late in the Tertiary, but local surface modification occurred, especially in the interior, as a result of vulcanism in the form of basaltic lava flows.

At the end of the Tertiary period, differential uplift and erosion occurred. In the Coast Mountains and Rocky Mountains total uplift was of the order of 1 km and resulted in deep incision by streams into what had been a subdued surface. These events established the main elements of the present topographic form of the province.

In broad terms then, the six main physiographic units in British Columbia may be defined on the basis of tectonic processes and geological evolution. Subdivisions within them are possible, based upon erosional/depositional processes and characteristics. Among the processes that have had a marked effect upon regional landscapes are those associated with glaciation. During Quaternary times, the entire province was glaciated in several cycles of ice advance (see Map 16). The mountain areas, plateau surfaces, and the major valleys, including fjords, have all been considerably modified by glaciation. It should be recognized, however, that much of what is seen in the present landscape is the work of streams acting through the aeons upon various rock and sediment surfaces. In that sense, glaciation can be considered to have produced mere embellishments, albeit interesting and often scenic ones, upon a pre-established landscape.

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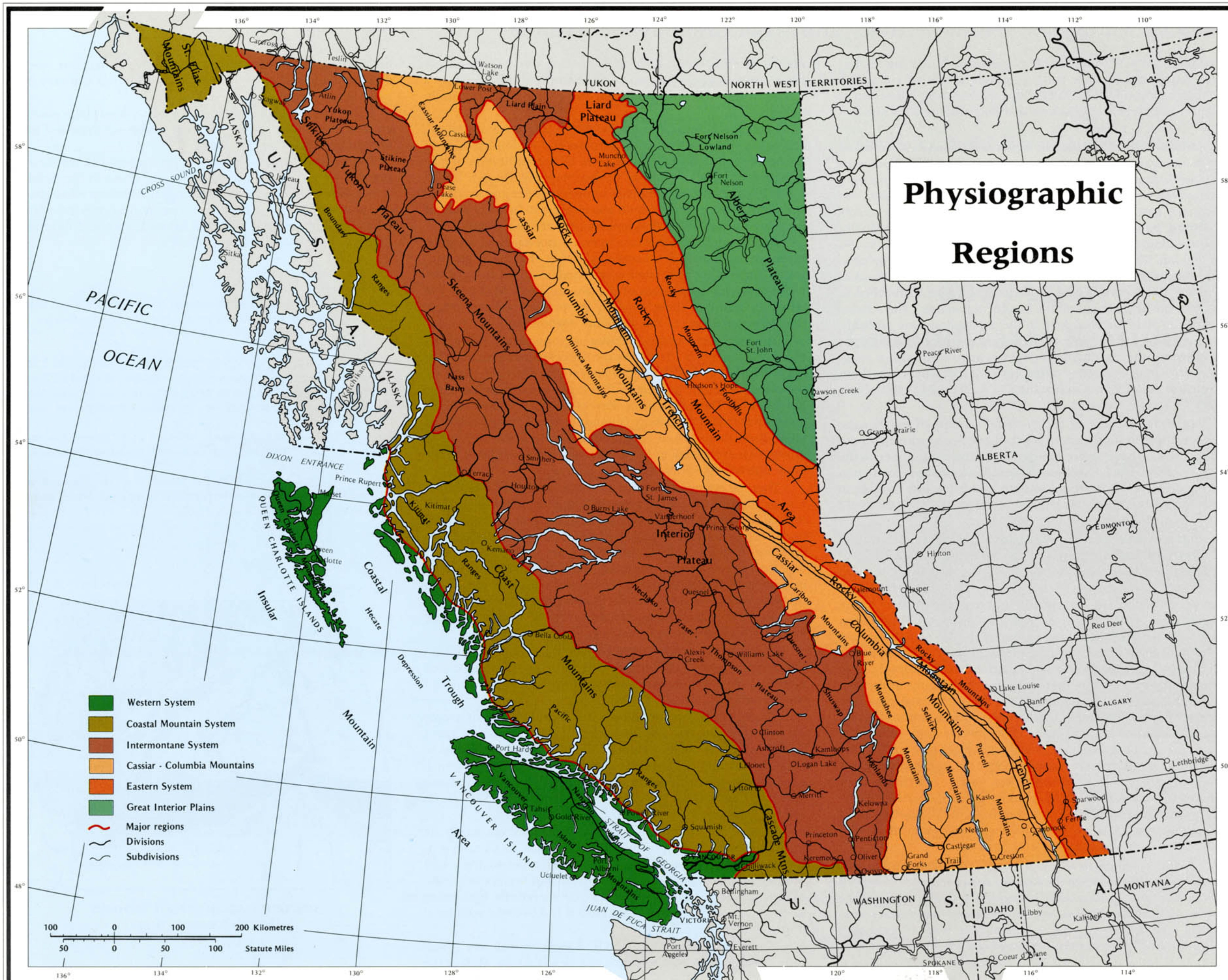
These terraces were formed by centuries of erosion and deposition by the Thompson River coursing through the Interior Plateau.


Physiographic Regions
Western System
Coastal Mountain System
Intermontane System
Cassiar - Columbia Mountains
Eastern System
Great Interior Plains
Major regions
Divisions
Subdivisions
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
WASHINGTON
IDAHO
MONTANA
ALASKA
U. S. A.
St. Elias Mountains
Yukon Plateau
Stikine Plateau
Boundary Ranges
Skeena Mountains
Nass Basin
Liard Plateau
Liard Plain
Fort Nelson Lowland
Alberta Plateau
Cassiar Mountains
Omineca Mountains
Columbia Mountains
Rocky Mountain Trench
Rocky Mountain Area
Rocky Mountains
Hudson's Hope Foothills
Interior Plateau
Nechako
Fraser
Thompson
Quesnel
Cariboo Mountains
Monashee Mountains
Selkirk Mountains
Purcell Mountains
Shuswap Highlands
Kitimat Ranges
Coast Mountains
Pacific Ranges
Cascade Mts
Coastal Trough
Hecate Depression
Insular Mountain Area
Queen Charlotte Islands
Vancouver Island
Strait of Georgia
Juan de Fuca Strait
Dixon Entrance
Cross Sound
Prince Rupert
Kitimat
Terrace
Smithers
Houston
Burns Lake
Fort St. James
Vanderhoof
Prince George
Quesnel
Williams Lake
Alexis Creek
Bella Coola
Port Hardy
Tahsis
Gold River
Ucluelet
Port Alberni
Nanaimo
Squamish
Victoria
Chilliwack
Lillooet
Lytton
Clinton
Ashcroft
Kamloops
Logan Lake
Merritt
Kelowna
Penticton
Princeton
Keremeos
Oliver
Osoyoos
Grand Forks
Trail
Castlegar
Nelson
Kaslo
Creston
Cranbrook
Fernie
Sparwood
Blue River
Valemount
Jasper
Hinton
Edmonton
Red Deer
Calgary
Banff
Lake Louise
Lethbridge
Peace River
Grande Prairie
Dawson Creek
Fort St. John
Fort Nelson
Muncho Lake
Dease Lake
Cassiar
Lower Post
Watson Lake
Teslin
Carcross
Atlin
Skagway
Juneau
Sitka
Ketchikan
Bellingham
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell

Map 15. Vulcanism, Seismic Activity, and Major Groundwater Features

Seismic activity, vulcanism, and, to some extent, thermal springs are related to large-scale earth processes associated with plate tectonics. Groundwater availability is more directly a function of climate, rock type and structure, and the nature and thickness of soil.

It is conceptualized that the North American Cordillera arose from interaction of the northwesterly moving Pacific Plate with the North American Plate, believed to be moving more strongly toward the west. In the eastern Pacific off Vancouver Island, the northerly part of the relatively small Juan de Fuca Plate moves eastward, passes under the continental margin, and is gradually absorbed into the upper mantle at depths ranging from about 250 to 700 km. The accompanying diagram illustrates the process. The plate arises along an offshore ridge and moves eastward at perhaps 3 to 4 cm per year. Its descending edge is absorbed at depth some distance east of the continental margin. The reheating of the plate material deep in the subduction zone probably gave rise to volcanoes such as Mt. Baker in adjacent Washington. Northward, the continental margin is associated with a long, steeply dipping, and active transform fault (the Queen Charlotte Fault, see Map 13), not unlike the San Andreas Fault of California.

In order to portray the regional pattern of earthquake events, those of southeastern Alaska have been included on the map. The data have been expressed as relative magnitudes on the Richter scale, which is calibrated logarithmically and based upon energy release. An earthquake of intensity 3 is just sensible to humans in the area of the epicentre; at intensity 6 (one thousand times as great), damage occurs to buildings.

Most of the seismic activity occurs in a north-south lineation off the coast that intersects with the mainland in the vicinity of Fairweather Mountain. This is a zone marked by prominent transform faults along the margins of the Pacific and North American plates. During the past quarter-century two strong earthquakes with epicentres in British Columbia have been recorded — one of Magnitude 8 occurred in 1949 just off the west coast of Graham Island, the other of magnitude 7.3 occurred near Comox in 1946. Magnitude and distance from populated places are not the only factors that influence the amount of damage ensuing from seismic events. Depth of the earthquake focus (the centre of energy-release), nature of the rock or unconsolidated material upon which man-made structures are built, and nature of those structures are also important. Evidence suggests that the focus of most earthquakes with epicentres in British Columbia is relatively shallow, averaging perhaps 16 km. For comparison, depths of over 600 km have been recorded elsewhere. Deep-focus earthquakes are felt over a wide area, but the surface effect is nowhere severe; conversely, shallow-focus events influence a limited area, but the surface effect is greater.

An international network of seismic recording stations now makes it possible to locate the focus of most earthquakes. Before 1900, however, information of any kind concerning seismic events in British Columbia was imprecise and fragmentary. Historical records indicate that an earthquake with an estimated magnitude of 7.5 occurred in 1872 and was felt over a broad area in central and southwestern British Columbia. The likelihood is that its epicentre was in the vicinity of Hope, which suggests that severe earthquakes are not restricted to the coastal zone — a matter of no small importance for the populous Lower Fraser Valley.

In a general sense, "groundwater" refers to water that occupies the spaces between soil particles and within fractures in the bedrock. Groundwater is supplied by the infiltration of precipitation or by seepage from stream channels. Though British Columbia has very large supplies of surface water and much use is made of them, groundwater is also important. In many places it provides the most easily developed source of water supply.

Because groundwater resources are not easily observable, inventory is difficult. It is known, however, that major groundwater supplies are associated with coarse-textured surficial deposits overlying large areas of the province (see Map 16). The most important of these deposits are in river valleys, where thicknesses in excess of 100 m are not uncommon.

The circulation and availability of groundwater that enters the bedrock is much affected by the rock type and structure (see Maps 13 and 14). In the Interior Plateau, for example, there are thousands of square kilometres that are covered with flat-lying, basaltic lavas. These structures allow relatively free circulation of groundwater, and springs are commonly found at the base of the lavas. Both thermal and non-thermal springs tend to occur in groups that are related to the same geological structure or to the same system of groundwater flow.

Thermal springs are defined as those that have a temperature significantly above the mean annual air temperature in their region. They are associated with areas where groundwater circulates deeply. In so doing it is heated and may also come in proximity to young intrusive masses that are at a higher temperature than the rocks of surrounding areas. As can be seen on the map, thermal springs in British Columbia are spatially grouped in six main areas — coastal islands, the Harrison-Lillooet area, the central coast, Stikine area, Northern Rocky Mountains, and Selkirk-Rocky Mountain Trench area.

Of the three in the coastal islands, that at Sharp Point on Vancouver Island is the largest. This spring may be associated with deep penetration of seawater in a region of intrusive rock of late Tertiary age.

Those in the Harrison-Lillooet area occur in a zone of steeply dipping faults in the granitic rocks of the Coast Mountains. Groundwater, percolating through the fault zones, penetrates to great depths and is heated as a result of normal geothermal conditions in the earth's crust. Of this group, the largest and best known is Harrison Hot Springs. It is shown on the map as a single symbol, but there are in fact two springs.

Most of the thermal springs in the central coast group are associated with zones of fractured metamorphic rock in the generally uniform crystalline (quartz diorite) rocks of the Coast Mountains. The only one of this group that has been developed is at Lakelse Lake near Terrace. It has a comparatively high mean temperature of 86°C, and since 1958 it has become a regional tourist attraction.

The Stikine group appears to be associated with recent volcanic activity and in that respect is unique in Canada. Most of the individual springs in the group are associated with major, steeply dipping faults and with volcanic cones, of which the now dormant Mount Edziza is the largest.

Thermal springs in the northern Rocky Mountains occur in an area of old sedimentary rocks of calcareous type and have formed large limestone terraces.

With the exception of Harrison Hot Springs, the best-known thermal springs in British Columbia are those in the Selkirk-Rocky Mountain Trench area. Halcyon Hot Springs was once the site of a sanatorium used in the treatment of tuberculosis patients. Radium and Fairmont are better known and have been extensively developed as tourist resorts.

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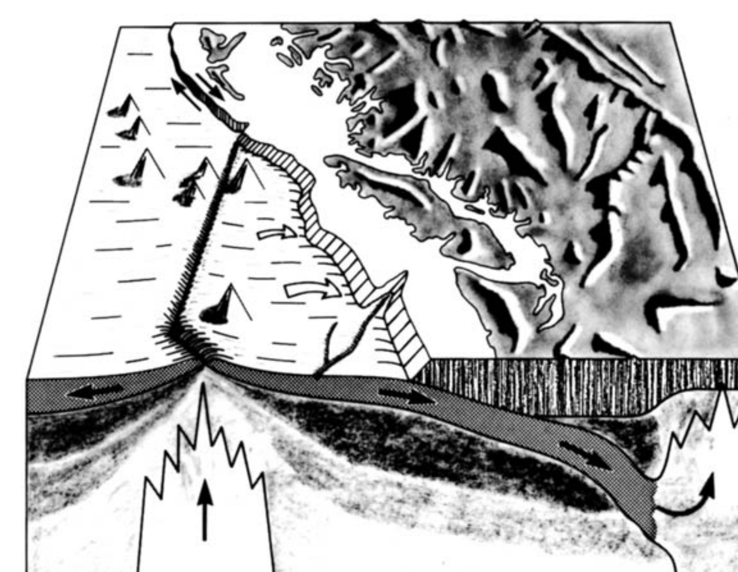
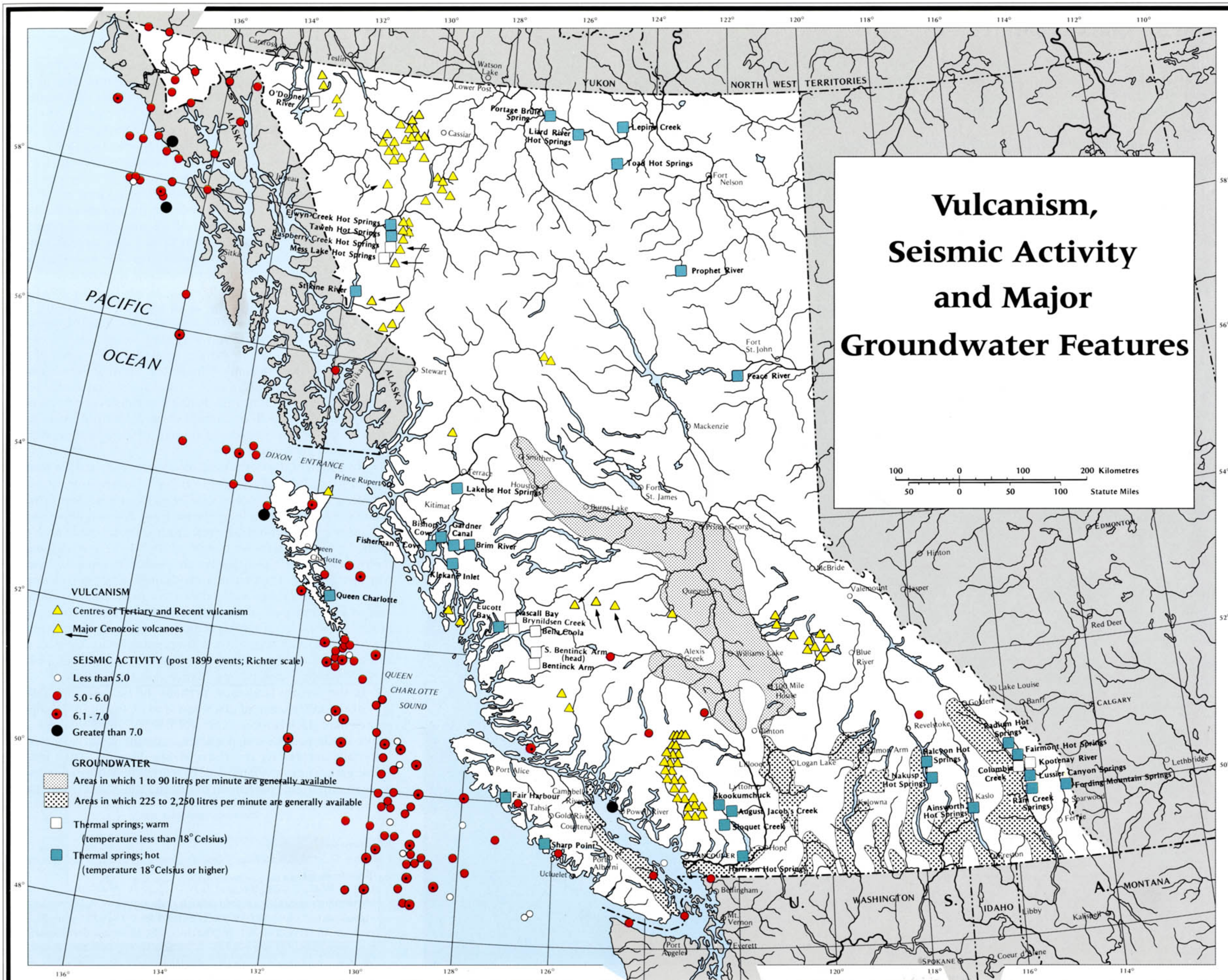


SCHEMATIC DIAGRAM OF PLATE TECTONICS
BRITISH COLUMBIA COAST



Vulcanism, Seismic Activity and Major Groundwater Features
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
VULCANISM
Centres of Tertiary and Recent vulcanism
Major Cenozoic volcanoes
SEISMIC ACTIVITY (post 1899 events; Richter scale)
Less than 5.0
5.0 - 6.0
6.1 - 7.0
Greater than 7.0
GROUNDWATER
Areas in which 1 to 90 litres per minute are generally available
Areas in which 225 to 2,250 litres per minute are generally available
Thermal springs; warm (temperature less than 18° Celsius)
Thermal springs; hot (temperature 18° Celsius or higher)
PACIFIC OCEAN
DIXON ENTRANCE
QUEEN CHARLOTTE SOUND
ALASKA
YUKON
NORTH WEST TERRITORIES
WASHINGTON
IDAHO
MONTANA
U. S. A.
O'Donnel River
Portage Brule Springs
Liard River Hot Springs
Lepine Creek
Toad Hot Springs
Elwyn Creek Hot Springs
Taweh Hot Springs
Raspberry Creek Hot Springs
Mess Lake Hot Springs
Stikine River
Prophet River
Peace River
Lakelse Hot Springs
Bishop Cove
Gardner Canal
Fisherman Cove
Brim River
Klekane Inlet
Queen Charlotte
Eucott Bay
Nascall Bay
Brynildsen Creek
Bella Coola
S. Bentinck Arm (head)
Bentinck Arm
Fair Harbour
Sharp Point
Skookumchuck
August Jacob's Creek
Sloquet Creek
Harrison Hot Springs
Halcyon Hot Springs
Nakusp Hot Springs
Ainsworth Hot Springs
Radium Hot Springs
Fairmont Hot Springs
Kootenay River
Lussier Canyon Springs
Fording Mountain Springs
Ram Creek Springs
Columbia Creek
Teslin
Carcross
Watson Lake
Lower Post
Cassiar
Juneau
Sitka
Fort Nelson
Fort St. John
Stewart
Ketchikan
Mackenzie
Prince Rupert
Terrace
Kitimat
Smithers
Houston
Burns Lake
Fort St. James
Prince George
McBride
Valemount
Jasper
Hinton
Edmonton
Red Deer
Quesnel
Alexis Creek
Williams Lake
Blue River
100 Mile House
Lake Louise
Banff
Golden
Calgary
Revelstoke
Clinton
Lillooet
Logan Lake
Salmon Arm
Lytton
Kelowna
Hope
Kaslo
Creston
Sparwood
Fernie
Lethbridge
Port Alice
Campbell River
Tahsis
Gold River
Courtenay
Powell River
Port Alberni
Ucluelet
Vancouver
Bellingham
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell

Map 16. Glacial Features

Much of Canada bears evidence of having been glaciated at one time or another during the Quaternary period. Nowhere are the effects of glaciation more evident than in British Columbia, where features of erosion and deposition by glacial ice are ubiquitous.

The Pleistocene epoch began about two million years ago, and during it several fluctuations in the quantity and distribution of glacial ice occurred. Different hypotheses have been advanced to explain these changes, but evidently they were linked with climate variations. In principle it is recognized that ice accumulation began in the higher elevations in much the same pattern evidenced by present-day glaciers. Accumulation started in alpine areas where snowfall was most abundant, but as the alpine ice became more extensive, it tended to spread. Thus, in the course of time, alpine ice that had accumulated in individual zones coalesced to form a complete Cordilleran ice-sheet. At its maximum extent, the ice-sheet covered all of British Columbia, merging in the northeast with the continental ice-sheet and attaining an estimated maximum elevation in excess of 2,400 m. The ice was thickest over the southern half of the province, but even in the north it is believed to have stood some 1,000 m above the present average terrain level.

Glaciers move under the force of gravity because ice is plastic under the great pressures produced by its own mass. The motion is slow but inexorable, and when an ice-sheet is thick it moves radially outward from the centre of accumulation. It continues to flow so long as the rate of ice accumulation (through precipitation) exceeds the rate of melting and evaporation. An alpine glacier moves in the same way, but it is constrained to follow the general contours of pre-existing stream valleys. In the course of motion the basal portions of glaciers become heavily charged with rock and soil debris. Under the pressure of ice above, the debris is a highly effective abrasive tool, scouring, rounding, and smoothing the underlying surface. When large boulders or particularly resistant rock fragments come in contact with bedrock, they cut grooves or striations that may be left exposed after the ice retreats. It is partly from interpreting such evidence that geologists are able to reconstruct the direction of ice movement. Interpretation is not easy, however, because successive ice advances may leave different sets of striations. In some cases the various directions of flow can be determined. These are shown on the map by small arrows included in the groups of lineation symbols. The composite pattern of ice movement during the Pleistocene epoch is complex, but at any one stage it can be assumed that the flow was in response to gravity and that it was most rapid in the direction of least frictional resistance.

The valleys of the Beaver and Duncan glaciers in the Columbia Mountains show many features characteristic of alpine glaciation.

Because the earth's crust has some elasticity, it was gradually warped downward under the increasing ice load. During the retreat of the glaciers the land began to flex upward (isostatic rebound), but the process was very slow in comparison to the rate of ice-retreat, and in early post-glacial times parts of the coastal lowlands were flooded by the sea. Uplift of the terrestrial surface has continued, however, so that stream deltas that were built along the coastal margin during late Pleistocene times now stand some 60–90 m above present sea level. Many of these have been commercially utilized as sources of sand and gravel for construction purposes.

Recession of the Cordilleran ice-sheet resulted in the formation of many depositional features. Debris carried in the basal portion of the ice was transported by meltwater streams flowing under the ice or issuing from the ice front and was deposited in various ways, including outwash aprons, eskers, and kame terraces. In cases where the supply of meltwater was sustained, meltwater channels or spillways are produced, some of them of considerable size. The Chasm, near Clinton, is but one example; there are many others, especially in southern British Columbia and in adjacent parts of Washington State. Among the more important features of ice-deposition are the sediments forming the beds of glacial lakes. In the Okanagan, Prince George, and Peace River areas fine-textured, arable soils have developed on such old lakebeds and are important to local agriculture.

In the present landscape, perhaps the most striking reflection of the inheritance of glaciation is to be found in the alpine areas where glacial processes are still at work. Sharply-sculptured peaks, U-shaped valleys, icefields, moraines, and spectacular waterfalls are among the characteristic features. They lend a scenic grandeur to the landscape that attracts visitors and constitutes an important component of British Columbia's recreational resources.

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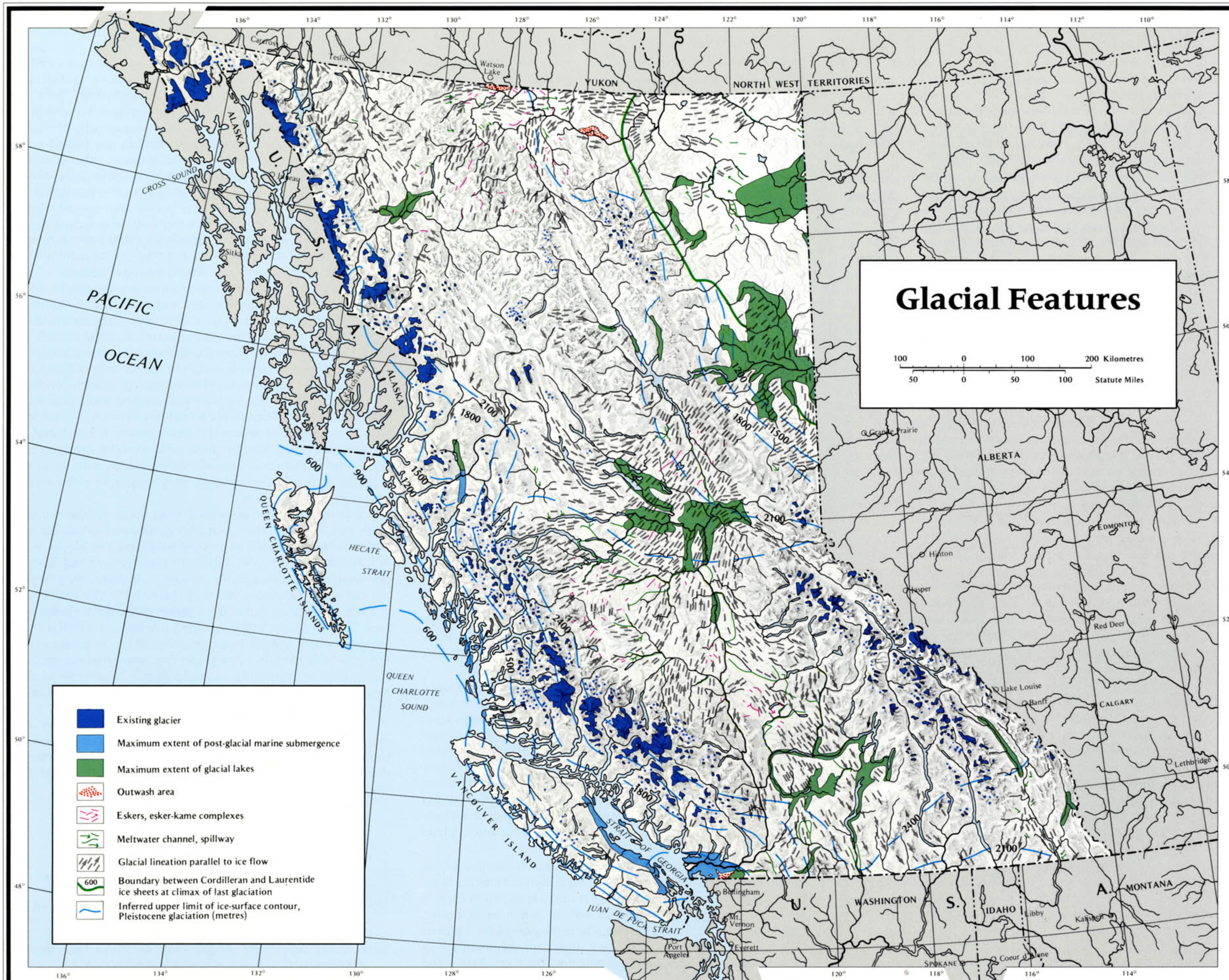
Glacial Features
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Existing glacier
Maximum extent of post-glacial marine submergence
Maximum extent of glacial lakes
Outwash area
Eskers, esker-kame complexes
Meltwater channel, spillway
Glacial lineation parallel to ice flow
600
Boundary between Cordilleran and Laurentide ice sheets at climax of last glaciation
Inferred upper limit of ice-surface contour, Pleistocene glaciation (metres)
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
CROSS SOUND
Watson Lake
Teslin
Sitka
Grande Prairie
Edmonton
Hinton
Jasper
Red Deer
Lake Louise
Banff
Calgary
Lethbridge
Bellingham
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell
600
900
1200
1500
1800
2100
2400

Map 17. Soils

Soil is the unconsolidated mineral or organic material on the surface of the land which is capable of supporting plant growth. It covers the entire surface of the province except where perennial icefields exist or where solid bedrock is exposed. But soils differ from location to location. On the dry slopes of the southern Okanagan Valley, for example, the silt terraces are very different from the alluvial soils of the lower Fraser Valley.

In any area, the nature of the soil present is the result of several environmental factors acting through time. Principal among them are parent material, topography, climate, vegetation, and soil organisms. Consequently, the distributional pattern represented on this map shows some similarities to bedrock geology, terrain, precipitation and temperature, and biogeoclimatic regions. Partly because the interaction between the various factors is highly complex, the similarities are general; coincidence of pattern is rare.

Parent Material is the rock or organic material from which soil develops. To a large extent, parent material governs texture, mineral composition, permeability, and stoniness of a soil.

Climate modifies the parent material through chemical and mechanical weathering and erosion and, indirectly, through the type of vegetation growing on the surface. Temperature as well as precipitation is important in the weathering of minerals and in the decomposition of organic matter into humus. Climate also plays a role in the physical disintegration of soil particles as a result of freezing and thawing, wetting and drying. Water and wind move soil particles from one place to another. Water also moves particles through the soil in solution and in suspension (leaching).

Vegetation contributes much needed material to soil. Organic matter and rock minerals are the sources of soil fertility. Under natural conditions, the type and amount of organic matter seasonally added to the soil give rise to distinctly different soils. For example, a soil that develops under a deciduous forest will be quite different from that under a coniferous forest.

Organisms important in soil formation range from microscopic plants and animals to earthworms, rodents, and man. Microscopic plants and animals aid in the decomposition of organic matter and in the weathering of minerals. Earthworms and rodents mix the upper layers of the soil, and man modifies the land surface in his agricultural, forestry, and industrial enterprises.

Topography influences soil development through drainage, angle of slope, and aspect of slope. Soil on a slope is often better drained than soil of the same texture on a flat area. Soil particles on a steep gradient gradually move downslope, and, in extreme cases, large volumes of soil and bedrock may slide or slump. The soil on a south-facing slope is drier and warmer than that on a north-facing slope.

Time also affects soil development. Gradually, more and more minerals are weathered and changed, more organic matter is added and decomposed, and more leaching and mixing of the soil occurs. Young soils are shallow and very like the original parent material, whereas in old soils the parent material may be almost unrecognizable.

The Canadian system of soil classification makes it possible to study and map individual soils. It arranges soils according to properties that for the most part are connected with particular groups of soil-forming factors and processes. In effect, soils are grouped according to the way in which they are formed; each group is associated with a particular environment.

The accompanying map shows the distribution of the first two categories of soils within the classification: the *Soil Order* (e.g. A, Brunisolic Soils) and the *Great Soil Group* (e.g. A1, Eutric Brunisol). In the legend the United States soil classification equivalent has been added in parentheses so that the pattern shown for British Columbia may be compared with other areas.

Brunisolic Soils occur under relatively open coniferous and, sometimes, deciduous forest. They are well-drained, but the parent material has been only slightly changed by moderate soil weathering. On the mountains and plateaus in the north, the change is slight because winters are long and mean annual temperatures are low. In southern interior valleys and east of the Rocky Mountains these soils are the result of coarse-textured parent material and relatively high rates of evapotranspiration. *Eutric Brunisols* occur in dry environments with little leaching. *Dystric Brunisols* occur in wetter environments; soluble salts and calcium carbonate have been leached.

Chernozemic Soils form under grasslands in the southern valleys under conditions of high summer temperatures, low rainfall, and high rates of evapotranspiration. Moisture is insufficient to support tree growth under natural conditions. The annual addition of organic matter from grass items and roots results in a dark topsoil. Chernozemic soils are fertile but often droughty. The *Brown, Dark Brown, Black* soils form a sequence from the drier to the wetter parts of the grasslands. The *Dark Gray* soils occur along the grassland/forest margins.

Cryosolic Soils contain permafrost (permanently frozen ground) because of their association with cold, exposed locations in higher latitudes. In northeastern British Columbia they occur in cold, organic terrain (muskeg) where a peat-like organic mat forms a surface blanket and soil water does not completely thaw in summer *(Organic Cryosols)*. In higher terrain, *Cryosols* occur in mineral soils where, because of elevation and exposure, prevailing soil temperatures are below freezing *(Turbic* and *Static Cryosols)*.

Gleysolic Soils are those that are saturated for long periods of the year. They develop under conditions where water will not drain away as fast as it is added to the soil. In the Peace River area, for example, fine-textured soils of low permeability derive from shale parent material in flat topography. In the lower Fraser River valley they are associated with high water-table conditions in proximity to the river. Such soils also occur in many other areas of British Columbia in depressions at the foot of slopes where there are better-drained soils. *Humic Gleysol* has an organic topsoil. *Luvic Gleysol* has clay accumulation in the subsoil. A true *Gleysol* has neither.

Luvisolic Soils have as their main feature a clay accumulation in the subsoil as a result of leaching from above. Sometimes an impervious layer ("hardpan") that restricts root penetration is produced. The largest expanse of soils of this type in British Columbia is in the central interior where they develop on parent material derived from basaltic rock under coniferous forest in which Douglas-fir and lodgepole pine are abundant. East of the Rocky Mountains they occur on shales and sandstones under a mixed forest of aspen and white spruce. The *Gray Luvisol* has a light-gray, leached topsoil of clay and organic matter.

Organic Soils differ from mineral soils not only because of the nature of the parent material, but also because it is constantly accumulating. *Fibrisols, Mesisols,* and *Humisols* are formed under saturated conditions with very poor soil drainage, either in areas of flat topography and impermeable parent materials (in northeastern British Columbia, for example) or in areas of very high rainfall (northern coastal area). *Fibrisols* are poorly decomposed, *Mesisols* moderately decomposed, and *Humisols* well decomposed. *Folisols* are well-drained, unsaturated organic soils that have formed on the flanks of the Coast Mountains as a result of the accumulation of large amounts of forest litter directly on top of bedrock.

Podsolic Soils are well-drained but infertile soils in which leaching is extreme. Clay, organic matter, iron, and aluminum are leached from the topsoil into the subsoil. They are associated with coarse-textured, acidic parent materials, high rainfall, and dense coniferous forest. *Ferro-humic Podsols* are characterized by an accumulation of organic matter in the subsoil; in *Humo-ferric Podsols,* iron and aluminum are the main accumulation products.

Regosolic Soils are very poorly developed and occur either where the parent materials are recent (for example, alluviums in river floor plains) or where the environment is harsh and the process of chemical weathering is very slow (for example, high alpine areas). *Regosols* are usually very shallow, with the parent materials only slightly modified; they may have some organic matter in the surface layer.

Solonetzic Soils are associated with areas of low moisture index (see Map 22). They contain high amounts of soluble salts, which cause the subsoil to become very hard and blocky when dry. The concentration of salts limits plant growth and in many cases only salt-tolerant plants survive. In British Columbia they are not really extensive, but they do occur in the Peace River country where they derive from highly saline marine shale bedrock. They also exist in the southern interior in areas of internal drainage where soil water evaporates and leaves an accumulation of soluble salts. In a few places the concentrations are sufficiently large to constitute a mineral resource. *Solods* occur in areas marginal to the true solonetzic type where rainfall is sufficient to leach away the more soluble components.

Lithic Soils do not constitute a distinct soil order. The term may be applied to soils of any order that are characterized by shallow bedrock. In British Columbia they are most common in the mountainous areas where they are mainly of the *Lithic Podzolic* type.

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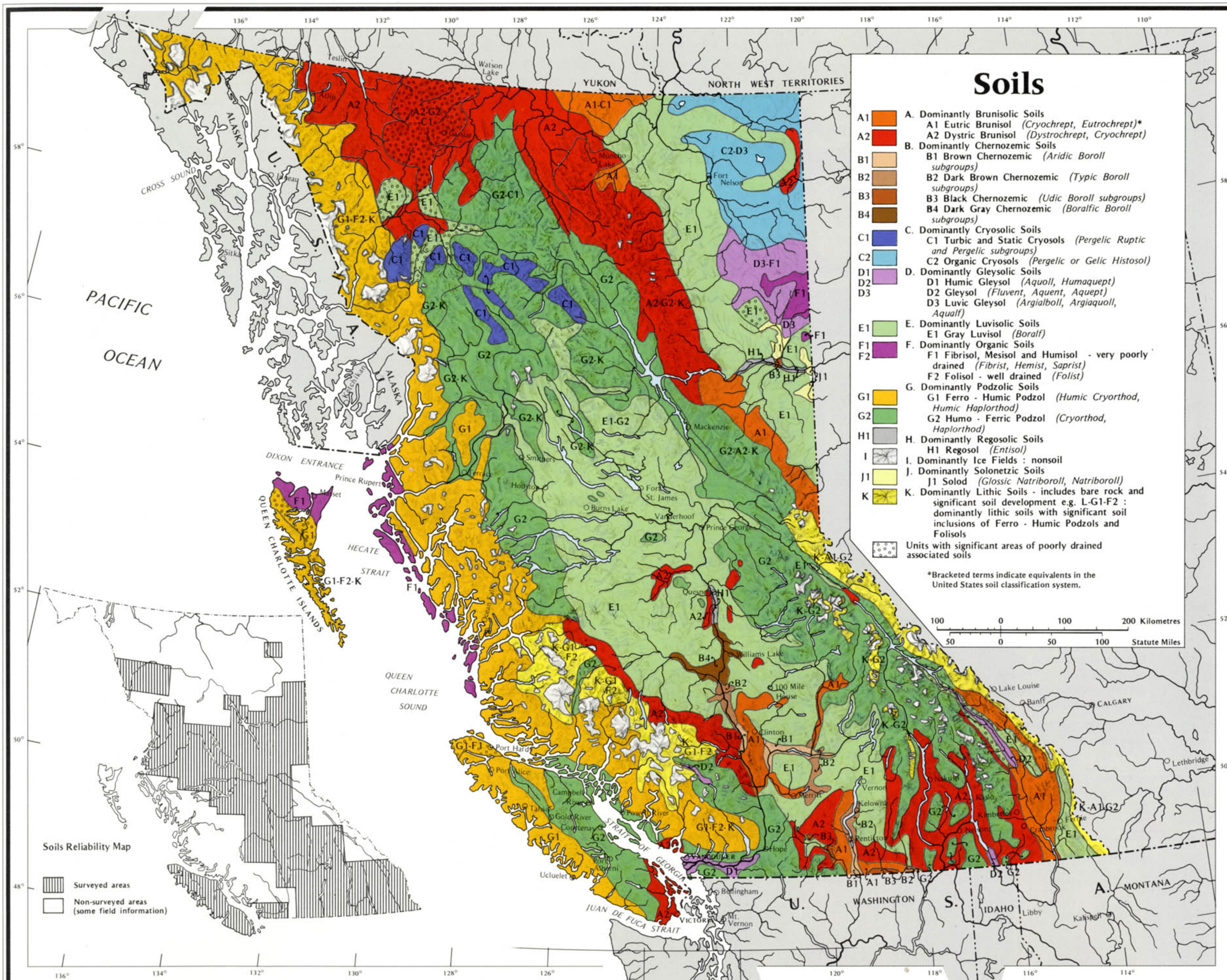
Soils
A1 A2 A. Dominantly Brunisolic Soils
A1 Eutric Brunisol (Cryochrept, Eutrochrept)*
A2 Dystric Brunisol (Dystrochrept, Cryochrept)
B. Dominantly Chernozemic Soils
B1 Brown Chernozemic (Aridic Boroll subgroups)
B2 Dark Brown Chernozemic (Typic Boroll subgroups)
B3 Black Chernozemic (Udic Boroll subgroups)
B4 Dark Gray Chernozemic (Boralfic Boroll subgroups)
C. Dominantly Cryosolic Soils
C1 Turbic and Static Cryosols (Pergelic Ruptic and Pergelic subgroups)
C2 Organic Cryosols (Pergelic or Gelic Histosol)
D. Dominantly Gleysolic Soils
D1 Humic Gleysol (Aquoll, Humaquept)
D2 Gleysol (Fluvent, Aquent, Aquept)
D3 Luvic Gleysol (Argialboll, Argiaquoll, Aqualf)
E. Dominantly Luvisolic Soils
E1 Gray Luvisol (Boralf)
F. Dominantly Organic Soils
F1 Fibrisol, Mesisol and Humisol - very poorly drained (Fibrist, Hemist, Saprist)
F2 Folisol - well drained (Folist)
G. Dominantly Podzolic Soils
G1 Ferro - Humic Podzol (Humic Cryorthod, Humic Haplorthod)
G2 Humo - Ferric Podzol (Cryorthod, Haplorthod)
H. Dominantly Regosolic Soils
H1 Regosol (Entisol)
I. Dominantly Ice Fields : nonsoil
J. Dominantly Solonetzic Soils
J1 Solod (Glossic Natriboroll, Natriboroll)
K. Dominantly Lithic Soils - includes bare rock and significant soil development e.g. L-G1-F2 : dominantly lithic soils with significant soil inclusions of Ferro - Humic Podzols and Folisols
Units with significant areas of poorly drained associated soils
*Bracketed terms indicate equivalents in the United States soil classification system.
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Soils Reliability Map
Surveyed areas
Non-surveyed areas (some field information)
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
CALGARY
VICTORIA

Map 18. Streamflows

Water in the environment is often considered in cyclical terms. The hydrologic cycle refers to the movement of water as solid, liquid, or vapour from the atmosphere to the earth's surface and back into the atmosphere. In a simple expression of this cycle, water evaporated from land and sea surfaces and transpired by plants enters the atmosphere as water vapour. If the air is then cooled sufficiently, condensation occurs, clouds form, and precipitation may result. If the precipitation is in the form of snow or hail, it will either accumulate or melt, though re-evaporation and sublimation may also take place. If water returns to the surface in the form of rain most of it will, like snow meltwater, either enter the soil or flow as surface runoff. Some of it will be lost to re-evaporation. Moisture that enters the soil tends to move laterally to intersect stream channels, but sometimes it penetrates deeply in its subterranean course (see Map 15). It may also be taken up by the roots of plants. Water that runs off on the surface accumulates in the valleys as streamflows. Thus, streamflows provide insights into the nature of the hydrologic cycle in a given area because they reflect the relationship between precipitation, rock structure, soils, and vegetation in that area.

Flow records are not available for all streams. On the map the wide lines overlying the main stream courses represent the volume of flow recorded for them. Where flow-lines are shown, the line width is made proportional to the flow at different gauging stations. The stations are represented by short, transverse lines across the flow. For simplicity, the river discharge is assumed to vary uniformly between any two successive stations.

From the spatial pattern of streamflows as an expression of water availability, it is obvious that British Columbia is generously endowed with water in most regions. It should be remembered, though, that the map shows only the quantity of water discharged by streams, not water quality. Some aspects of the latter are expressed on the succeeding map page.

The Fraser River drainage basin occupies about one-quarter of the total area of the province. Among British Columbia streams it has the greatest mean annual discharge; approximately 3,600 cubic metres per second empty into the Strait of Georgia. Although the Fraser River is not among Canada's largest, its flow is sufficient to transport a great volume of sediment. Ultimately this material is deposited in the lower reaches of the river or carried to the sea, and this erosional/depositional process, continuing over thousands of years, has built the fertile lowland that stretches some 140 km from Hope to the Strait of Georgia.

COMPARISON OF BRITISH COLUMBIA'S MAJOR STREAMS
(Figures are Approximate)

Stream	Mean Annual Discharge (m^3/sec)	Drainage Basin Area (km^2)	Water Yield Expressed as Discharge/km^2 of Drainage Basin (litres/sec)
Fraser	3,600	230,000	15.7
*Columbia	2,800	88,000	31.8
*Peace	1,400	99,000	14.1
*Liard	1,300	135,000	9.6
Skeena	1,000	42,000	23.8
*Stikine	1,000	29,000	34.5
*Nass	900	21,000	42.9
*Taku	250	17,000	14.7

*B.C. portion only

The fact that the Fraser River has a high discharge is partly a function of its relatively large drainage basin. But as the table shows, it is possible to compare the water yield of different-sized drainage basins by considering discharge per unit area.

Among the major streams, the Nass River, with a drainage basin area less than one-tenth that of the Fraser, provides the highest water yield. The Columbia, second only to the Fraser in total discharge at the international border, has a higher water yield. In fact, the water yield per unit area in the British Columbia portion of the Columbia is substantially higher than the average for the United States' portion, an important consideration in connection with the International Columbia River Treaty.

The inset graphs show the seasonal regimes of a selection of British Columbia streams. The profiles from stream to stream vary largely because of differences in precipitation and temperature of the respective areas. The Cowichan River on Vancouver Island, for example, has a seasonal pattern that suggests it is rain-fed, the discharge being much higher in the fall and winter months than in the summer when rainfall is modest. Most of the graphs shown, though, display the characteristics of snow-fed streams, peak discharges occurring at the time of maximum snow (or glacial) melt. In the northeast especially, snowmelt is complemented by the precipitation regime, since maximum rainfall occurs in the summer months.

The fact that peak flows on the major streams occur not long before the time of peak water demand is of some importance in water management, especially in connection with the availability of water for irrigation. The relationship is not always advantageous because a protracted warm spell in early summer usually causes rapid snowmelt. The high streamflows that result may be excessive and can cause serious erosion and, in low-lying areas, flooding and economic loss. Consequently, much of the lower Fraser Valley and the Creston area (lower Kootenay River) is protected by dikes. The protection they give is only partial, however. A surer solution to these problems could be achieved by the construction of dams to impound the excess water. Still, the large structures that would likely be needed have their own disadvantages. They would be costly to build, the large reservoirs created would lead to conflicts over land use, and there would be serious problems for fisheries management.

Although possible resolutions to such seemingly intractable problems have long been the focus of discussion among resource authorities in British Columbia, in the broader continental perspective British Columbians are fortunate in having such a generous water endowment.

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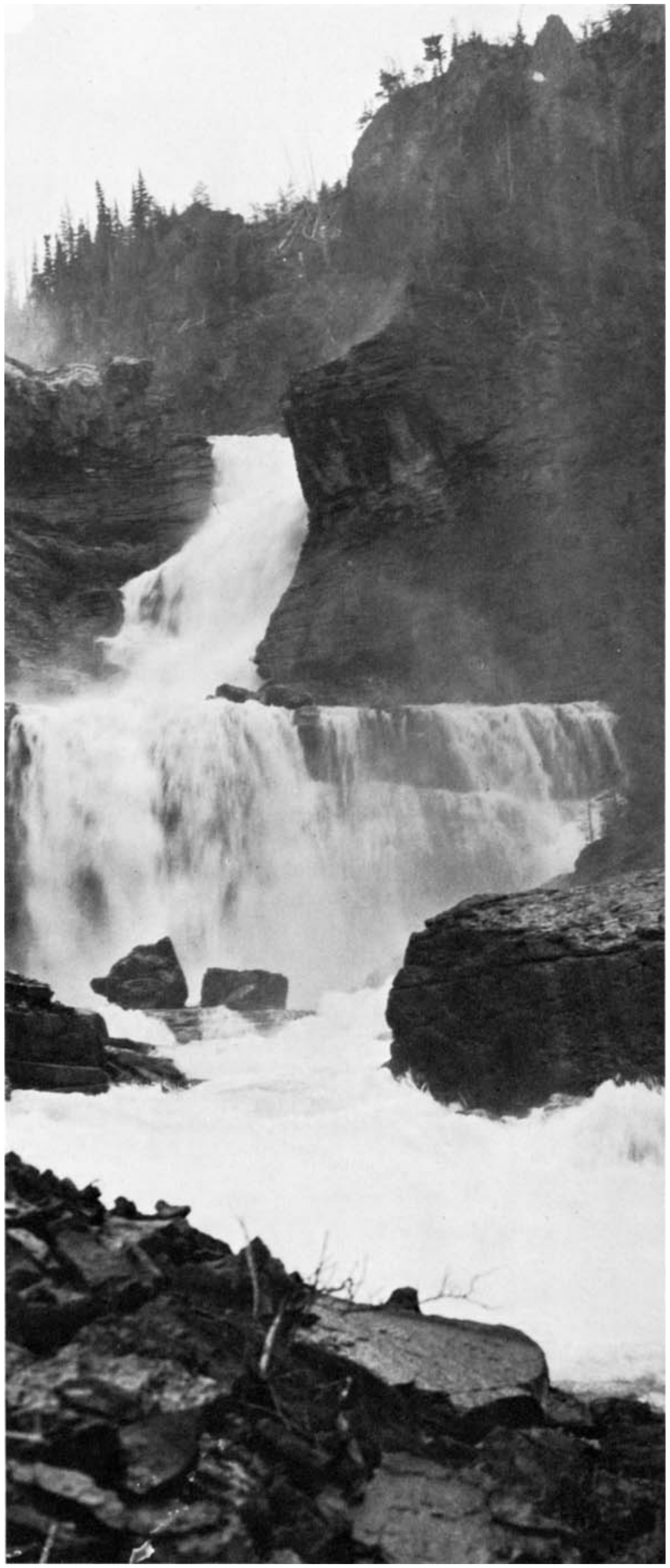
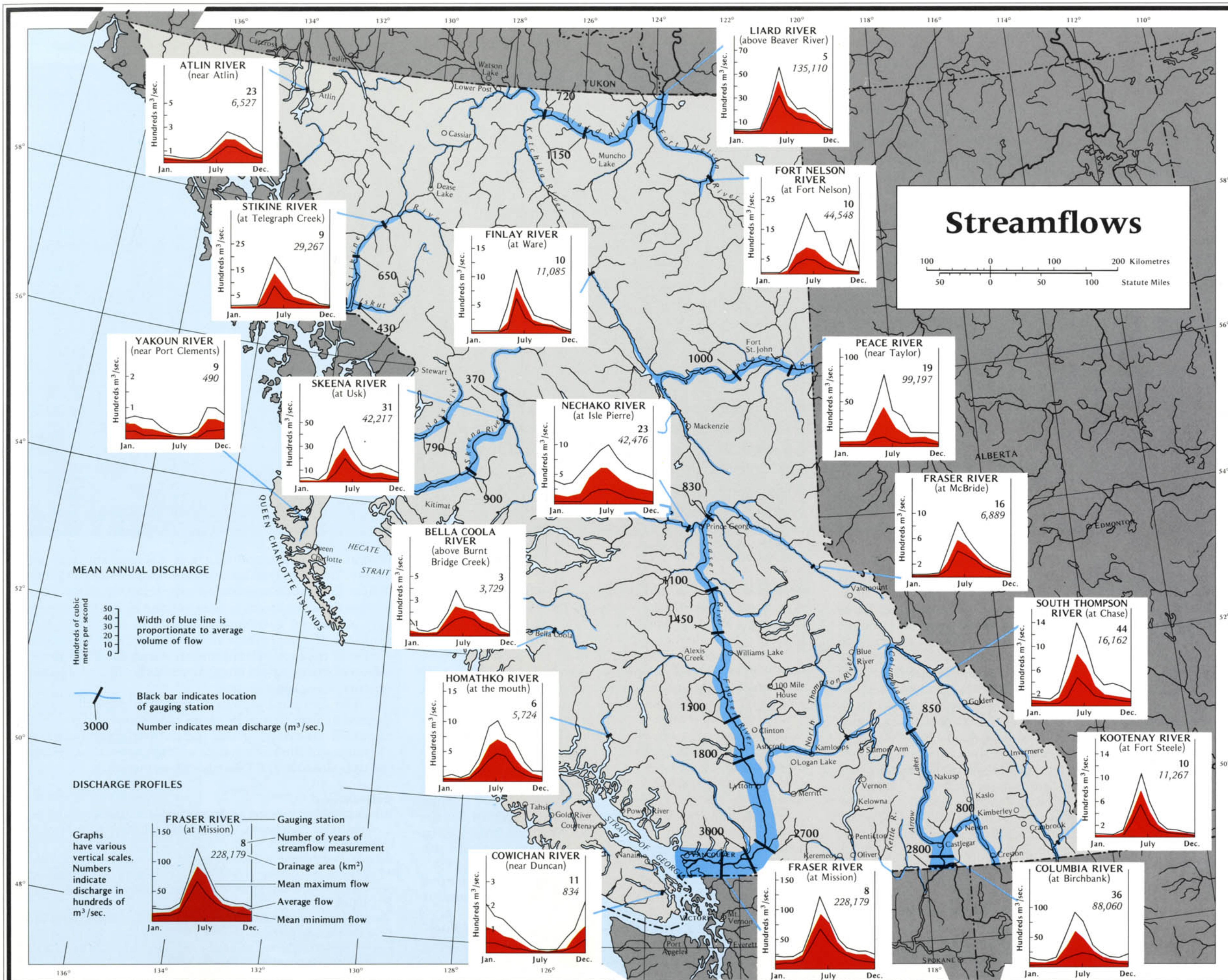


White Falls on the Robson Trail is typical of the profile of many of British Columbia's mountain streams.



Streamflows
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
ATLIN RIVER (near Atlin) 23 6,527
STIKINE RIVER (at Telegraph Creek) 9 29,267
YAKOUN RIVER (near Port Clements) 9 490
SKEENA RIVER (at Usk) 31 42,217
FINLAY RIVER (at Ware) 10 11,085
NECHAKO RIVER (at Isle Pierre) 23 42,476
LIARD RIVER (above Beaver River) 5 135,110
FORT NELSON RIVER (at Fort Nelson) 10 44,548
PEACE RIVER (near Taylor) 19 99,197
FRASER RIVER (at McBride) 16 6,889
BELLA COOLA RIVER (above Burnt Bridge Creek) 3 3,729
HOMATHKO RIVER (at the mouth) 6 5,724
SOUTH THOMPSON RIVER (at Chase) 44 16,162
KOOTENAY RIVER (at Fort Steele) 10 11,267
COWICHAN RIVER (near Duncan) 11 834
FRASER RIVER (at Mission) 8 228,179
COLUMBIA RIVER (at Birchbank) 36 88,060
Hundreds m³/sec.
Jan. July Dec.
MEAN ANNUAL DISCHARGE
Hundreds of cubic metres per second
Width of blue line is proportionate to average volume of flow
Black bar indicates location of gauging station
3000
Number indicates mean discharge (m³/sec.)
DISCHARGE PROFILES
Graphs have various vertical scales. Numbers indicate discharge in hundreds of m³/sec.
Gauging station
Number of years of streamflow measurement
Drainage area (km²)
Mean maximum flow
Average flow
Mean minimum flow
YUKON
ALBERTA
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
STRAIT OF GEORGIA
720 1150 650 430 370 790 900 1000 830 1100 1450 1500 1800 3000 2700 2800 800 850
Atlin Teslin Watson Lake Lower Post Cassiar Muncho Lake Dease Lake Stewart Kitimat Fort St. John Mackenzie Prince George Valemount Williams Lake Alexis Creek Blue River 100 Mile House Clinton Ashcroft Kamloops Salmon Arm Logan Lake Merritt Lytton Vernon Kelowna Penticton Oliver Keremeos Nakusp Kaslo Nelson Castlegar Kimberley Cranbrook Creston Invermere Golden Edmonton Bella Coola Tahsis Gold River Courtenay Powell River Nanaimo Vancouver Victoria Port Angeles Mt. Vernon Everett Spokane
Liard River Fort Nelson River Kechika River Finlay River Peace R. Stikine River Iskut River Nass River Skeena River Fraser River North Thompson River Columbia River Arrow Lakes Kettle R.

Map 19. Water Quality

The water resource varies in quantity and in quality both in time and in space. Some aspects of the variation in quantity are outlined in the preceding text and on Map 15.

Among the attributes of water quality that are readily measurable are clarity (expressed as turbidity), temperature, and chemical content. Depending upon the use to which the water is put, any or all of these and a number of other variables may be of considerable importance. For example, a sports fisherman is likely to prefer a clear stream to a turbid one regardless of the dissolved mineral content; the supervisor of a steam plant is likely to be more concerned about the relative water hardness of boiler feed than about its temperature. Because water is a universal solvent, it is readily contaminated with various solutes. It is also the environment for a number of life forms, and, in addition, it is capable of holding organic and inorganic material in suspension. Consequently, even an apparently pristine streamlet coursing through a high alpine meadow may be "polluted" in the sense that it contains a higher bacterial count, dissolved mineral content, or suspension load than can be tolerated for the particular use to which it is to be put.

The three maps on the accompanying page are based upon data collected at water sampling stations, most of which were of a temporary nature, operated only for a short period during the summer. Since they do not include sampling of groundwater, they are incomplete. Partly because of this, and because of the need for a simple way of portraying the data, the assumption was made that the water conditions recorded at any one station extended uniformly upstream to the next recording station or to the stream source. While detailed comparison cannot be made, the result provides a general indication of the spatial distribution of water quality.

In the light of general quality guidelines and minimum standards to be met for various uses, the quality of surface waters in British Columbia is considered high. The maps make clear, however, that substantial regional differences exist in each of the parameters shown. The Fraser and the Skeena, for example, show considerable variation in water turbidity from section to section of their respective courses. Turbidity is much affected by the nature and composition of the stream channel and by the velocity of the current. Flow in the upper Skeena River is turbulent, and there is abundant material available for transport. As a result, especially in summer, there is a considerable amount of suspended matter carried by the stream. In qualitative terms the water might be described as being discoloured or muddy-looking. Farther downstream, the strength of the current is less and some of the suspension load settles to the bottom, improving the clarity of the water. Similarly, along the mainstem of the Fraser River between Quesnel and Williams Lake, land slips are common, and there is an abundance of fine sand and silt which is readily carried in suspension during the high-flow summer period. Summer turbidity levels on both the Fraser and the Skeena usually exceed the desirable limit for use in municipal water systems.

Summer water temperatures are governed not only by prevailing air temperatures, water depth, and rate of flow, but also by the temperature and volume of tributary streams. As might be expected, relatively high temperatures are shown for the many streams in the south, but those on the Stikine and Nechako systems are less readily accounted for. The answer may be that the data are based upon near-surface water samples and that the number of hydrometric stations is fewer in the north.

At Lytton the less-turbid Thompson River meets the silt-laden Fraser.

The hardness and alkalinity of water in a stream are commonly expressed as calcium carbonate equivalent, small amounts of that compound being generally found in water samples. The amount of dissolved solids, especially in surface waters, is very small and is often recorded by milligrams per litre or as "parts per million," one p.p.m. being roughly equivalent to one-quarter teaspoon per barrel. The nature and distribution of the rock and soil surfaces with which the surface water is in contact and length of time of that contact are the determinants of solution load. It is not surprising to find, then, that streams associated with the Rocky Mountains and Rocky Mountain Trench carry relatively high solution loads (see Map 13). In general terms such water is described as "hard," whereas the Skeena, the Fraser, and the coastal stream systems have "soft" water. Water from the Columbia River is sufficiently charged with dissolved solids that, for some industrial applications, it would likely require pre-treatment.

Although the quality of the waters in all of British Columbia's river basins is relatively high, in certain localities it has been appreciably degraded. Many view discharges of municipal, industrial, and agricultural wastes as a serious threat to water quality. The Okanagan River system has received particular attention because eutrophication may seriously affect summer tourism there. Studies have been initiated by municipal, provincial, and federal government agencies in an attempt to find workable solutions to these and related concerns. Recent proliferation of the exotic plant Eurasian water milfoil has been the subject of extensive and intensive research with the objective of effective, economical control.

With continued growth of provincial population and associated industries, such problems can be expected to increase. Sustained inventory of the surface and groundwaters and monitoring of the environment are fundamental to the future management of British Columbia's water resource.

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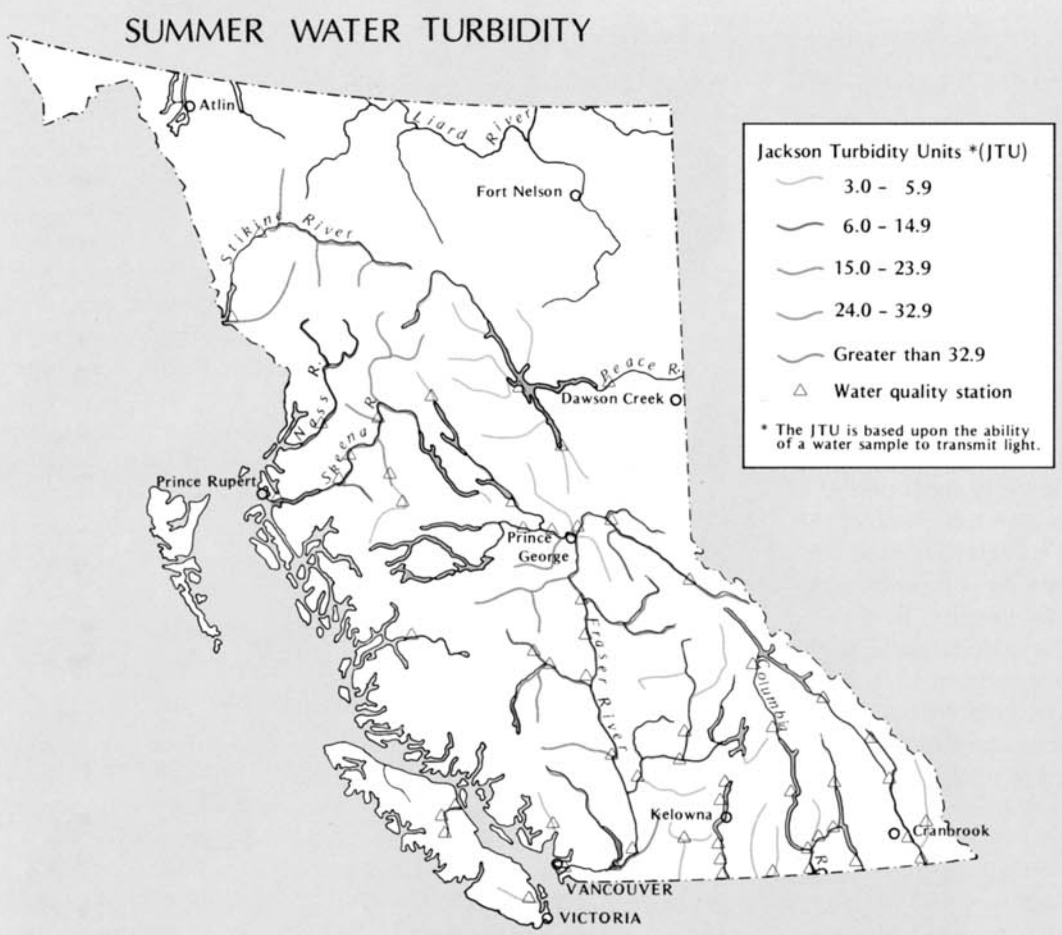
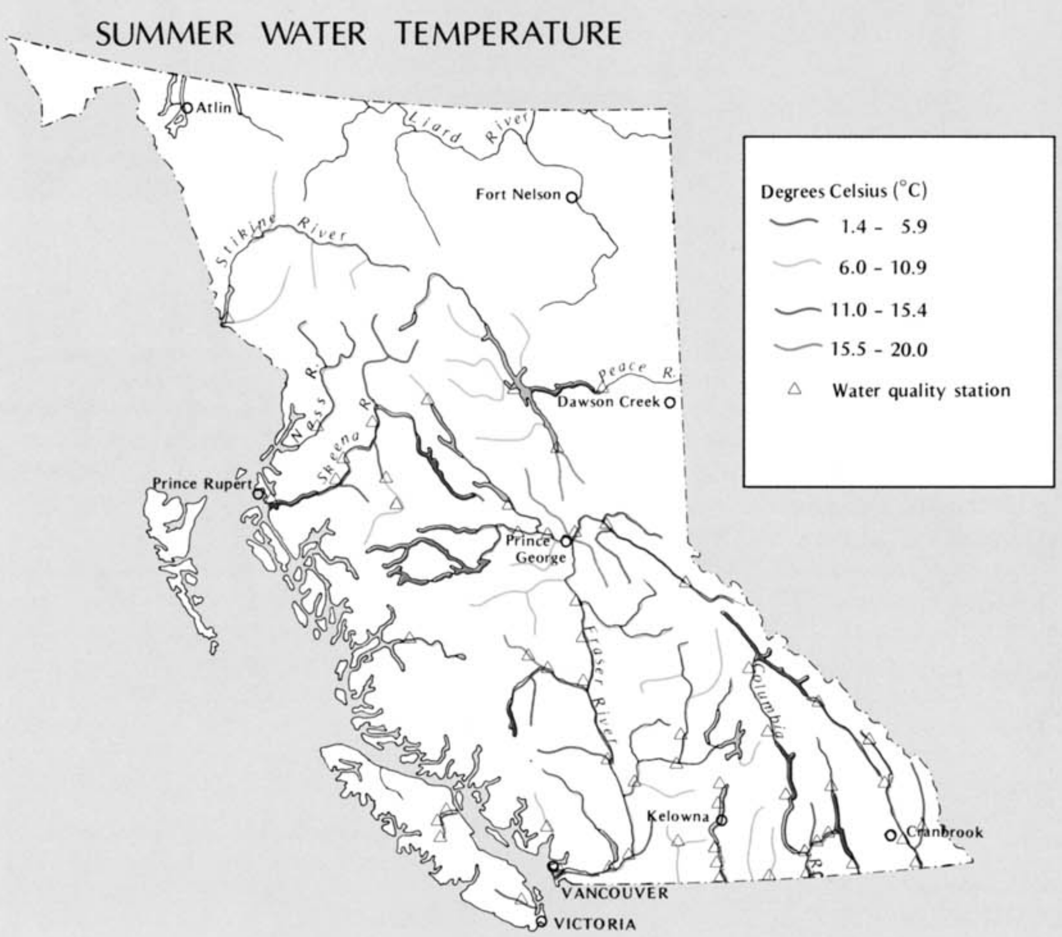
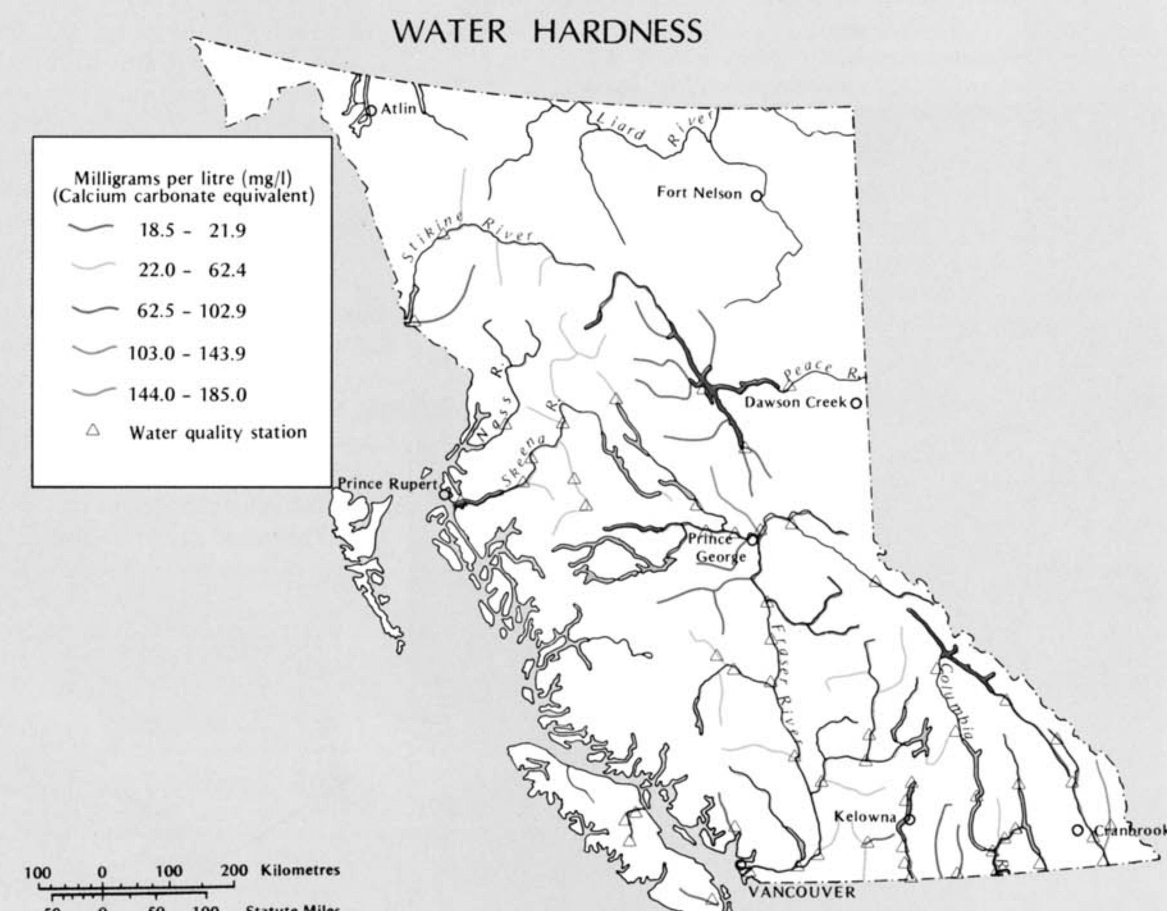
Water Quality







Map 20. Mean Annual Precipitation

The spatial distribution of precipitation in British Columbia is strongly influenced by the pattern of topography and the predominant direction of air flow (see Map 22). The result is a place-to-place variation of total precipitation that exceeds any other part of Canada. Tahsis on the west coast of Vancouver island, for example, has an average annual total of 274 cm; Kamloops, in the sheltered valley of the Thompson River, records only 25 cm. These are long-term averages; for any one year the range would probably be much greater.

The map is based upon standard climatological data that indicate average annual total precipitation for each recording station. Included in the total are all forms of precipitation — rain, snow, hail, and sleet — expressed as rainfall equivalent. Snow is expressed as equivalent rain in the ratio 10:1. As might be expected, the proportion of the annual total that comes as snow is greater in the northern part of the province than in the south, but once again there is great variation from place to place, even in the same latitude. Cape St. James at the southern end of the Queen Charlotte Islands averages 36 cm of snow (3.6 cm equivalent rainfall) annually out of a total precipitation of 143 cm. Mica Dam, north of Revelstoke, in about the same latitude but on the Columbia River, records a similar annual average (145 cm), yet snowfall averages nearly 7.4 metres (73.6 cm equivalent rain). Obviously elevational difference is of some importance — the station at Cape St. James is scarcely 90 m above sea level while that at Mica Dam stands at nearly 580 m — but there are many other factors involved such as seasonal air temperatures, dominant air masses, and topographic configurations. Since the frost-free season in the north is short, about half the total annual precipitation is recorded as snow (see Map 22).

Vancouver's high annual precipitation, mostly in the form of rain, contrasts with the lower moisture index of the interior.

In addition to variation in the total amount and form of precipitation, there is also considerable difference in its seasonal distribution. In general, stations in the Kootenays and in the whole zone west of the Interior Plateau record maximum precipitation in the winter months. The northeast and the Cariboo experience a summer maximum, while most of the remainder receives a more or less uniform distribution through the year (see Map 21).

One of the aspects of precipitation that is of special interest in connection with engineering design and construction work is rainfall intensity. This refers to the amount of rain received in a given area within a specified and comparatively short period of time. The probability of high intensity rainfall has considerable relevance, for example, to the design of culverts for road construction. While the problems of scanty data are compounded by the complications of mountainous topography in British Columbia, some calculations of intensity have been made. In the Vancouver area, for example, maximum amounts of 13 to 25 cm are possible within a 24-hour period. In the Prince George area, intensities of 5 cm/24 hours are more likely. On a 6-hour basis, maxima of 8 cm and 3 cm respectively are probable in the two areas.

In the overall pattern, the most distinctive feature of mean annual precipitation distribution in British Columbia is its close association with topography. Several distinct zones which correspond to the general "grain" of the topography are easily recognizable on the map. The Insular Mountains and the western flanks of the Coast Mountains are wet zones, separated by a somewhat drier coastal trough. East of the Coast Mountains, the Interior Plateau and associated valleys represent a relatively dry zone, bounded on the east by the "interior wet belt" within which is the less humid zone of the Rocky Mountain Trench. The pattern is not only a function of topography but also of prevalent air masses and the direction of air flow. The windward slope–leeward slope contrasts are particularly marked in the case of the Coast Mountains, but they are also apparent across Vancouver Island and on opposite sides of the Strait of Georgia. To illustrate, Victoria has a long-time average of about 75 cm per year while Vancouver receives 150 cm annually. Such windward slope–lee side relationships are especially important to an understanding of the strong contrasts that exist in the natural landscape from coast to interior. These contrasts have many implications with regard to resource distribution and resource utilization. Some of them are elaborated in the subsequent section of this atlas.

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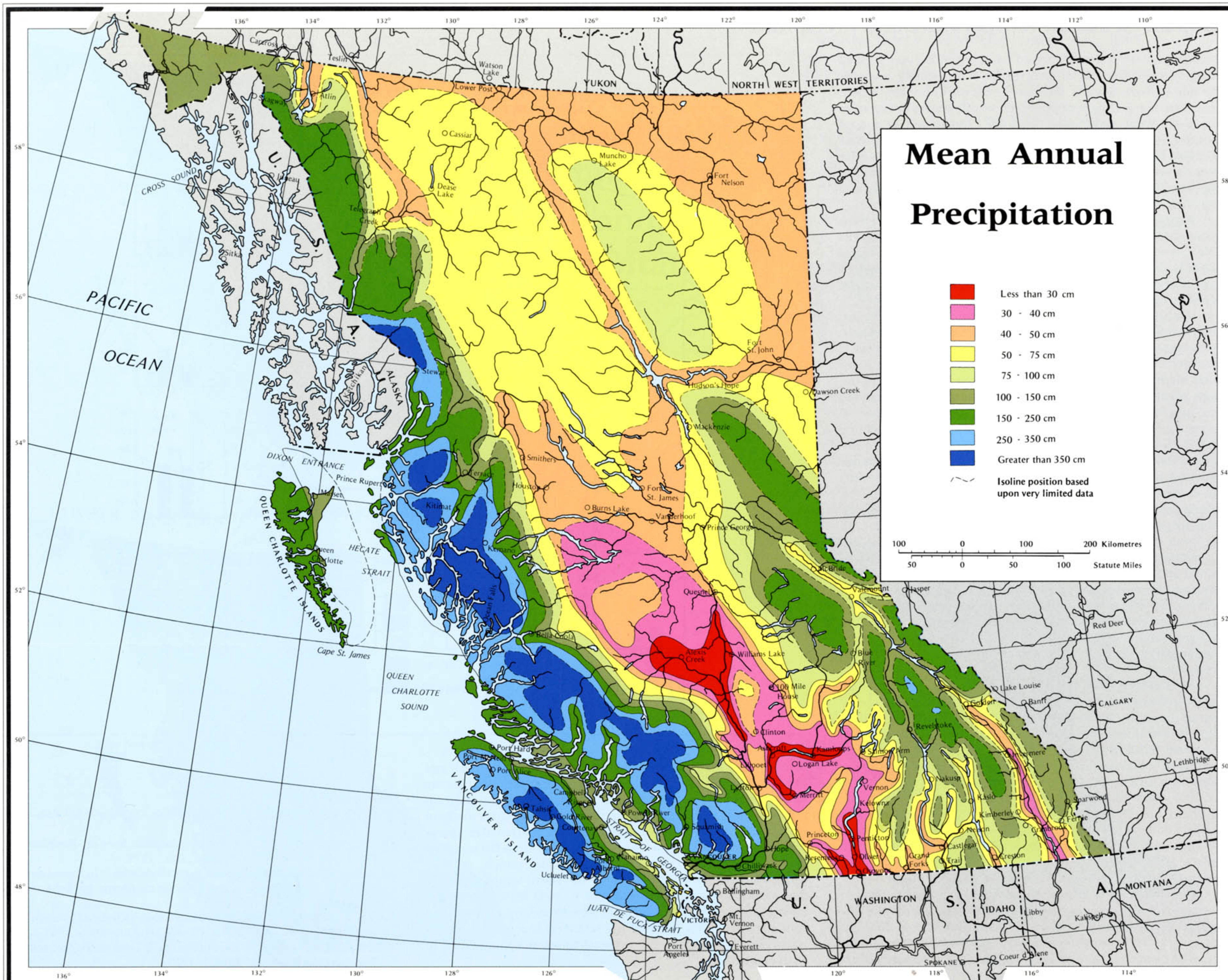
Observers examine a core sample taken on one of many British Columbia snow courses.



Mean Annual Precipitation
Less than 30 cm
30 - 40 cm
40 - 50 cm
50 - 75 cm
75 - 100 cm
100 - 150 cm
150 - 250 cm
250 - 350 cm
Greater than 350 cm
Isoline position based upon very limited data
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
DIXON ENTRANCE
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
CROSS SOUND
WASHINGTON
IDAHO
MONTANA
Watson Lake
Lower Post
Atlin
Teslin
Carcross
Cassiar
Dease Lake
Telegraph Creek
Muncho Lake
Fort Nelson
Fort St. John
Hudson's Hope
Dawson Creek
Mackenzie
Stewart
Prince Rupert
Terrace
Kitimat
Smithers
Houston
Burns Lake
Fort St. James
Vanderhoof
Prince George
McBride
Valemount
Jasper
Quesnel
Williams Lake
Alexis Creek
Bella Coola
Blue River
100 Mile House
Clinton
Kamloops
Logan Lake
Merritt
Vernon
Kelowna
Penticton
Princeton
Oliver
Revelstoke
Golden
Lake Louise
Banff
CALGARY
Red Deer
Lethbridge
Nakusp
Kaslo
Kimberley
Nelson
Cranbrook
Fernie
Sparwood
Castlegar
Trail
Creston
Grand Forks
Hope
Chilliwack
VANCOUVER
VICTORIA
Squamish
Powell River
Port Hardy
Port Alice
Campbell River
Courtenay
Tahsis
Gold River
Nanaimo
Alberni
Ucluelet
Cape St. James
Bellingham
Mt. Vernon
Everett
Port Angeles
SPOKANE
Coeur d'Alene
Kalispell
Libby
Sitka
Juneau
Ketchikan
Skagway

Map 21. Seasonal Temperature and Precipitation

Because climate is much affected by topography, any area of complex configuration is likely to have an equally complex climatic pattern. Such is the case in British Columbia, where great variation is experienced because of differences in elevation above sea level, slope aspect, latitude, and inland or coastal location. In the province the difficulties of description are compounded by the fact that the distribution of climatic stations is far from uniform. Most of the stations are clustered in or near the populated areas so that few data are available for the upland and mountain locations or for the northern half of the province.

Further, constraints of scale and graphic representation necessitate considerable generalization of the data that are available. From them, however, much information can be derived, not only about such things as climatic potential for the growth of agricultural crops and commercial timber, but also about the livability of different parts of the province.

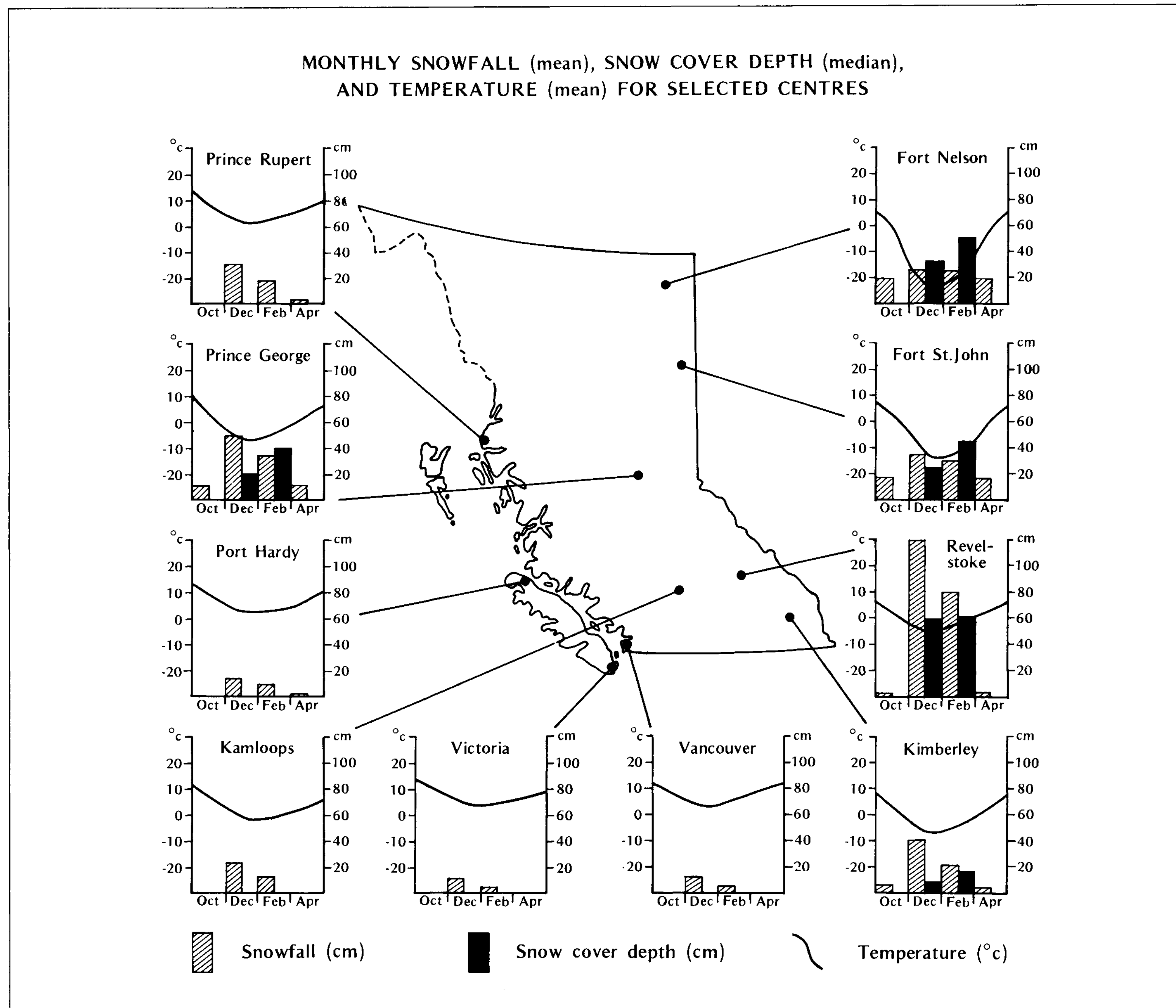
In a broad sense, the seasonal distribution of air temperature and precipitation can be interpreted as the result of the relative dominance of different types of air mass. The coastal zone is dominated by the flow of air from the Pacific Ocean, that is, by Polar Maritime air (see Map 22). In summer, this air makes the coast relatively cool; in winter, it contributes to temperatures that are mild in comparison to those of the interior. Coastal winters are wet because of the frequent mid-latitude cyclonic storms, strong air flows, and the existence of mountains in the path of the general air flow. Overcast conditions are common, and most January days receive a measurable amount of precipitation. The exposed outer coast is particularly susceptible to cloudy skies and winter rain. During summer, however, the air pressure gradients are not so strong, air flow is gentler, and there are fewer days with measurable precipitation.

Northeastern British Columbia is dominated by Polar Continental and Arctic air masses. These are much less humid than maritime air masses, and they are associated with intensely cold winters and mild to warm summers. Because the air is relatively dry, total precipitation is modest, though winter snow is common (see preceding map). Summer convective showers account for the comparatively high proportion of July days with measurable precipitation.

Most of interior British Columbia is strongly influenced by both continental and maritime air, the latter being more prevalent in the south. In consequence, the southern interior valleys experience winter temperatures much less rigorous than those in the north. With the exception of the higher elevations and the northeast, locations throughout the interior experience fewer rainy days than those of the coastal zone.

The warmest summer temperatures are recorded in the southern interior valleys, which are sheltered from the immediate influence of cool Pacific air. The considerable differences in summer temperature that exist between coast and interior are reflected in the natural vegetation, the range of crops grown, and the recreational opportunities afforded (see Map 56).

One of the aspects of regional climate that is most difficult to assess pertains to human comfort or livability. Clearly, the difficulties relate not only to data limitations but also to different preferences. For example, some people prefer cold, snowy winters with clear skies to mild, rainy winters with frequently overcast skies. For many urban dwellers, the amount of snowfall and the monthly mean temperatures likely to be experienced during winter are of some consequence. The accompanying diagram indicates those variables for a selection of representative places in British Columbia. For any one place the combination of temperature and snowfall suggests how much of the snowfall accumulates and how much melts. Prince Rupert, for example, receives about 30 cm of snow in December, but mean temperature for that month is above freezing; hence it could be expected that most of the snow would melt. In Revelstoke, by contrast, the combination of high snowfall and relatively low mean monthly temperatures would suggest a substantial snow accumulation in an average winter.



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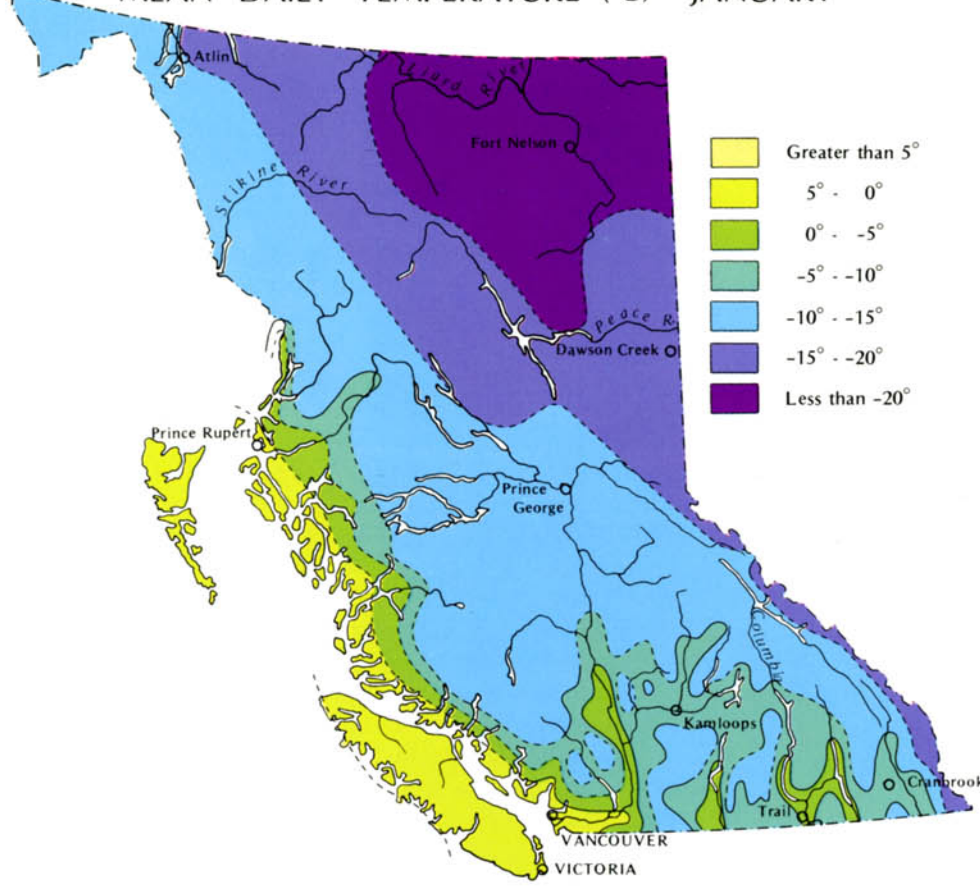
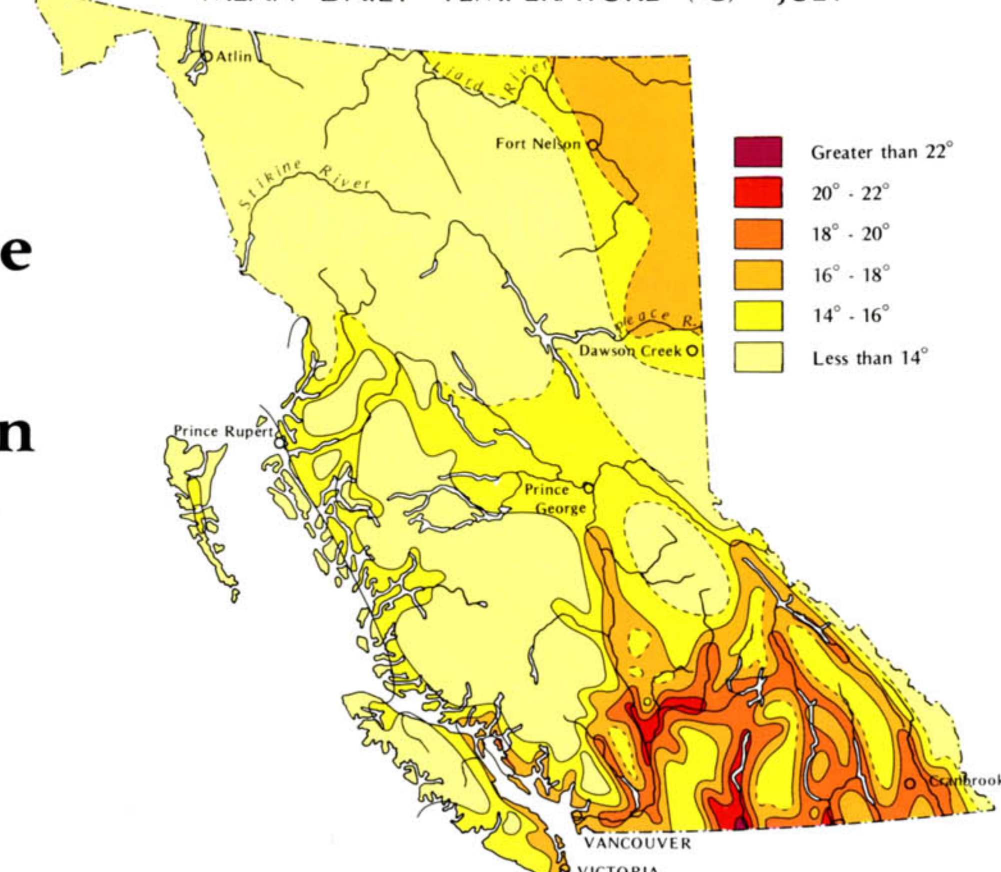
Seasonal Temperature and Precipitation

Broken lines indicate very limited data

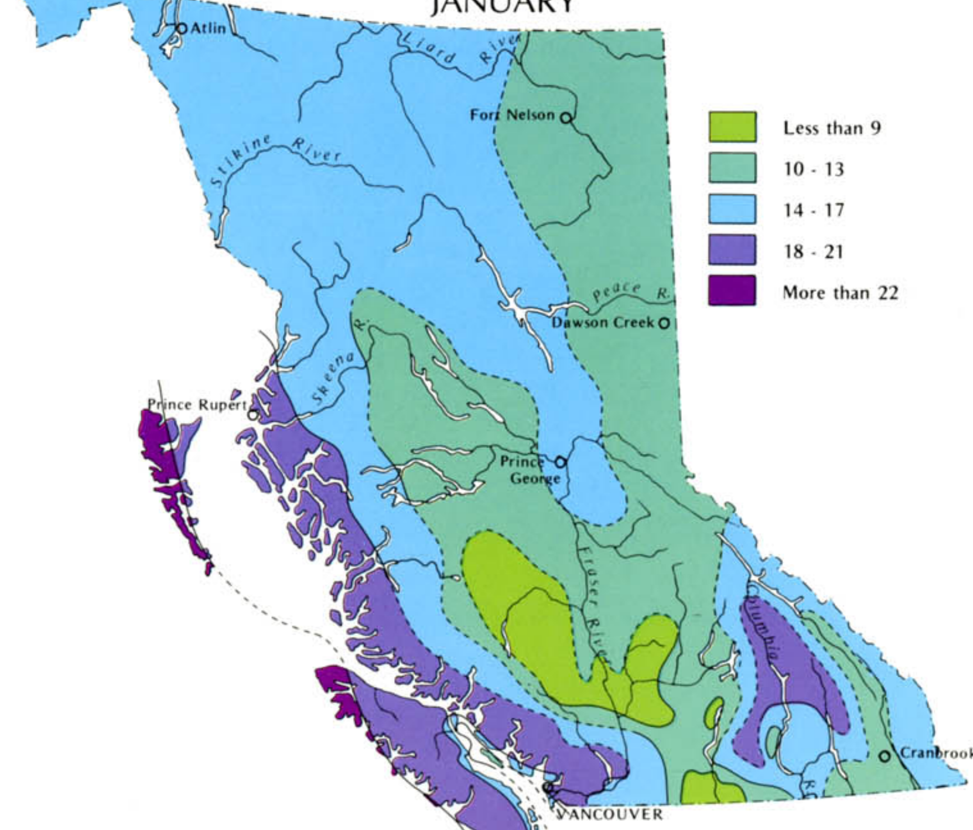
MEAN DAILY TEMPERATURE (°C) - JANUARY



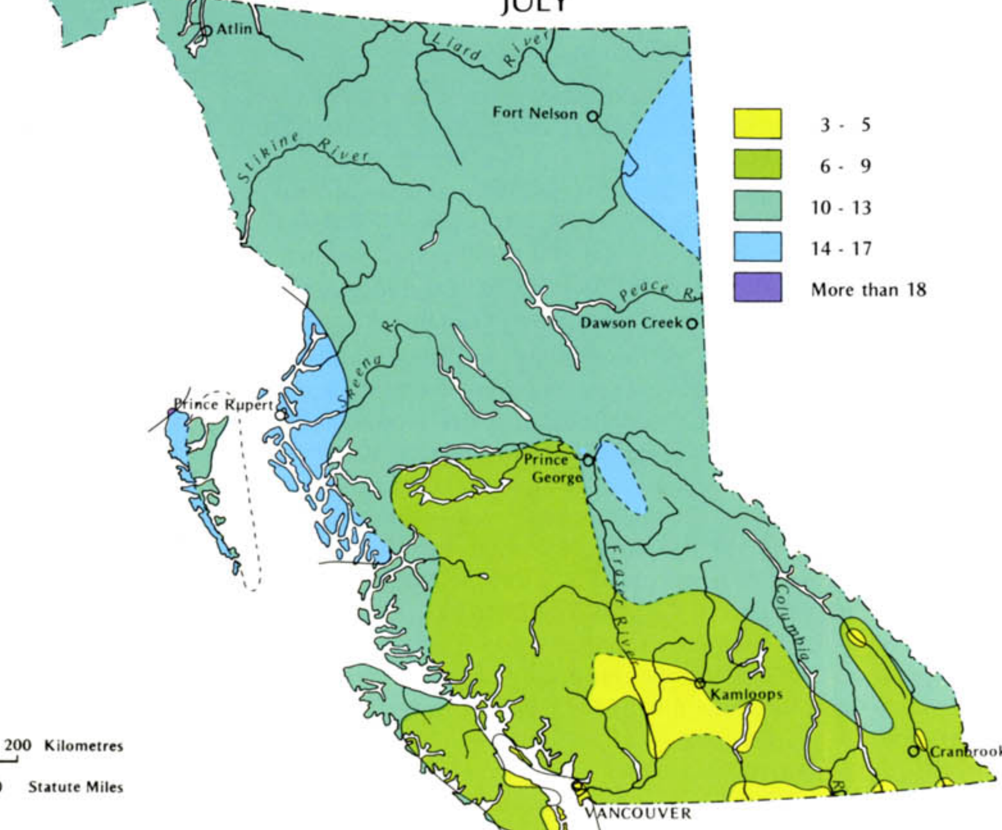
MEAN DAILY TEMPERATURE (°C) - JULY



NUMBER OF DAYS WITH MEASURABLE PRECIPITATION JANUARY



NUMBER OF DAYS WITH MEASURABLE PRECIPITATION JULY



100 0 100 200 Kilometres
50 0 50 100 Statute Miles

Map 22. Frost-Free Period and Moisture Index

The whole coastal zone from Alaska southward is dominated by air masses that have their origins over the North Pacific and move shoreward in the general planetary circulation. In this way the temperature effects of the North Pacific Drift, that vast, sinuous and slow-moving component of oceanic circulation in the Pacific Basin, are brought not only to the outer fringes of the coast, but also toward estuaries and fjord-heads of the mainland. Surface temperatures in the North Pacific Drift vary little from season to season, especially in its eastern extremity many miles off the B.C. coast. But, like their North Atlantic counterparts, they are relatively warm and impart an ameliorating influence, especially apparent in winter, on the temperature of the coastal zone. It is understandable, therefore, that while James Bay and the Labrador Coast, which lie in the same latitude, are ice-bound in winter, the entire coast of British Columbia is ice-free the year around.

As the map indicates, the combined effects of oceanic circulation and air mass movement, as expressed by length of the frost-free season, are most apparent along the coast. With the exception of the Fraser River trench and major valleys in the southern part of the province, there is an abrupt decline in frost-free period with progression from the coast to the interior. Much of the hinterland experiences a frostless season of less than sixty days, and for many places in the interior plateau, seasons of less than thirty days are not uncommon. This relatively short frostless period has many implications. Agriculturally it means not only that tender crops are unlikely to be grown as a commercial enterprise, but also and more importantly, that the number of options open to the agriculturalist are severely limited. To the forester and the game biologist it means that tree growth and, indirectly, the whole biomass potential are lower than for comparable locations on the coast (see Maps 24 and 28).

The abrupt change in pattern from coast to interior shown on the map is characteristic of many geographic distributions in the province — coast and interior are two distinctly different environments. The main reason for this is the nature of British Columbia's terrain (see Maps 7 and 12). The Coast Mountains in particular act as a vast barrier, shielding the coast from much of the influence of air masses of continental origin and substantially modifying maritime air masses that move to the interior.

Such is the coupling of topography and the influence of planetary circulation, however, that the more sheltered interior valleys experience frostless seasons comparable to those of the better-known agricultural areas of eastern Canada. The central Okanagan Valley, for example, compares favourably with southern Ontario, and the Kootenay Lake area with much of the St. Lawrence Valley. Some parts of coastal British Columbia enjoy frostless seasons in excess of 220 days — far greater than those for any other part of Canada. The frost-free period cannot be directly equated with growth potential for commercial crops, however, because some crops require a high concentration of temperature and sunshine during the period of growth. As other maps in the atlas illustrate (see, for example, Map 21), many parts of coastal British Columbia experience a high frequency of cloudy days and relatively low summer temperature which reduce their suitability for many crops.

Not only do British Columbia's mountains blockade advancing air masses, but also their elevation results in comparatively low surface temperatures. On account of elevation alone then, locations like Prince George (elevation approximately 650 metres above sea level) experience mean annual temperatures some 3°C lower than sea level locations in the same latitude. The accompanying map is much generalized in a spatial sense, and it is also based upon a thirty-year average of temperature records. In such a portrayal the topographic influence upon air drainage, which is of great importance in many facets of resource development, is not immediately apparent. Under conditions of air drainage, colder air from adjacent slopes descends into depressions, creating "frost pockets" in many areas that might otherwise be agriculturally suitable. The effects of air drainage upon the incidence and severity of low temperatures can be of critical importance to agriculturalists both during the normal growing season and during the winter, when very low temperatures may result in winter-kill of perennial crops.

The representation of moisture index is based upon concepts developed around mid-century by C.W. Thornthwaite and other climatologists. It attempts to express the amount of moisture available for plant growth under natural conditions. Available moisture is a function not only of precipitation but also of evaporation from soil and plant surfaces, transpiration by plants, and the available reserve of soil moisture. Many factors, including air humidity and temperature, influence the amount of evaporation that takes place. The nature of the plant itself is an important determinant of transpiration.

Other factors, such as soil texture and the level of the soil water table, have an effect upon the amount of water available to plant roots. Consequently, the conditions that apply in the natural system vary considerably. The map shows an average pattern, derived from a thirty-year record of observations at climatological stations, and it is based upon simple climatic variables that can only approximate natural conditions. It conveys, nevertheless, a better indication of moisture availability (and moisture demand) than a map showing the distribution of precipitation, a single climatic variable.

The index indicates the proportion of the total water required for optimum plant growth that is supplied by precipitation. Thus, there are general similarities between the distribution shown on this map and that of annual precipitation (see Map 20). The areas with the lowest moisture index are the areas of greatest moisture demand, that is, areas where potential evapotranspiration is highest. These include the southeastern tip of Vancouver Island, the Lytton-Kamloops area, the Okanagan Valley, and the southern extremities of the Kootenay and Rocky Mountain trenches. Slightly higher index values are associated with "rainshadow" areas lying on the lee side of the mountains. The blockade the mountains present reduces rainfall in southern interior valleys, in the area west of Prince George, and at two locations in the northwestern part of the province.

The latter experience deep rainshadow effects from the northern portion of the Coast Mountains, but the portrayed configuration of these areas is somewhat conjectural because there are very few climatic stations in northern British Columbia on which to base the representation. In general, even valley locations in the northerly areas have a moderate to high moisture index because the growing season is short, summer temperatures are modest, and therefore the effectiveness of available precipitation is greater than in the south. Thus, in the grain-growing area around Dawson Creek, where the frostless season is less than one hundred days and annual precipitation only about 42 cm, the moisture index is in the range of 60 to 80 per cent. At Creston, on the other hand, where the annual precipitation is in excess of 53 cm, the moisture index is less than 40 per cent.

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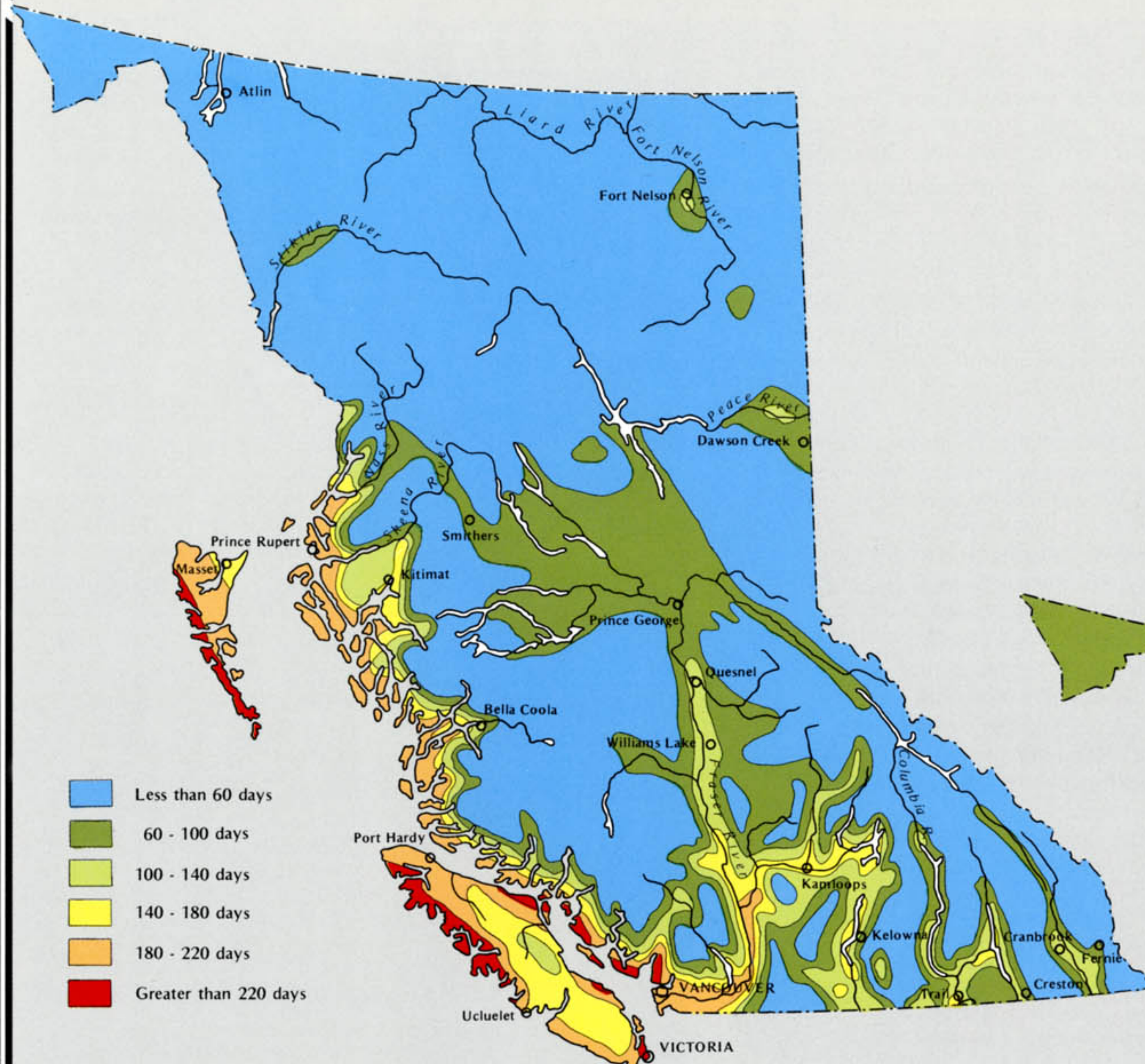
Greenhouses extend the growing season in southwestern British Columbia.

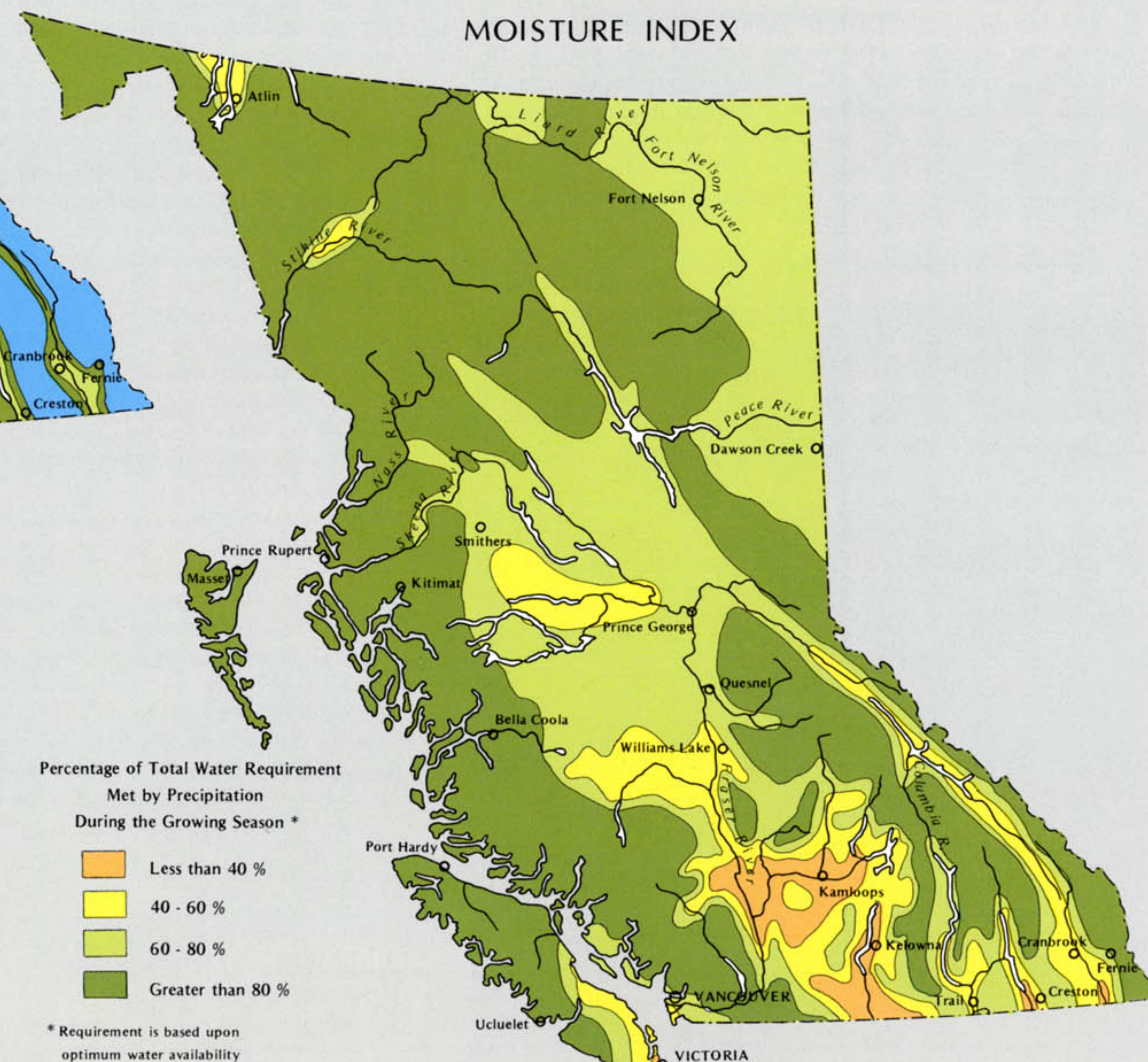
Frost-Free Period and Moisture Index



AVERAGE FROST-FREE PERIOD (DAYS)

100 0 100 200 Kilometres
50 0 50 100 Statute miles

MOISTURE INDEX



Percentage of Total Water Requirement
Met by Precipitation
During the Growing Season *

- Less than 40 %
- 40 - 60 %
- 60 - 80 %
- Greater than 80 %

* Requirement is based upon optimum water availability for plant growth during the period May - September.

Map 23. Biogeoclimatic Zones

The accompanying map is based upon the work of Dr. V.J. Krajina and attempts to portray, at small scale, the biotic regions of British Columbia. As the title suggests, each of the twelve zones is delineated on the basis of vegetation (and fauna), soils, topography, and climate. The detailed studies upon which the map is based provide insights into ecological processes in various parts of the province and are particularly applicable to long-term forest management.

The zones can be divided into four formations: Mesothermal; Semi-Arid, Cold Steppe; Microthermal Coniferous Forest; and Alpine. The regions within each of the formations vary in temperature, precipitation, and altitude, and, consequently, they vary also in vegetation.

The Mesothermal Formation includes the Coastal Western Hemlock and the Coastal Douglas-fir zones. The former is the most humid zone in British Columbia and produces several commercially important tree species. The latter is the drier mesothermal zone and has capability for both tree production and agriculture.

The Semi-Arid, Cold Steppe Formation is the driest in the province and experiences the highest summer temperatures. The deeper valleys are semi-desert. As a result, grassland vegetation predominates, but ponderosa pine and aspen are common.

In the Microthermal Coniferous Forest Formation there are a number of regions, but the formation as a whole is characterized by cold, snowy winters and short, warm summers. In the warmest region, the Pacific Coastal Subalpine Forest (MHem), the vegetative season is limited mainly by great quantities of snow, which protect the soil from freezing. In the Canadian Cordilleran Subalpine Forest Region (ESpr and SW), however, the soil is commonly frozen before snowfall, and only trees that tolerate an extended period of frozen ground are found. In the Spruce-Birch-Willow Zone (SW) growth of deciduous cover is promoted by long summer days and protracted twilight. In the northern part of the Canadian Boreal Forest Region (BSpr), the winters are even more severe, and the soil is deeply frozen. The summers are short, though warm, and the growth of trees is very slow. In the Sub-boreal Spruce (SSpr) Zone, the growth rate is a little greater. The Canadian Cordilleran Montane Forest Region has lower elevations than the Subalpine Forest and a much longer summer. In the Cariboo Aspen-Lodgepole Pine Zone (CA) the number of coniferous trees is limited as a result of severe winters and warm, dry summers. The drier parts of the Interior Western Hemlock Zone (IHem), on the other hand, constitute one of the richest areas of coniferous forest in the province. The warmest biogeoclimatic unit in British Columbia, except for the Ponderosa Pine-Bunchgrass Zone is also in this region, the Interior Douglas-fir Zone (IFir).

The final Formation is the Alpine, which is characterized by long, cold winters and high snowfalls. Trees do not thrive, though both coniferous and deciduous trees are found in stunted form in the lower elevations. Vegetation is mainly herbs, bryophytes, and lichens.

The following tabulation indicates the general outline of the classification.

Exquisite wildflowers grace the high-altitude meadows of the Alpine zone.

GEOCLIMATIC CRITERIA

Zone	No. of Months 0°C	No. of Months 10°C	Frostless season (days)	Mean Annual Precip. (cm)	Alt. Range South	Alt. Range North
CHem	0	5–6	185–350	155–440	0–1,000m	0–300m
CFir	0	5–6	250–350	66–152	0–450m	0–150m
Py	2– 3	5–6	220–250	21– 35	270–750m	
MHem	0	1–4	110–210	180–430	900–1,500m	300–900m
ESpr	0	1–3	100–150	40–185	1,200–2,200m	1,000–1,700m
SW	7	1	100	70	950–1,700m	900–1,650m
BSpr	5– 7	3–4		30–139	165–850m	
SSpr	4– 5	3–5		45– 60	300–1,100m	
CA	4– 5	3–5	110–180	30– 60	500–1,100m	
IHem	3– 5	4–5	140–250	60–145	360–1,260m	
IFir	3– 5	4–5	150–260	35– 60	300–1,300m	450–900m
AT	7–11	0	25–100	70–280	above 1,500m on windward side and above 1,800m on leeward side.	

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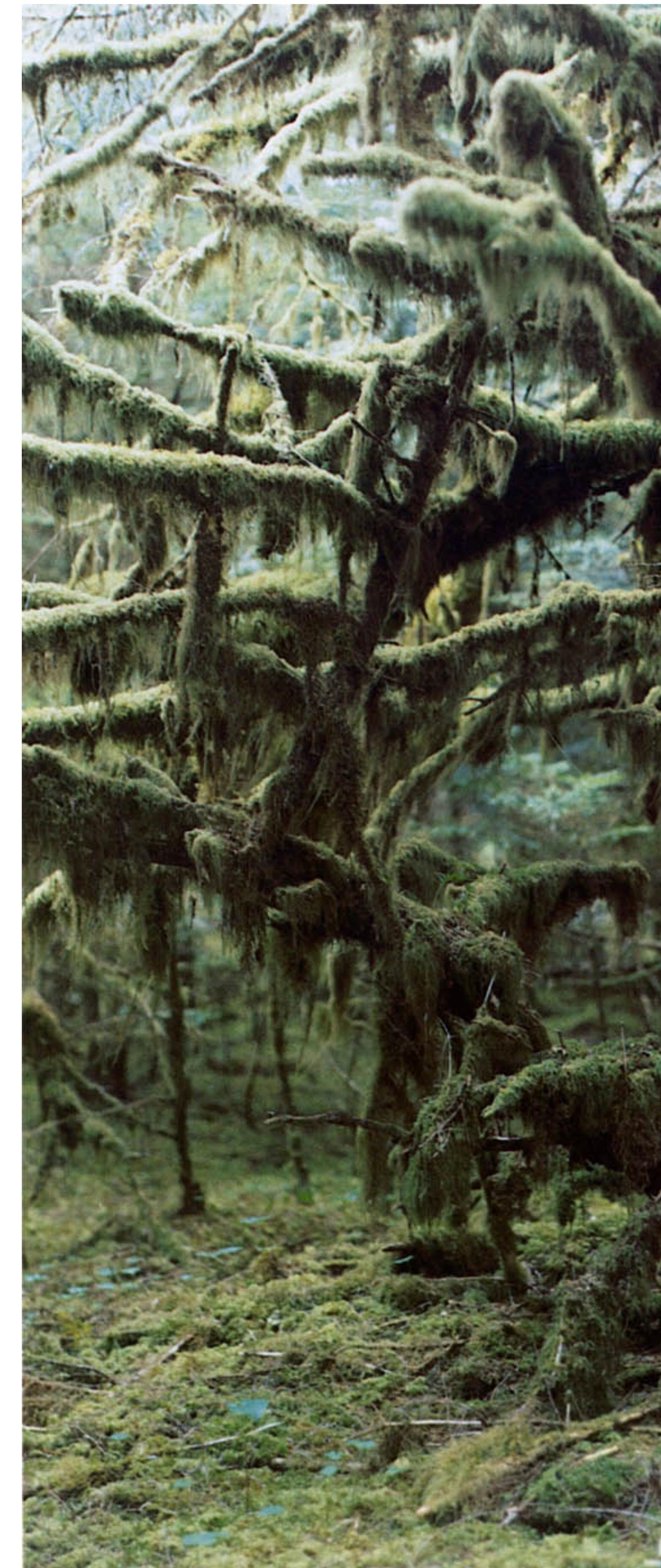
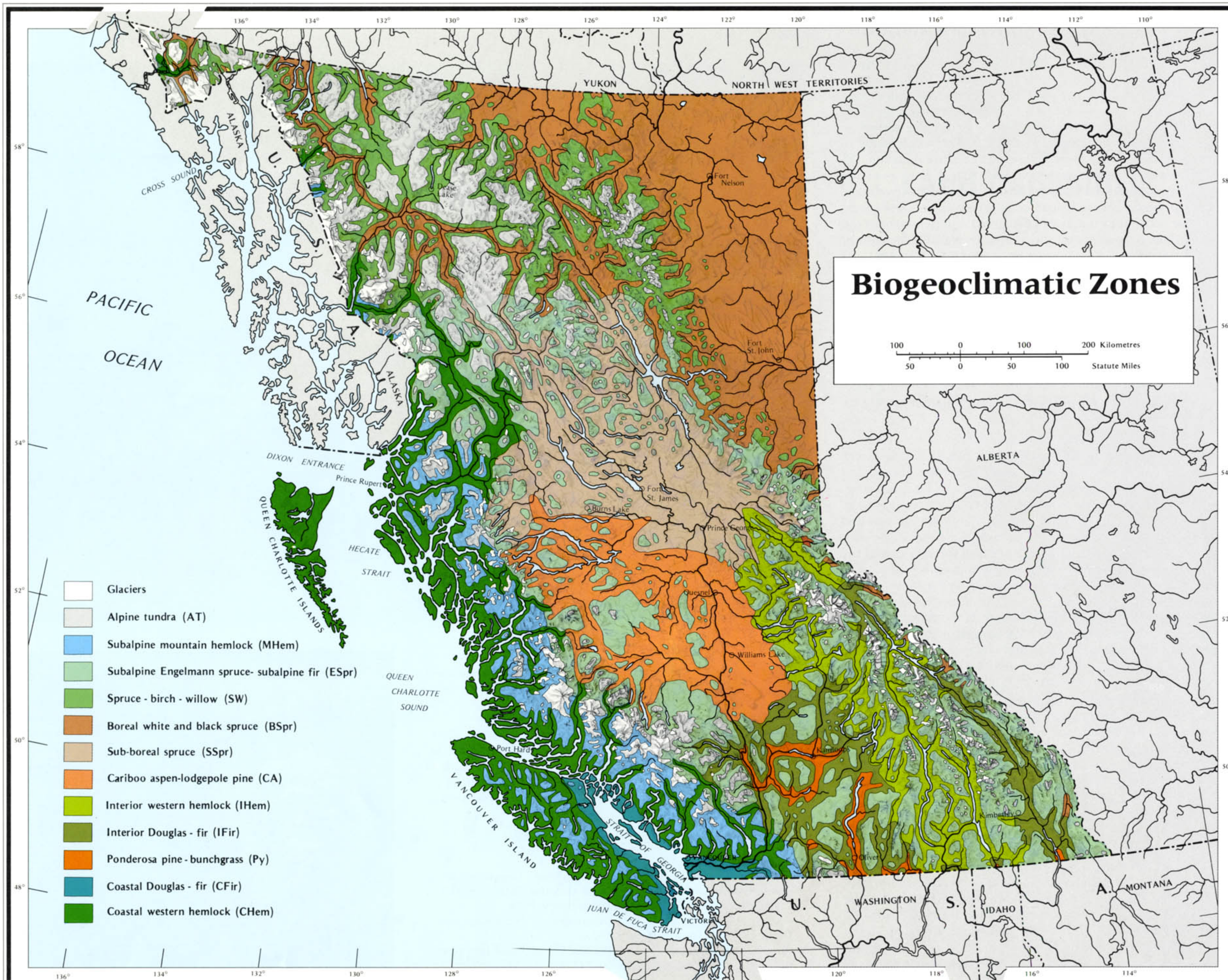


The moss-hung undergrowth of this Queen Charlotte Island rainforest is characteristic of the Mesothermal Formation.

Biogeoclimatic Zones



Map 24. Land Capability for Wildlife — Ungulates

The accompanying map is based upon information compiled under the Canada Land Inventory programme. That programme was established in 1963 as a joint federal-provincial undertaking with the objective of developing an information base for land-use decisions. The information gathered covers five sectors — agriculture, forestry, recreation, wildlife, and present land use — and is prepared in map form. Following a careful evaluation, the input from each sector is expressed, again in map form, as a Land Capability Analysis for each region covered by the inventory. The map shown here is a small-scale generalization and covers only one sector, but it may be considered representative of the extent of land-capability information now available for most of southern Canada.

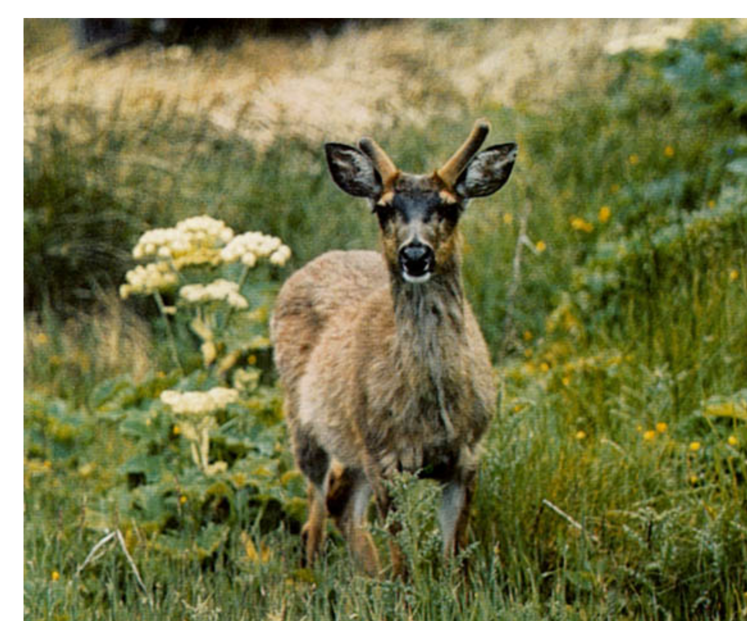
The inventory excludes much of British Columbia's coastal area and a substantial part of the north. Consequently, those areas are not represented on the map. Within the C.L.I. boundary, the capability rating is derived from an appraisal of the quantity and quality of food and cover available to support wild ungulates. The appraisal is based upon the existing or inferred natural state of the land regardless of present use, ownership, access, or hunting pressure. Because of the constraints of scale, only those lands that have at least moderately high capability are shown on the map opposite.

Ungulates are hoofed mammals, nearly all of which are herbivorous, including domestic sheep, horses, and cattle as well as moose, deer, elk, mountain goat, mountain sheep, and cariboo. The general needs of all of these animals are much alike, but only the wild species are considered here. Each requires food, protective cover, and space to meet its needs for survival and growth. The ability of an area to provide these requirements is determined by both the particular needs of the species and the natural characteristics of the area. Land and climatic factors are of vital importance because they govern the ability of an area to produce suitable food and cover. In a dry climate, for example, while the vegetative cover may be relatively nutritious, exposure to prevailing winter winds may be an important limitation. Similarly, excessive snow depth in winter is likely to reduce both the availability of natural forage and the mobility of the animals depending upon it for survival.

In response to natural conditions and long-term changes in those conditions, the density distribution of ungulate populations shows considerable variation. There is also variation from species to species and from season to season, depending upon the preferred habitat. In summer the populations are generally dispersed throughout the species range (see Map 25). During the winter season, however, when less food is available, there is a general migration to lower elevations.

As the map pattern suggests, much of the land in the highest capability classes for ungulate species is within or immediately adjacent to the settled parts of the province. Those parts also contain the agricultural land and the areas devoted to livestock grazing (see Map 38). In consequence, the potential exists for conflicting land uses. Land that may be ideal summer range for cattle may represent critical winter range for mountain sheep, and a lowland meadow containing a rancher's winter hay supply may be pre-empted by moose. Under such circumstances, losses to wildlife through winter starvation coupled with direct economic losses to agriculture are a distinct possibility. Acceptable solutions to such land-use conflicts are usually difficult to find, yet they must ultimately depend upon adequate information. The Canada Land Inventory does much to provide that informational basis.

Cattle herds, such as this one near Douglas Lake, have grazing requirements broadly similar to those of wild ungulates.



Deer are numerous on Vancouver Island where winters are mild and forage is generally available.

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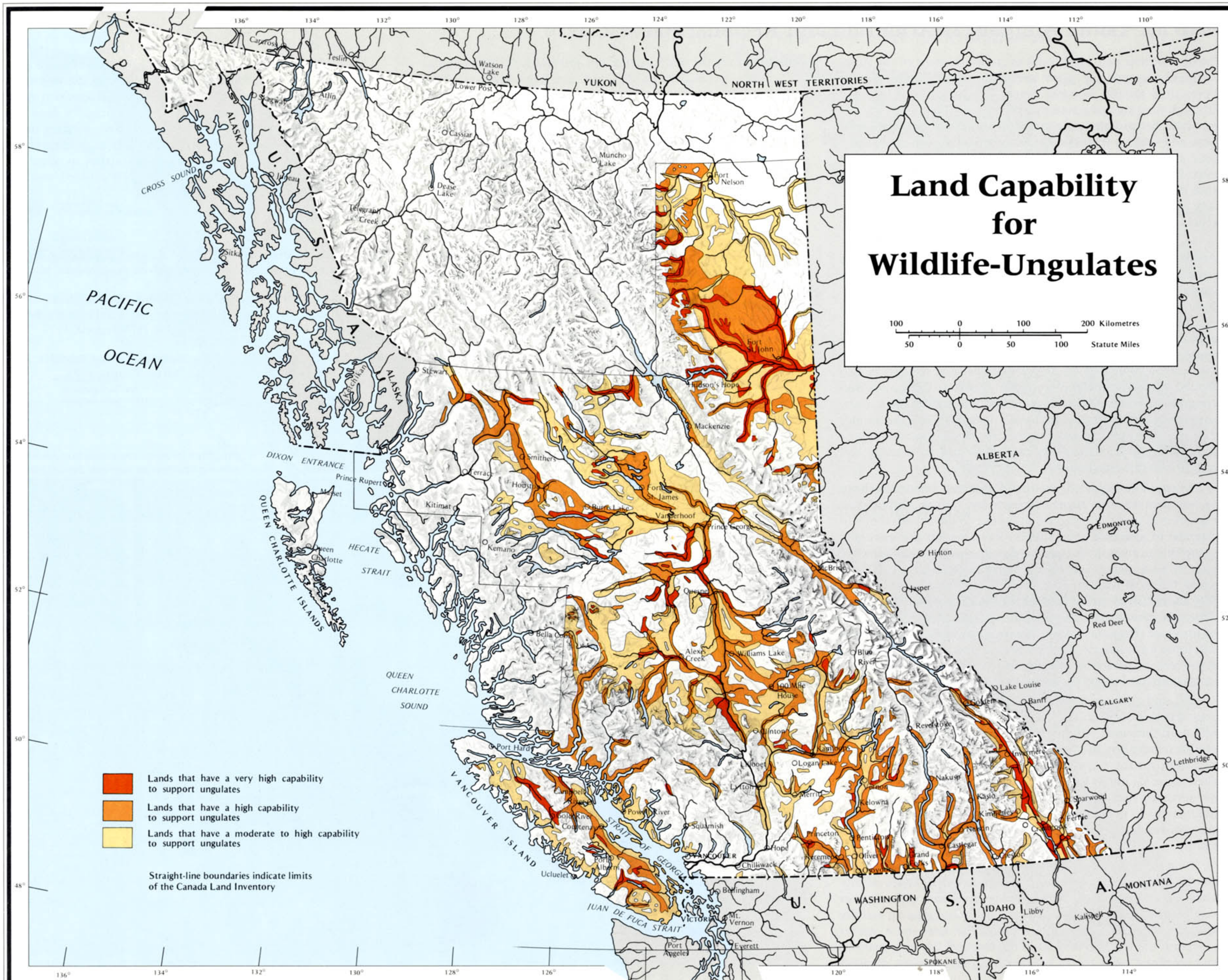

Land Capability for Wildlife-Ungulates
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Lands that have a very high capability to support ungulates
Lands that have a high capability to support ungulates
Lands that have a moderate to high capability to support ungulates
Straight-line boundaries indicate limits of the Canada Land Inventory
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
Fort Nelson
Fort St. John
Hudson's Hope
Mackenzie
Smithers
Terrace
Prince Rupert
Kitimat
Kemano
Fort St. James
Vanderhoof
Prince George
McBride
Quesnel
Williams Lake
Bella Coola
100 Mile House
Clinton
Kamloops
Revelstoke
Golden
Invermere
Vernon
Kelowna
Penticton
Nelson
Cranbrook
Fernie
Port Hardy
Campbell River
Courtenay
Powell River
Squamish
Vancouver
Victoria
Chilliwack
Hope
Edmonton
Calgary
Red Deer
Lethbridge
Jasper
Hinton
Banff
Lake Louise
Spokane
Bellingham

Map 25. Game Animals: Distribution and Regional Harvest, 1974

The distribution and 1974 resident-hunter harvest of the more commonly hunted big game species in British Columbia are represented on the adjacent maps. Cougar are also included although they are not a major game species. Their distribution is important because there is a predator-prey relationship between them and various ungulate species, especially deer. Since 1975 game animal harvest data have been compiled on the basis of seven Provincial Resource Management Regions that are somewhat different from those shown on the accompanying maps. Such changes do not significantly affect the cartographic portrayal.

In aggregate, the total area over which the various species are distributed is considerable, but the actual number of animals is relatively small. One of the most critical factors governing natural populations is the availability of suitable winter range. Therefore, game population is not so much a matter of total area occupied as it is of the capability of the area to meet the particular requirements of each species, that is, of its carrying capacity (see preceding map). Carrying capacity varies from place to place, from season to season, and from species to species. It is also affected by such naturally occurring events as forest fires and economic activities such as logging and livestock grazing. Consequently, wildlife authorities have undertaken detailed studies of range conditions and game counts in order to establish appropriate hunting regulations in each area and to manage the wildlife resource effectively.

As could be expected, mountain goat and mountain sheep are found in areas of rugged topography, though within their respective ranges they migrate in winter to lower elevations in response to available food supply. Even within the generally mountainous areas, however, the distribution is incomplete; the range of both species is more extensive in the north. To a large extent, the areal distribution is reflected in the annual harvest. In 1974 about half of the total kill of mountain goat and 70 per cent of the take of mountain sheep were made in the northern part of the province (Regions 8 and 9). If non-resident data are included with those for residents, the 1976 proportions are 75 per cent and 85 per cent, respectively. Because the total harvest is small, only the smaller-sized symbols appear on the map.

Elk and caribou show a complementary distribution, elk range being mainly in the southern part of the province and caribou in the north. Elk herds have been introduced in several locations, including the Queen Charlotte Islands and the Lytton area, but over three-quarters of the annual harvest is normally taken in the Kootenay Region. Much of the caribou kill is made in the northern half of the province. In 1976, for example, approximately 95 per cent of the total provincial harvest (resident and non-resident) came from the Skeena and Omineca-Peace regions.

Deer are widely distributed in the southern two-thirds of the province, and their populations are higher than those of any other big game species. Numbers are greatest on Vancouver Island, where the effects of over sixty years of logging activity have made suitable browse more plentiful and where winter conditions are less severe than in the interior. Deer populations have declined even there, however. Annual harvest statistics reflect not only the wide distribution and relatively high populations of deer but also the hunting pressure. Regions closest to the main centres of population experience the greatest pressures. Roughly half of the total deer kill is made on Vancouver Island; about 90 per cent is made in the southern third of the province. Despite the relatively high number of deer on Vancouver Island, cougar are not numerous, and of the modest total provincial harvest, only about 20 per cent were taken in that region.

Over the past fifty years, moose have extended their range southward so that they are now found throughout the interior. The extension of moose range is partly the result of changed environmental conditions after forest fires, logging, and land clearing. It is also attributable to the fact that, because of their size and strength, moose are able to forage under heavy snow conditions and to browse more effectively than deer. Since they are large animals, however, each individual requires a considerable area of range to sustain it. On that account the populations in some areas, notably in the Chilcotin and in the southern Cariboo, have tended to outstrip the carrying capacity. Accordingly, bag limits have been maintained at high levels. Annual harvest of moose in 1976 is estimated to have been 12,500, approximately 55 per cent of the total coming from the Omineca and Peace River areas.

As understanding of the habitat and ecology of game animals has increased, so has the ability to manage the resource. Hunting seasons and bag limits within each Management Area are carefully controlled in order that hunting pressure does not exceed the ability of a species to sustain itself. At the same time, the annual harvest allocated to hunters acts as a control on animal numbers. Thus, the winter starvation that so often accompanies overpopulation of a given species is avoided, and the big game resource is more effectively used.

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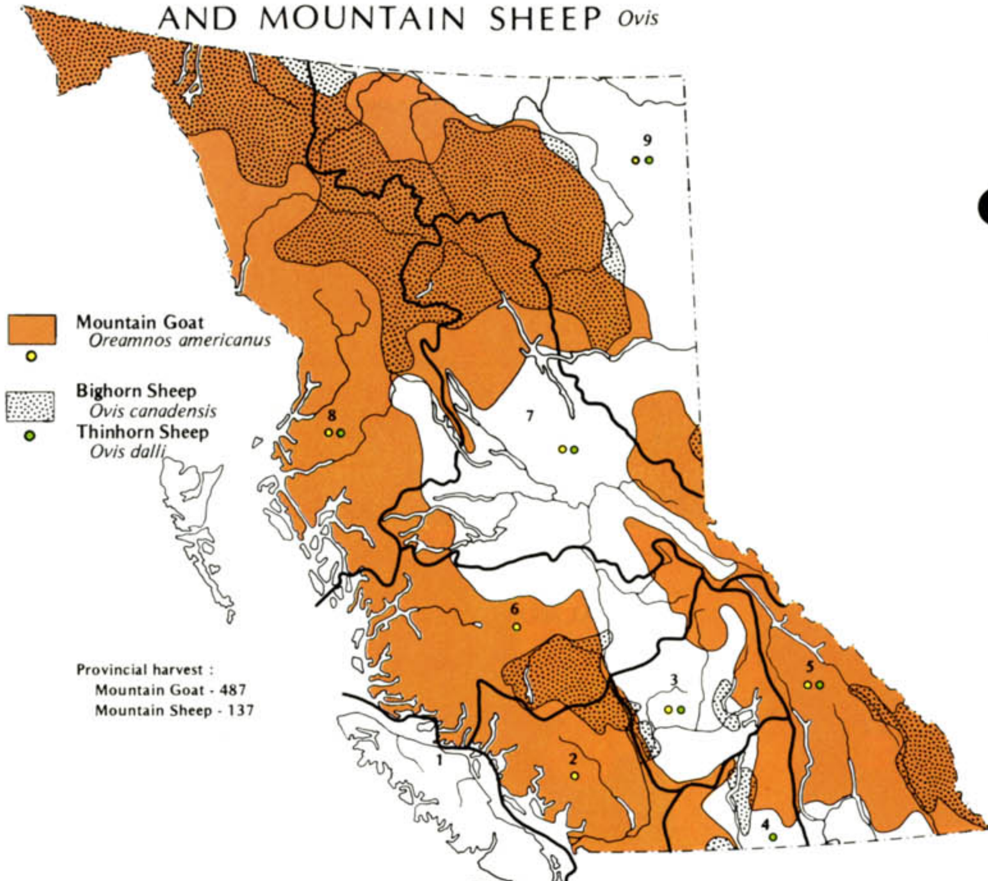
Growth in the moose population throughout the province has led to an increased annual harvest.

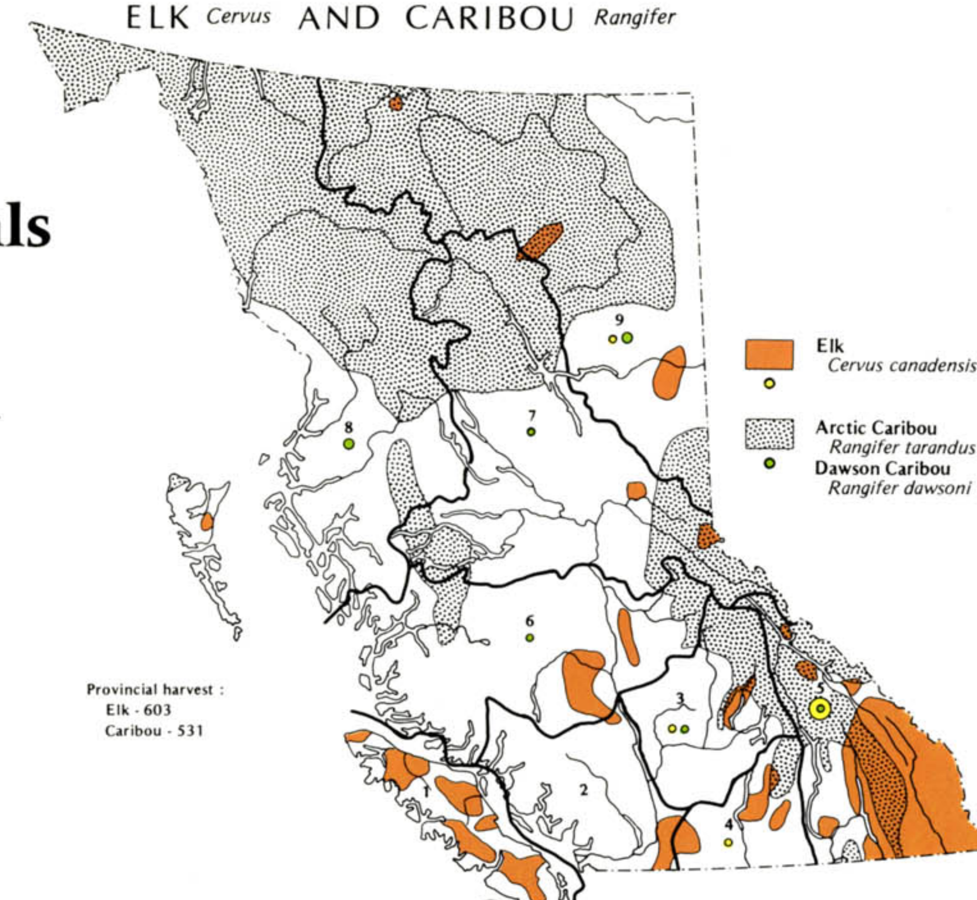
Game Animals

DISTRIBUTION
AND
REGIONAL HARVEST
1974

MOUNTAIN GOAT *Oreamnos* AND MOUNTAIN SHEEP *Ovis*



ELK *Cervus* AND CARIBOU *Rangifer*

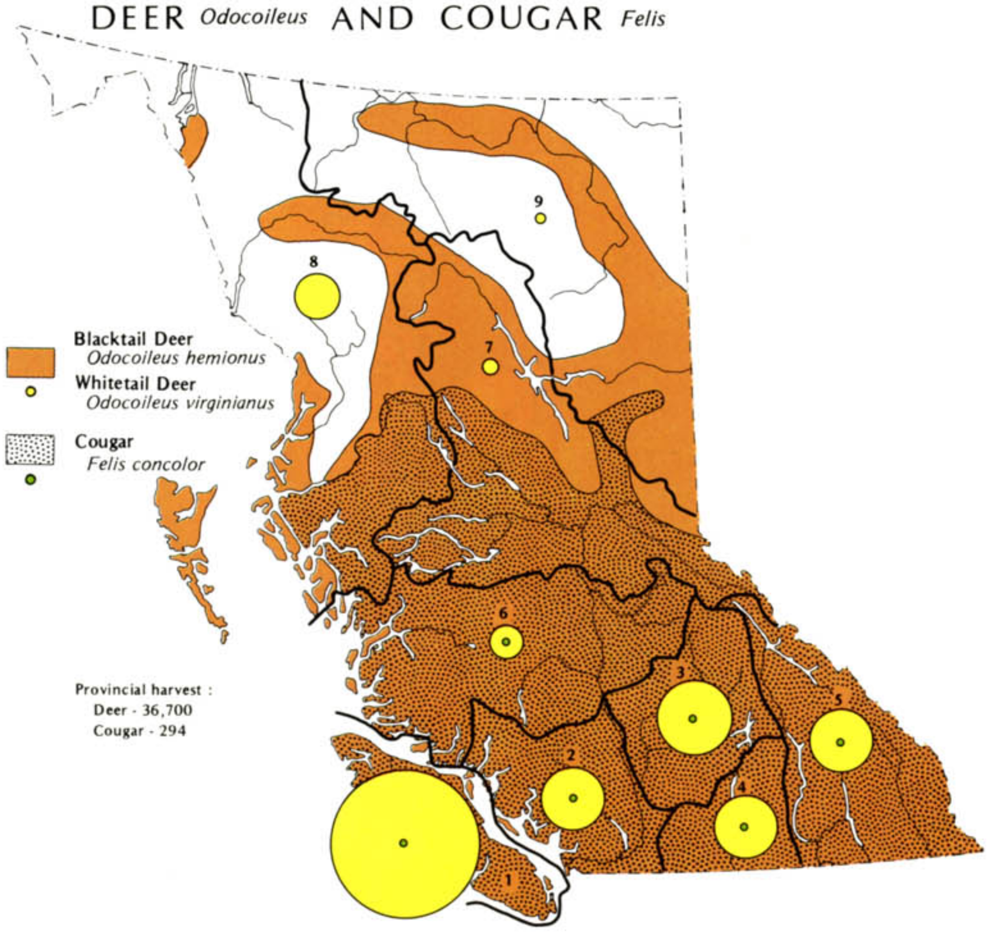


Fish and Wildlife Regions

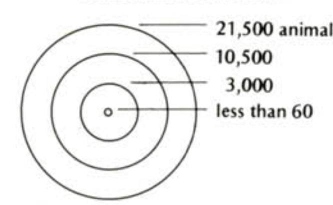
1. Vancouver Island
2. Mainland – Coast
3. Kamloops
4. Okanagan
5. Kootenay
6. Cariboo – Coast
7. Prince George
8. Smithers
9. Fort St. John

Region boundary

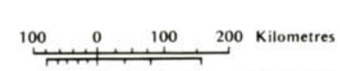
DEER *Odocoileus* AND COUGAR *Felis*



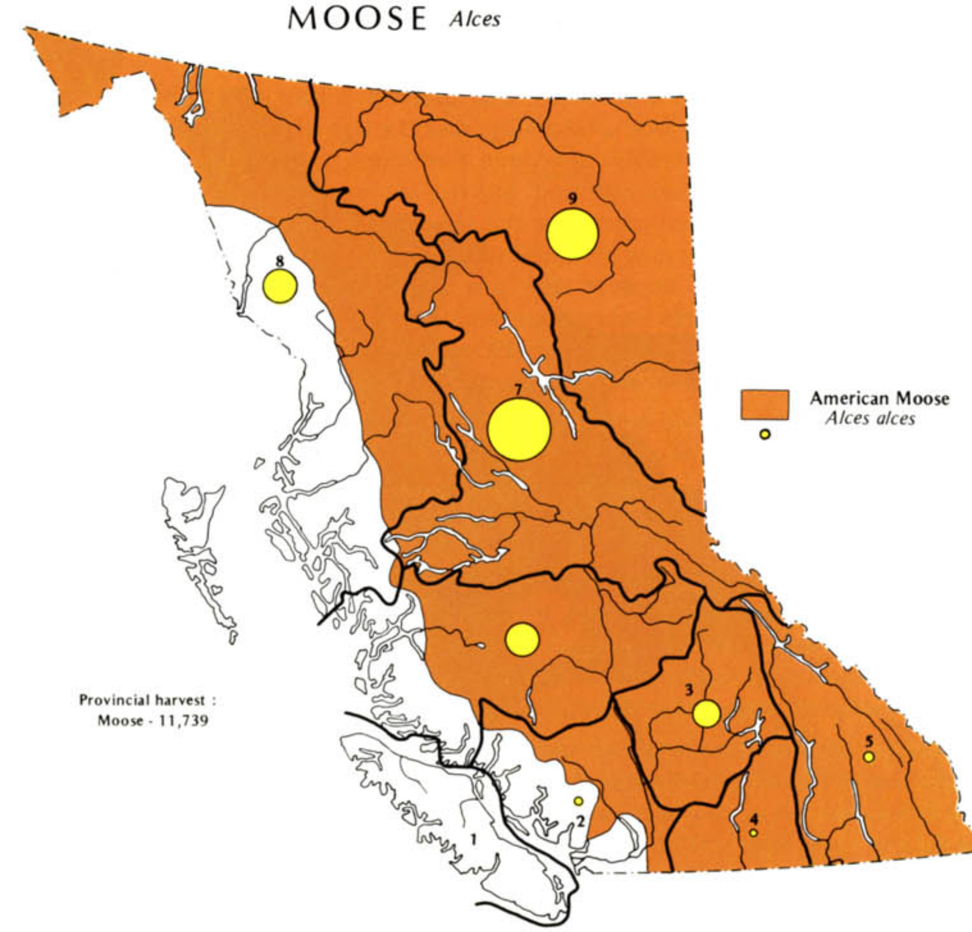
Game animals harvested



Where harvest of both genera is small, symbols are shown side by side. Otherwise, symbols are concentric.



MOOSE *Alces*



Map 26. Freshwater Sport Fish

Of the many species of freshwater game fish in British Columbia, the most popular are trout (*Salmo* species), char (*Salvelinus* species), and Pacific salmon (genus *Oncorhynchus*). Like big game, stocks of sport fish have been under government management for many years. The general management objective is to maximize annual catch without depleting the resource. Ongoing study is necessary to determine the requirements of individual species, the limnology of the province's myriad lakes and streams, and environmental changes from both natural and human causes.

The true trouts (*Salmo* species) are represented by rainbow (*S. gairdneri,* which includes Kamloops and steelhead varieties), cutthroat (*S. clarki,* which includes two subspecies, coastal and Yellowstone), and brown trout (*S. trutta*). The brown trout is not native to British Columbia and has been introduced in only two regions, the West Kootenays and Vancouver Island. Partly because of their limited distribution, brown trout are not represented on the map, and comparatively few are taken. They are, however, locally important, especially to anglers on southern Vancouver Island. Coastal cutthroat are more widely distributed and more prominent in the sport fishery than the interior subspecies. Like their close relative, the rainbow trout, some populations of the species migrate to the sea, returning to freshwater to spawn. Because of their value as a sport fish, cutthroat trout have been introduced in parts of the southeastern interior, but through most of their range, the populations are indigenous. Approximately 500,000 cutthroat are taken annually, about 50 per cent of them on Vancouver Island and another 30 per cent on the mainland coast. Rainbow trout are by far the most numerous and most important of the *Salmo* species in the game fishery and can be taken on a variety of tackle. Depending upon conditions in the particular water body, food availability, and the age of the fish, the size varies considerably. Specimen Kamloops trout in the range of 23 kg have been reported, but the average size is much less. Steelhead, which constitute the sea-run (anadromous) form of rainbow trout, may also attain large size; the British Columbia record is 17 kg. Because they run to salt water and grow as large as some Pacific salmon species, they constitute a minor component of the commercial fishery and are occasionally caught in the sea by sport fishermen.

Char (*Salvelinus* species) are widely distributed in the province. There are three species present, lake "trout" (*S. namaycush*), brook (speckled) "trout" (*S. fontinalis*), and Dolly Varden (*S. malma*). The second of these was introduced from eastern North America where its common name was given to it. The range of occurrence of Dolly Varden is not shown on the map, but like the sea-run cutthroat and the steelhead, it is anadromous and it is widely distributed in the western part of the province. In some local fisheries char are highly prized, but opinions vary as to their sporting qualities compared to those of other fish.

Pacific salmon (*Oncorhynchus* species) constitute a major component of both the freshwater and the saltwater sport fishery in British Columbia as well as providing the basis of the commercial fishery (see Map 43). In freshwater, kokanee (*O. nerka*), chinook (spring) (*O. tschawytcha*), and coho (*O. kisutch*) are important. In salt water, the sports catch is mainly of coho and chinook, though pink (humpback) salmon (*O. gorbuscha*) are also taken. Kokanee are a land-locked variety of sockeye salmon. Although generally identical to the main species, the kokanee is a smaller fish and will readily take an artificial lure. As a result, anglers take them in considerable numbers. The biggest single kokanee fishery is in Kootenay Lake. Chinook and coho are widely distributed in the major streams and lakes (excluding those of Arctic drainage), but for simplicity, their distribution and catch statistics are not represented on the accompanying map. A general indication of distribution may be gained from Map 44.

The accompanying maps show the distribution of some of the main species and the catch by angler region. In reading the maps it is important to bear in mind that all adult freshwater anglers must be licensed and that catch statistics are given by home address of the licensee. Thus, for example, a significant catch of lake trout is shown for Region 2 (Mainland-Coast), even though they do not naturally occur within that region. The pie-graphs, then, are in part an indication of angler origin as well as of catch success. As was seen in connection with the game animals map, however, it is not unreasonable to assume that the areas of high catch are also areas of greatest fishing pressure and relative fish abundance. This assumption is supported by the evidence of fishing effort. The distribution of fishing effort (angler-days) shows that by far the largest share of the licensees in a given region do their sport fishing within that region. Of an annual estimate of 350,000 angler-days in the Okanagan Region, for example, 75 per cent is spent by Okanagan residents; on Vancouver Island, 90 per cent of the angler-effort is attributable to Island residents.

The diagram suggests the great importance of salmon as sport fish in tidal waters. Well over half a million salmon are taken annually, over 80 per cent of them in and around the Strait of Georgia. Coho make up about 70 per cent, chinook and jacks (immature male chinook salmon) most of the remainder. Both coho and chinook are highly prized by sport fishermen because they can be taken on artificial lures and because of their sometimes spectacular activity when hooked. As a result, each year many anglers are attracted to British Columbia waters. Chinook attain the largest size, and trophy fish (often referred to as "tyees") may attain weights in excess of 25 kg. The world record chinook taken on rod and reel weighed 43.5 kg, but considerably larger specimens have been recorded in the commercial fishery.

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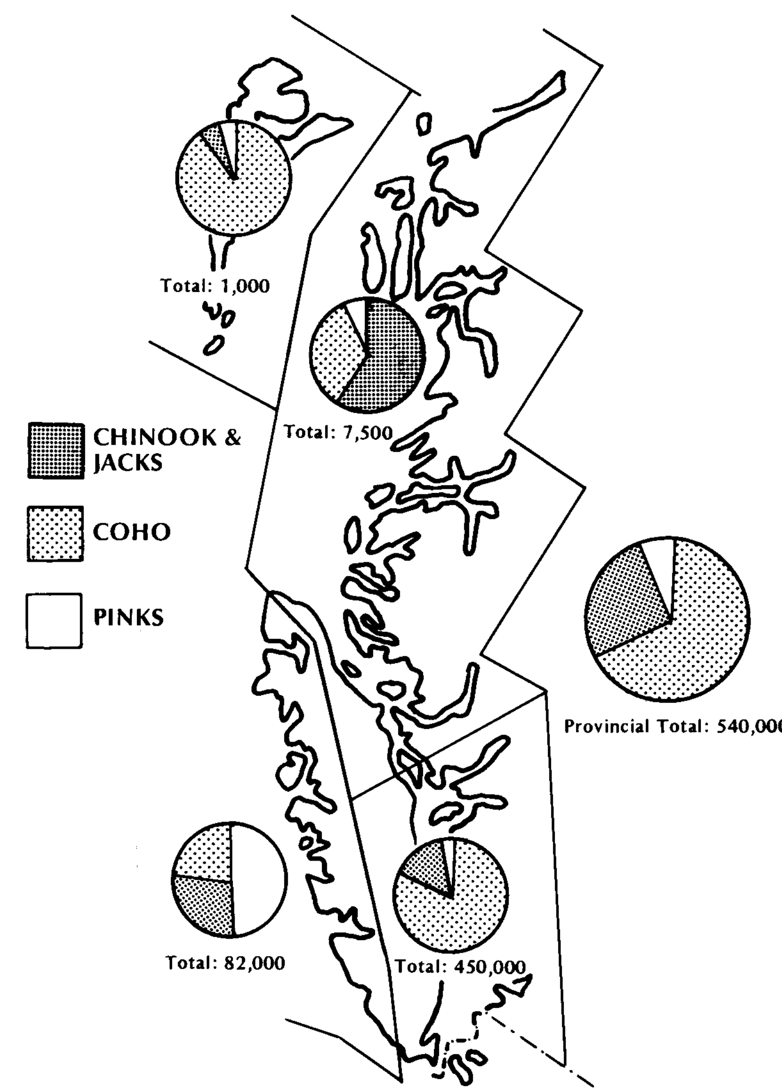
Large sport fish such as this one attract fishermen to British Columbia's coastal streams.

SALMON SPORTFISHING, TIDAL WATERS

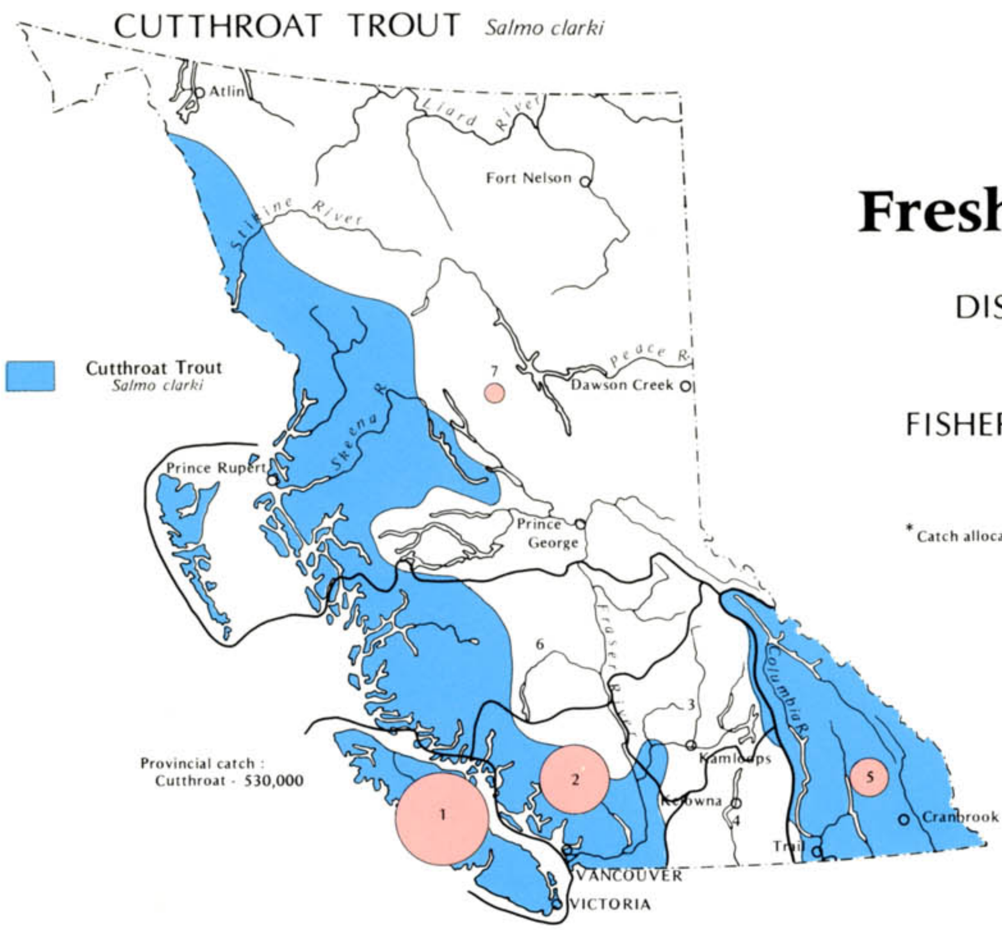
Numbers, Proportion and Species by Region, 1971

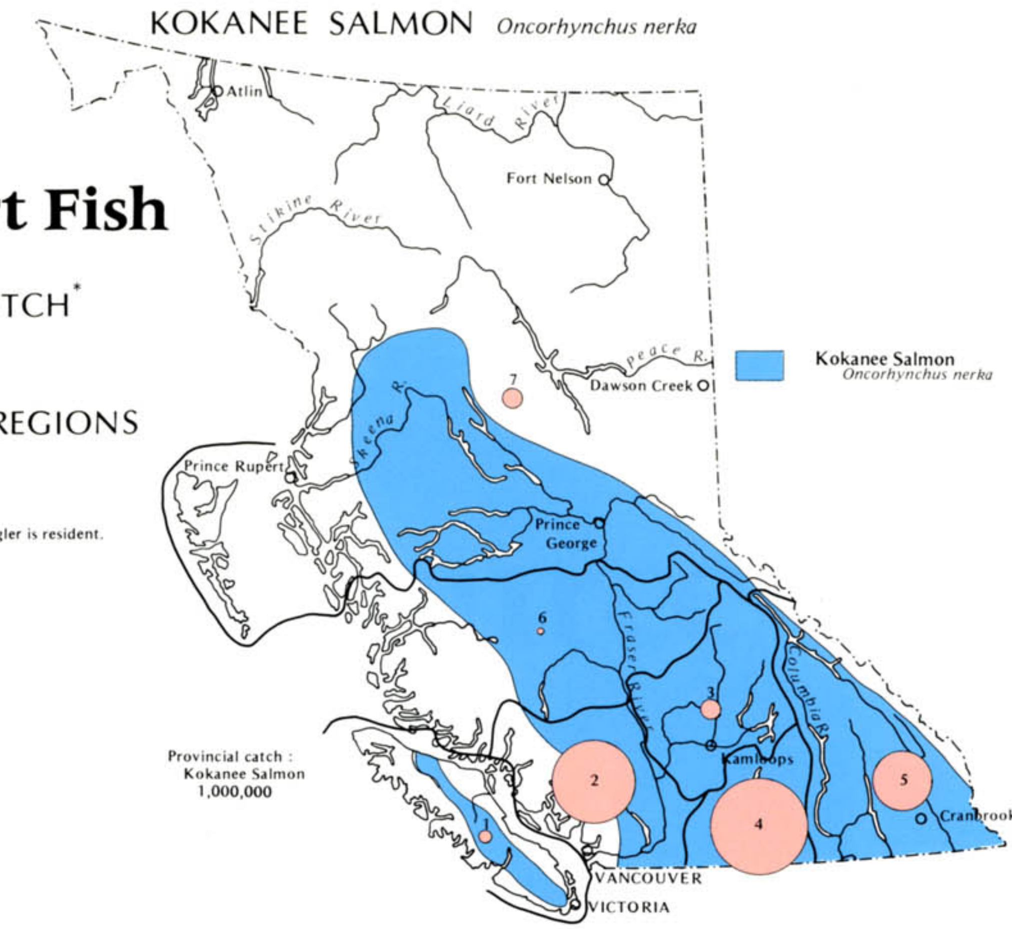


Freshwater Sport Fish

DISTRIBUTION AND CATCH*
BY
FISHERIES MANAGEMENT REGIONS
1969 - 1970

*Catch allocated to Fisheries Management Region in which angler is resident.

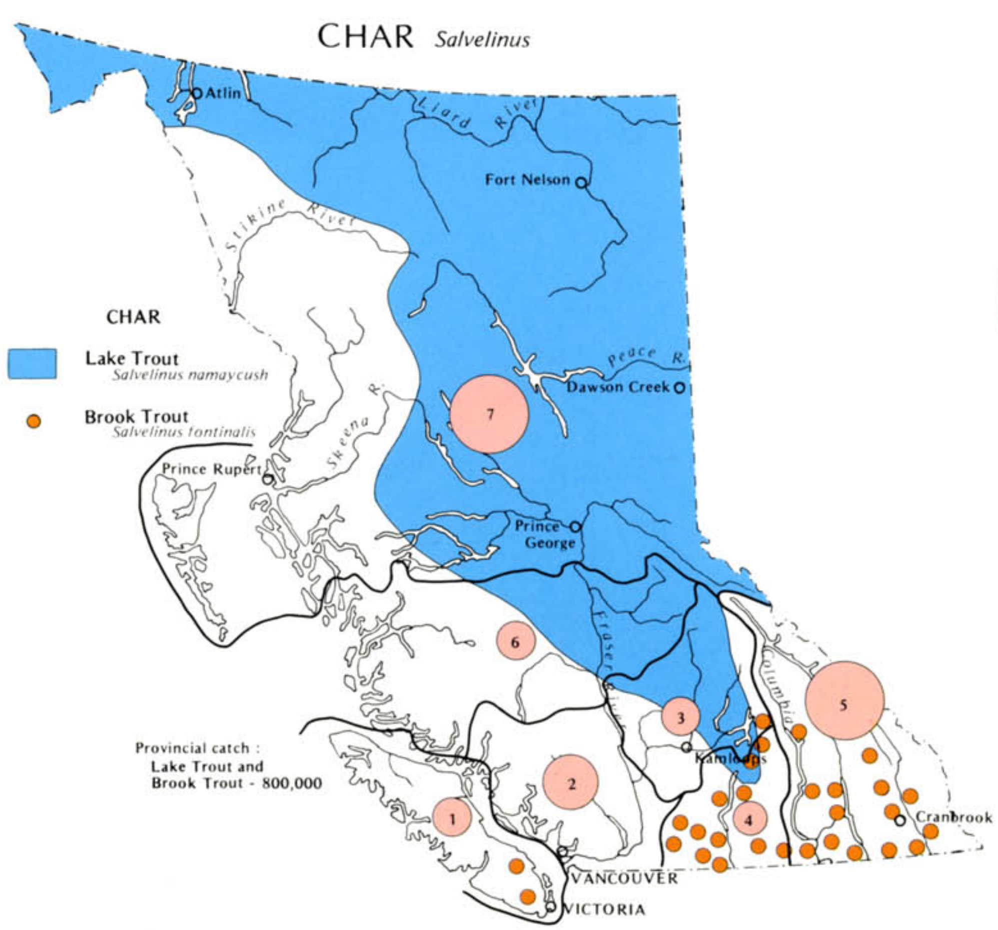




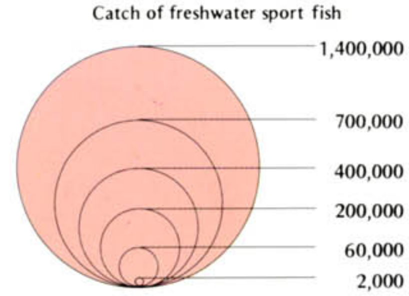
Fisheries Management Regions

1. Vancouver Island
2. Mainland – Coast
3. Kamloops
4. Okanagan
5. Kamloops
6. Cariboo – Coast
7. Northern

Region boundary

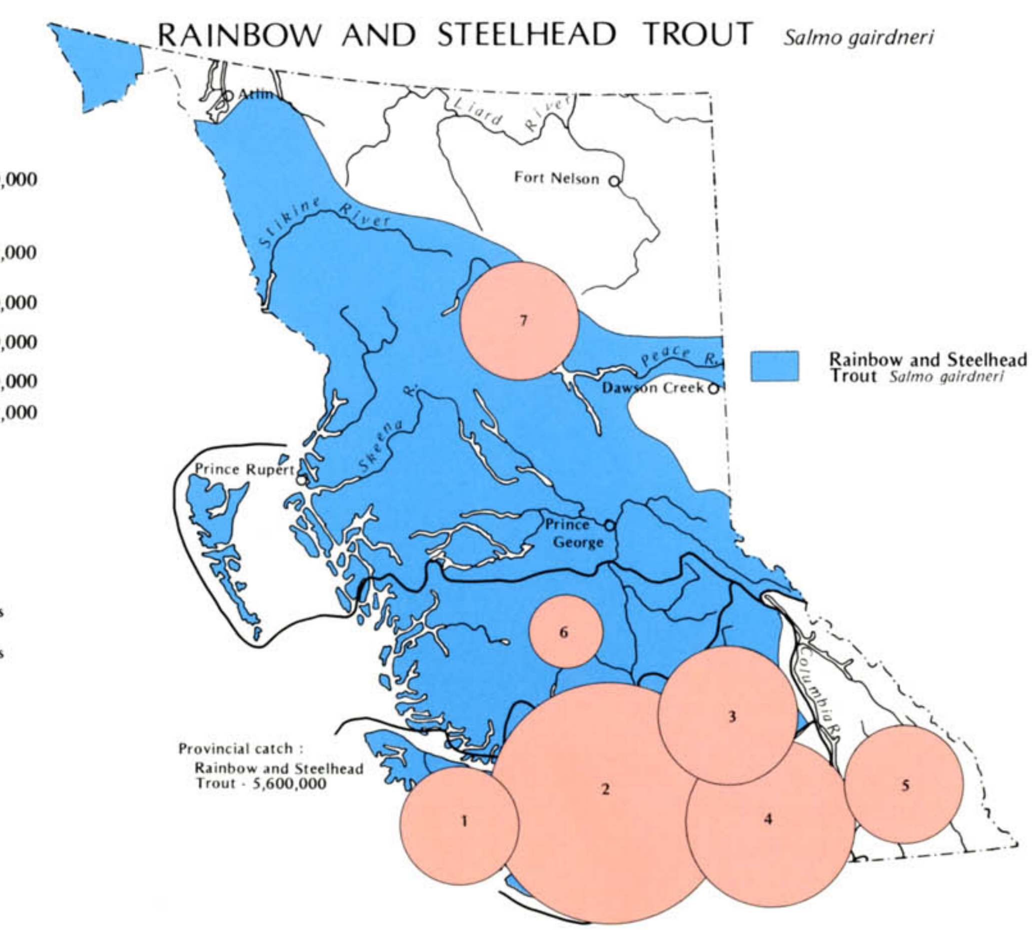


Catch of freshwater sport fish



100 0 100 200 Kilometres

50 0 50 100 Statute Miles



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Resource Use

Map 27. Forestry: Distribution of Forested Land

British Columbia has only 17 per cent of Canada's total amount of forested land, but that comparatively small area contains 40 per cent of the nation's merchantable timber. It is not surprising, then, that the Pacific province is a major producer of forest products (see Maps 31 and 33).

British Columbia's total area is approximately 95 million hectares. Of this, 55 per cent is forested, mostly in stands of coniferous trees. The accompanying map illustrates the distribution and reveals the strong influence exerted by topography, soils, and climate (see Maps 12, 14, 17, and 20). The major topographic units are reflected in the northwestward-trending, alternate zones of forested and non-forested land. The insular mountains and the associated margins of the Coastal Trough are mainly forested. The great mass of the Coast Mountains, by contrast, is largely non-forested. Except for its northern portion, the Intermontane System supports forest growth, indicating that the area has a less rugged topography and at least a thin veneer of glacially derived soils. The Cassiar-Columbia Mountains and the Rocky Mountain area may be recognized by the non-forested land in those parts of the map, while the Alberta Plateau in the northeast is predominantly forested. The most extensive areas of sedentary agriculture in the lower Fraser Valley, in the Okanagan, and in the Peace River area are insignificant in the general pattern of non-forested land. On the other hand, the main areas of open grassland, in the Kamloops-Merritt area and along the Fraser mainstem south of Williams Lake, are quite distinctive as non-forested areas.

As one progresses northward the effect of latitude on climate results in a decrease in elevation of treeline. More non-forested (mountain) area is evident. In the northern plateau areas most of the tree cover (but not all of it) is in the valleys. As noted elsewhere in this atlas, latitude has a significant effect upon temperature regime, length of day, and growth potential, especially for the interior.

Altitudinal influences are clearly reflected in the intricate, interlocking pattern of wooded valleys and alpine barren land that is apparent from the fjordland of the coast to the Rocky Mountains and from the 49th parallel to the Yukon. Similar interrelationships exist in the vertical zonation of the forest; the heaviest stands are concentrated in the valleys and the upper slopes support only a light subalpine cover (see Map 23).

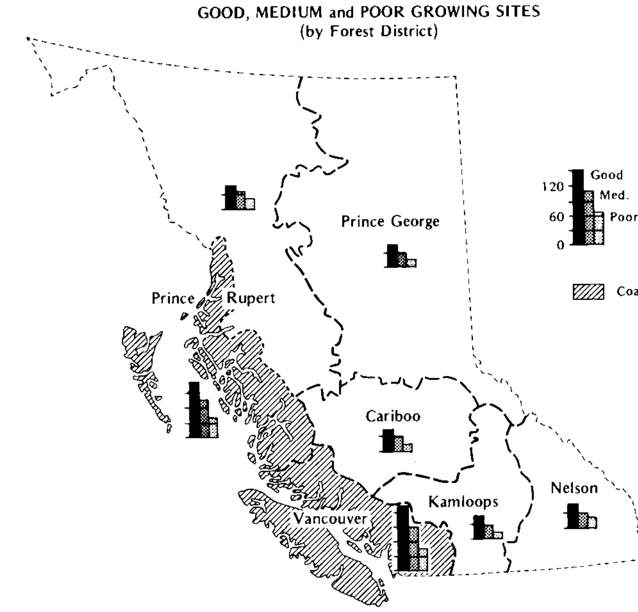
Timber land, that is, land supporting the species that are most utilized for sawn lumber, comprises most of the area of forested land. Principal among those species are Douglas-fir, western hemlock, the spruces, and the true firs. The map does not attempt to distinguish the timber land nor the areas of highest timber volumes. In general, however, the Coast Forest (the area west of the Coast Mountains summit-line) contains most of the large stands of Sitka spruce, western hemlock, Douglas-fir, and cedar. The mild, wet conditions that prevail on the coast promote relatively rapid growth and the development of large individual trees. Most of the old-growth stands containing huge trees have long since been harvested, but occasional specimens are still found that have attained a height of over 60 metres and a diameter well in excess of 1 metre.

Typical interior old-growth tree stands are smaller in stature and composed of different species than coastal ones. Characteristically, mature forests of the southern interior contain a greater range of commercial species and higher timber volumes per unit area than those in the north. South of latitude 53°N, Douglas-fir is common, though mature trees do not attain the size of their coastal counterparts. In the Prince George area and northward to about latitude 56°N, balsam fir, spruces, and lodgepole pine represent the most abundant and widely used species. Northward of 56°N, white spruce is a major lumber species, though until the 1970's, the northern forests of British Columbia had not been used commercially.

Logging has been extensive elsewhere for many years — on the coast since the beginning of this century and in the interior since mid-century. Large areas have now been cut over. Also, the rate of cutting has increased considerably over the years, so that the total area of non-forested land is rather greater than what is shown on the map, especially for Vancouver Island. As the accompanying illustration of regional growth potential indicates, however, the coastal area, and particularly southwestern British Columbia, has the greatest capacity for forest regeneration, and the rate is sufficiently high to warrant classifying most of the cut-over land as "forested." On that basis and in the sense of long-term management, the coast forest can be considered the keystone of British Columbia's forest industry.

Dark-green strips of coniferous growth, left to allow natural reseeding of logged areas, contrast with lighter deciduous cover.

MEAN ANNUAL INCREMENT
GOOD, MEDIUM and POOR GROWING SITES
(by Forest District)



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Forestry

DISTRIBUTION OF FORESTED LAND

Map 28. Forestry: Distribution of Commercial Species

From its beginnings in the middle of the nineteenth century, British Columbia's forest industry has depended upon a bountiful resource of coniferous trees. Deciduous trees constitute less than 3 per cent of the forest volume. Over the years different species have been utilized, but for a very long time the industry was synonymous with a single species, Douglas-fir.

The distribution of Douglas-fir and that of some other commercially important species are shown on the accompanying maps. For clarity of presentation, only the overall range limits are shown; non-forested areas within those limits, particularly those associated with mountainous topography, have been disregarded (see Map 23).

The range of Douglas-fir covers only half the province, and even within that area, heavy growth is limited to a relatively few locations. Forest Service inventory statistics indicate that less than 7 per cent of the total volume of mature tree stands in the province is made up of Douglas-fir. While the proportion of Douglas-fir was never very high, until mid-century it was cut at a faster rate than regeneration could support. Partly on that account and partly because of the world demand for lumber and wood products, other species have now replaced it in volume of cut.

The true firs have a combined range that covers almost the entire province. Of the three species represented on the map, *A. amabilis* and *A. lasiocarpa* have far the widest distribution and the largest volumes, grand fir being limited to the southern part of the coastal trough. Collectively, the true firs constitute 19 per cent of British Columbia's mature forest volume and contribute a significant share of the annual cut, especially in the central interior.

Red cedar is associated with the humid and relatively mild climate of the coastal forest. It is widely known for its resistance to decay and for its decorative qualities as well as for the important place it held in the native Indian culture of the Pacific Northwest. Cedar shingles, rustic shakes, siding, and panelling are in considerable demand for housing construction. Of the province's 7.8 billion cubic metres of mature forest, red cedar constitutes 11.5 per cent.

Like cedar, hemlock grows in the more humid areas of the province, notably in the coast forest and in the Columbia forest ("Interior wet belt"). Although it does not have the structural rigidity of Douglas-fir, it is well-suited to many building applications and now competes in a lumber market that was once the exclusive realm of Douglas-fir. Accounting for over 23 per cent, hemlock constitutes the largest single share of the mature forest volume.

Among the important commercial species in British Columbia's forest industry are the spruces and pines. Because of space constraints, these are not shown on the map. Collectively, their ranges are province-wide, though individual species, such as Sitka spruce or western white pine are much more limited. Some idea of the range of each can be gained from Map 23.

Spruce, including three species which in combined range cover the province, ranks next to hemlock in mature forest volume, representing 22 per cent; balsam ranks next at 19 per cent, followed by lodgepole pine with 14 per cent.

The accompanying text illustration shows the present and potential wood harvest from British Columbia's forests based upon 1973 Forest Inventory data. The diameter of the pie-graphs is proportionate to the volume of cut for each district. The species cut is a reflection of species availability and relative market demand. Total cut reflects the basic resource endowment, overall market demand, and historical evolution of the forest industry.

The Vancouver Forest District, one of the smaller districts in area, accounts for the largest single share of the total cut and a large part of the cut of hemlock, Douglas-fir, and balsam. Cedar accounts for much of the graph segment labelled "other." The circle representing allowable cut suggests, however, that the present harvest has reached the sustainable maximum.

In some other districts, notably Prince Rupert and Prince George, the actual cut is well below the sustainable maximum. The areas of those two administrative units are much greater than those of southern districts. The Prince George District, for example, is as large as the combined areas of Great Britain and Northern Ireland. Even though the average forest growth rate there is slow, the total allowable cut from so vast an area exceeds that of the southwest coast. Against this background, it seems likely that the trend toward acceleration of forest cutting in the interior will continue so long as market conditions permit. Prince George now ranks second among the Forest Districts in total cut and has the potential to match Vancouver in annual harvest volume.

The declining availability of Douglas-fir and the increasing importance of the interior districts are made apparent by a comparison of provincial forest cut over a number of years.

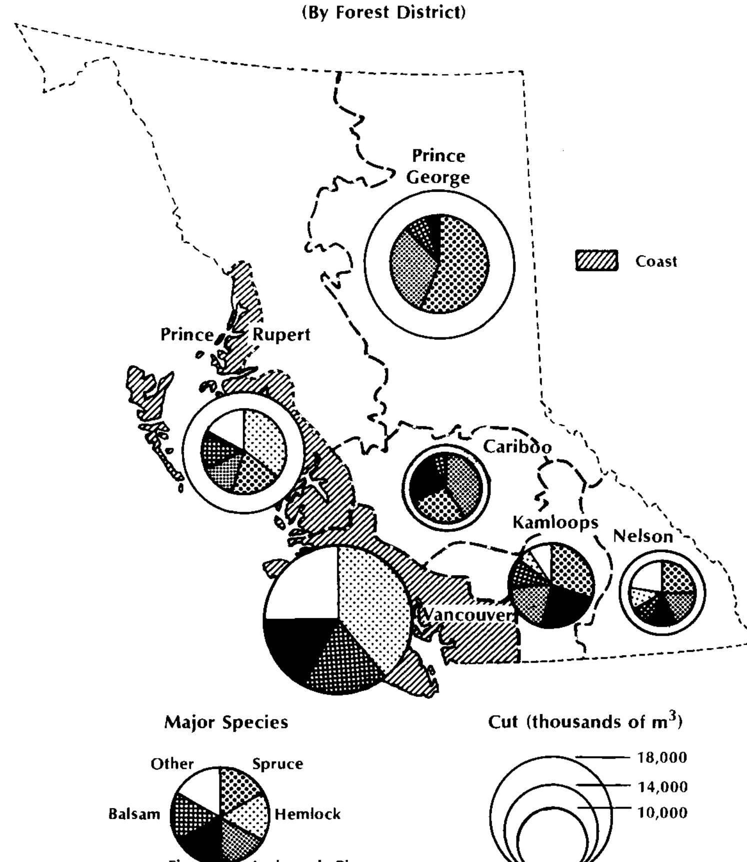
PROVINCIAL FOREST CUT, 1955–1976

	Total cut (millions of m³)	Coast	Interior	D. Fir	Hemlock	Spruce	Lodgepole pine	Balsam
1955	29.3	63%	37%	31%	20%	13%	no signi-	6%
1965	43.4	56	44	25	22	21	cant cut	10
1976	69.5	46	54	13	22	21	16	13

Since 1968, both hemlock and spruce cuts have exceeded that of Douglas-fir. The harvest of lodgepole pine became significant in 1967, and by 1972 it had risen to fourth place in volume produced. In 1972, total interior cut exceeded that from the coast, and since 1973, Douglas-fir harvest has shown an absolute as well as a relative decline. These relationships help explain the changing spatial pattern of forest-based industrial activity in British Columbia. They also serve as a warning that the once-bountiful resources of Douglas-fir, upon which the industry was founded, and on the basis of which British Columbia lumber has been able to command high prices in world markets, are indeed finite.

PRESENT AND POTENTIAL FOREST HARVEST

(By Forest District)



Outer circle indicates total allowable annual cut. Inner circle indicates actual annual cut (by species). Where differences between actual and allowable cut is small, a single circle is shown.

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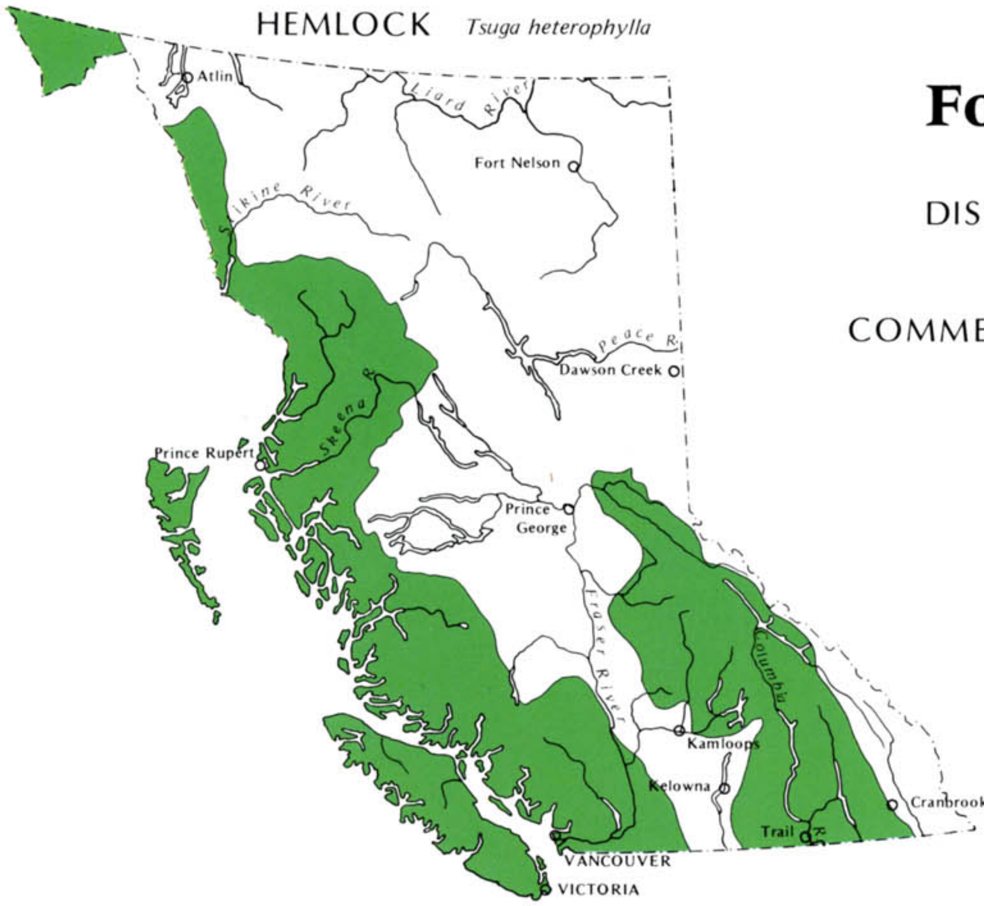
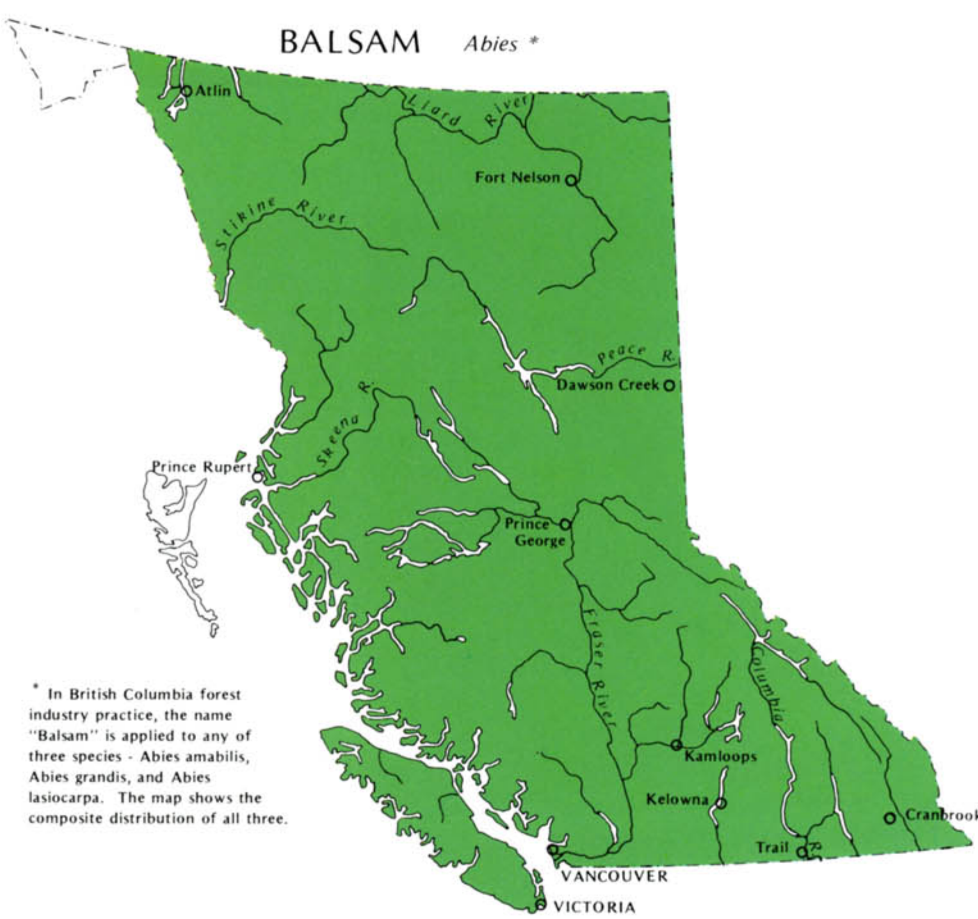
A Walk in the Forest. Vancouver: MacMillan Bloedel Ltd., 1973.

Thousands of seedlings are planted in reforestation programmes.

Forestry

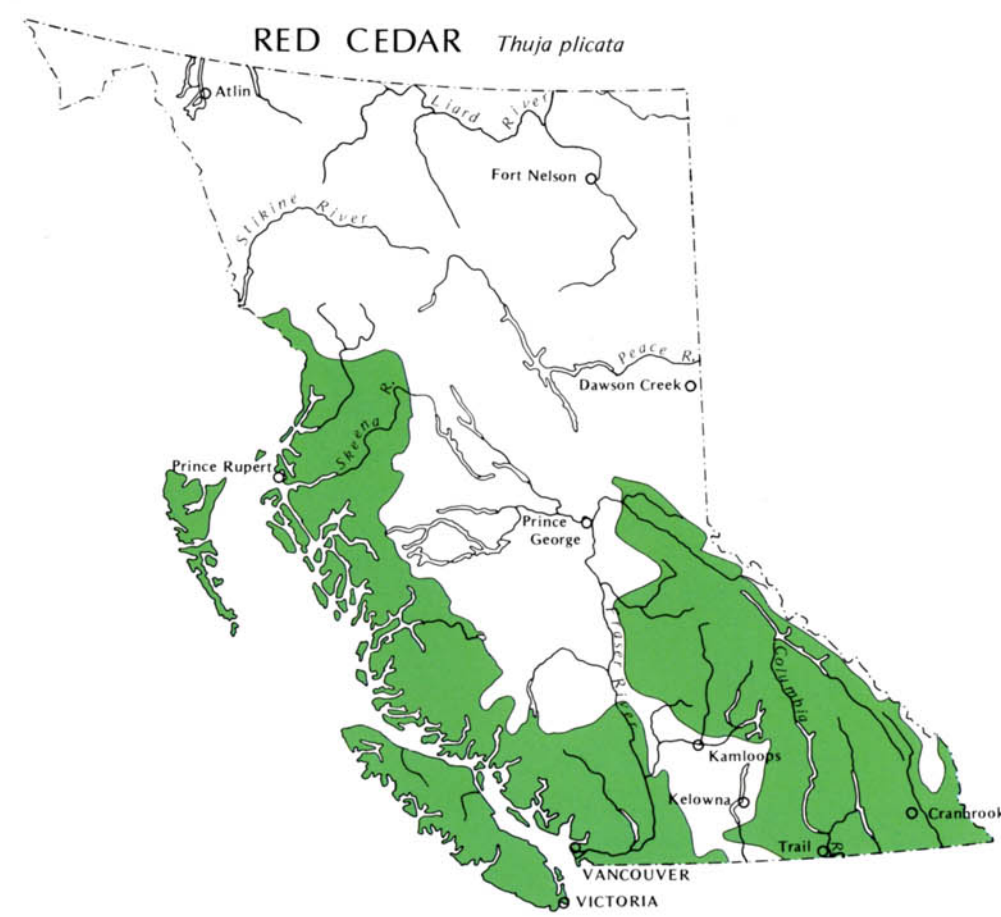
DISTRIBUTION OF COMMERCIAL SPECIES





* In British Columbia forest industry practice, the name "Balsam" is applied to any of three species - Abies amabilis, Abies grandis, and Abies lasiocarpa. The map shows the composite distribution of all three.

100 0 100 200 Kilometres
50 0 50 100 Statute Miles



Map 29. Forestry: Forest Administration, 1976

Forestry has been an integral part of British Columbia's economy from the beginnings of permanent white settlement in the 1840's. By the turn of the twentieth century the forest industry had become the major source of employment and the main generator of provincial wealth among the goods-producing industries. For many years the bountiful timber resource was considered more than sufficient to meet the needs of an expanding industry. But by mid-century it was becoming increasingly apparent to both industry and government that some form of long-term management programme was necessary. Since the rapidly growing forest-industrial complex required successively greater levels of capitalization, it needed a guaranteed source of raw material. With the adoption and implementation of the major recommendations of the Sloan Commission in the late 1950's, a sustained yield programme was initiated in British Columbia's forests. More recently, the Pearse Commission has recommended revisions to stumpage and royalty payments in light of the long-term needs of the industry. The changeover has been gradual and is not yet complete, but in 1976, 75 per cent of the forested land was under one form or another of sustained yield management.

The map shows the distribution of management units. Those units are of two main kinds, Tree Farm Licences and Public Sustained Yield Units. The former are operated by private forest companies, the licensee being responsible for access, fire protection, disease control, harvesting, and general management of the forest on a sustainable basis and in accordance with Forest Service regulations. The area within the licence usually consists of a combination of crown (public) land and privately held (alienated) land, but it may be entirely crown land. The purpose of granting these licences is to provide industry with an assured, low-cost wood supply.

Public Sustained Yield Units, on the other hand, are under the direct management of the Forest Service. They consist of crown land and cover the largest share of the forested area. When a given tract of timber is ready for harvest, it is auctioned, and the successful bidder has the right to extract the timber under specified conditions. The purpose of sustained yield units is to provide a source of wood supply to smaller companies and to private operators whose levels of capitalization are insufficient to meet the required conditions of a Tree Farm Licence.

In addition to the two major forms of forest tenure, there are certified tree farms and farm woodlot licences. Though small in total area, they provide incentives to private owners of forested land to manage it according to sustained yield principles. In that sense, they are by no means insignificant in the programme to ensure timber supplies for the future.

Large logs cut on the Queen Charlotte Islands are loaded onto trucks for transport to waterside.

In the interior, logs of smaller girth are mechanically harvested.

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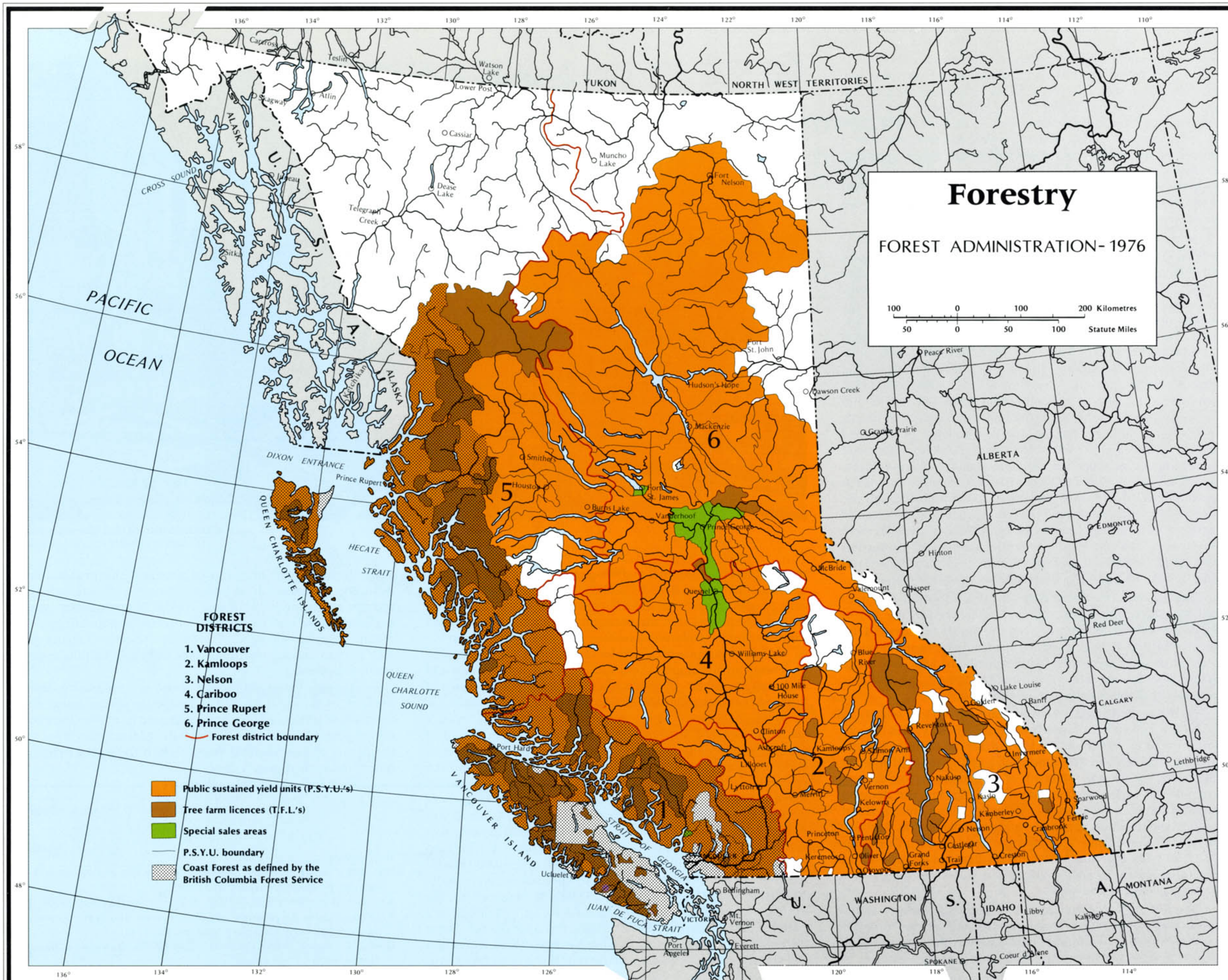

Forestry
FOREST ADMINISTRATION - 1976
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
FOREST DISTRICTS
1. Vancouver
2. Kamloops
3. Nelson
4. Cariboo
5. Prince Rupert
6. Prince George
Forest district boundary
Public sustained yield units (P.S.Y.U.'s)
Tree farm licences (T.F.L.'s)
Special sales areas
P.S.Y.U. boundary
Coast Forest as defined by the British Columbia Forest Service
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
WASHINGTON
IDAHO
MONTANA
U.S.A.
ALASKA
QUEEN CHARLOTTE ISLANDS
VANCOUVER ISLAND
HECATE STRAIT
QUEEN CHARLOTTE SOUND
DIXON ENTRANCE
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
CROSS SOUND

Map 30. Forestry, Historical: Location and Capacity of Sawmills, 1931–1961

Commercial sawmilling in British Columbia began near Victoria early in the European settlement history of the province. Because the forests were abundant and the technology of extraction was primitive, sawmilling and logging were spatially associated. Logging sites were close to tidewater, so that timber could be floated to the mills, and they, in turn, were commonly located at sources of hydro-mechanical power. As the more accessible stands were depleted, expansion of logging took place, especially along the east-coast lowland of Vancouver Island. By the mid-1860's, commercial logging and sawmilling had been extended to the mainland, particularly along the shores of Burrard Inlet.

With the completion of the C.P.R. line to Vancouver in 1887 and the associated integration of external trade connections, sawmilling received major impetus. By 1900 logging was rather widely dispersed in the Vancouver area, along the lower mainland coast, and along the east coast of Vancouver Island. But the location of sawmills was becoming centralized in a relatively few nodes. On the mainland, Vancouver was the centre and to it moved logs from an expanding resource frontier, especially along both margins of the Strait of Georgia. Central to the increasing separation of logging and sawmilling was the application of innovative technology in extracting logs from the forests and transporting them to the mills. The bull-teams and horse-teams gave way to inanimate energy. The development of high-lead yarding systems and the use of the steam (donkey) engine and the logging railway opened up large stands of high-volume, high-quality timber on Vancouver Island. Logs were dumped at tidewater, sorted into rafts, and towed to the mills through the comparatively sheltered waters of coastal inlets and the Strait of Georgia. Consequently, large-capacity, stationary sawmills were developed at tidewater sites, where economies of production scale could be realized and an extensive resource hinterland could be linked with convenient processing and export locations.

The location factors that led to centralization of large-capacity mills on the coast were well established by the 1930's and continue to be important. Even the timber resources of the Queen Charlotte Islands, over 800 km from points of utilization in the Vancouver area, were being tapped. The logs were made up into large bundle rafts to withstand the open sea conditions between the Queen Charlottes and the lower coast.

As the accompanying maps indicate, sawmilling activity in 1931, both in number of mills and in mill capacity, was heavily concentrated on the coast. By 1961, dramatic changes had occurred in the interior. The limited size and number of interior mills in the 1930's was the result of several interacting factors. International export markets were growing, but the demand could be met by established coastal mills, whose efficiencies of log flow and transport connectivity were considerable. Further, the species composition of interior forests is different (see Maps 23, 27, and 28), individual trees are smaller, and stand volumes tend to be lower. In addition, low-cost water transport is not available to most inland mills.

The few mills that existed in 1931 were sited where abundant supplies of quality timber were available, where local demand existed for sawn lumber, and where rail transport was at hand. Following World War II, remarkable changes took place in national and international markets, and these were reflected in the spatial pattern of British Columbia's forest industries. In the early postwar years there was a burgeoning demand, particularly for sawn lumber. Later, the packaging revolution provided the stimulus for tremendous increases in pulp and paper output.

Coastal mills marked the beginning of British Columbia's timber-processing industry.

Major development of interior sawmilling was the outcome of several forces, among them escalating market demand and declining accessibility of good timber on the coast. But because of the species and quality composition of interior forests, comparatively large areas of forest were needed to supply even a medium-sized mill. Such conditions encouraged the attraction of mills to timber resource areas rather than the reverse. The result was the proliferation of small, diesel-powered mills that could be operated by a few men and that could be dismantled and moved when the local timber stand had been depleted. In 1955 there were nearly 2,500 operating sawmills in the province, all but about 350 of them in the interior. By 1961 the areal expansion of interior sawmilling had reached its maximum. As the map shows, most of the mills were of small capacity — 50,000 board-feet a day or less. Most coastal mills, by comparison, were in the 100,000–500,000 board-foot range. Typically, the green lumber from portable units would be trucked to an established rail centre, such as Kelowna, Williams Lake, or Prince George. There it would be dried and planed into lumber of standard dimension and shipped via rail to interior markets or to the coast for export.

With the extension of the road network, the organizational evolution of forested land under sustained yield management, and the emergence of corporate control of the industry, spatial expansion gave way to a pattern of consolidation. Logging and milling practices changed accordingly. Selective logging gave way to clear-cutting with spar-trees and cable-hauling systems much in evidence.

Although major differences exist in topography and in medium of transport as well as in species composition of the forests, similarities exist between coast and interior in the evolution of sawmilling pattern. The coastal organization evolved over the period of one hundred years; that in the interior emerged within the span of twenty-five.

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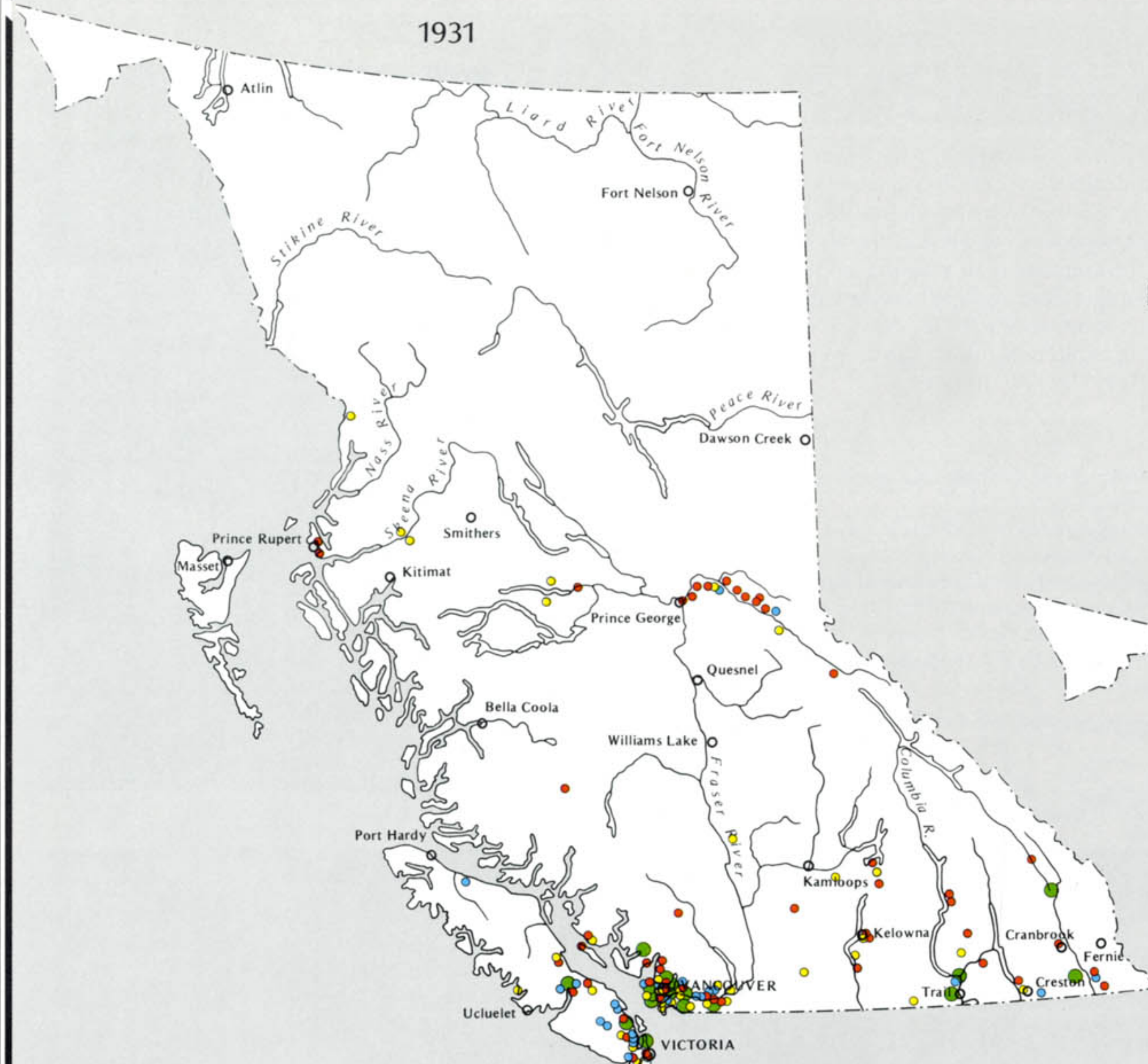
Forestry

HISTORICAL

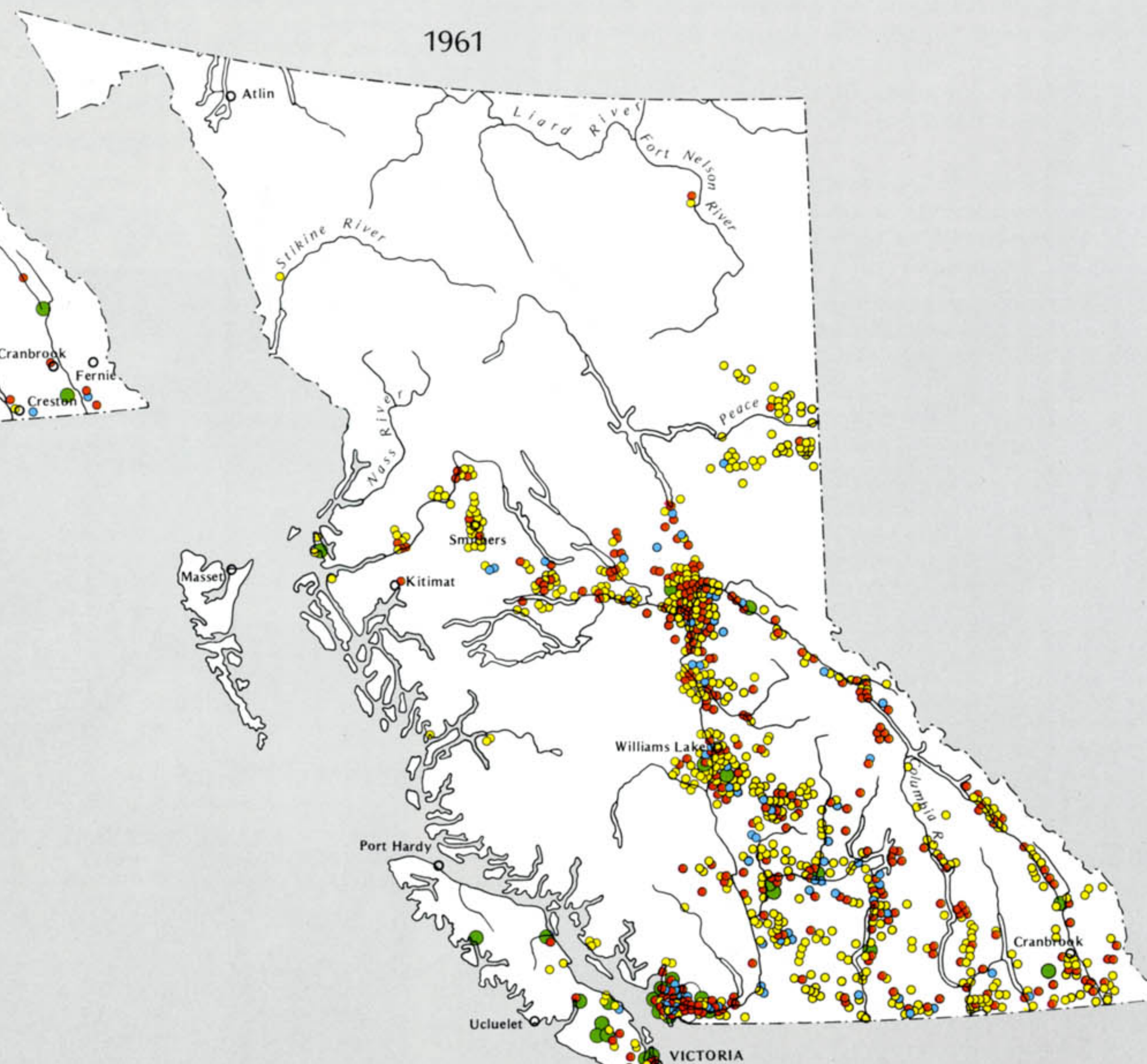
LOCATION AND CAPACITY OF SAWMILLS

1931-1961

1931



1961



Estimated daily capacity in thousands of board feet (M B.F.)

- 10 - 20
- 21 - 50
- 51 - 100
- 101 - 500
- Greater than 500

100 0 100 200 Kilometres

50 0 50 100 Statute miles

Map 31. Forestry: Location and Capacity of Sawmills, 1971

Collectively, logging and the manufacturing of forest products provide more employment and contribute more value added than any other industrial sector in British Columbia (see Map 51). Sawmilling is the traditional conversion enterprise, and over three-quarters of the annual log harvest goes directly to lumber mills. The remainder is used in the production of pulp and paper and plywood; log export is negligible. In recent years British Columbia has produced about 70 per cent of the Canadian output of sawn lumber. The production amounts to approximately nine billion board feet annually, which would be sufficient to build over one million wood-frame homes. So very large an output is the result not only of resource wealth and product demand but also of the size of the work force. In fact, sawmilling accounts for well over half of the total employment in wood products industries within the province and generates nearly half of their annual value.

Like those on the preceding page, this map is designed to emphasize the mills of small and intermediate size-range. Consequently, the circle symbols representing the largest capacity groupings are left uncoloured. Capacities are shown in the conventional units of lumber measure. The abbreviation f.b.m. signifies feet, board-measure; M B.F. indicates thousands of board-feet. Exclusive of saw kerf, there are approximately 424 f.b.m. in 1 m^3.

The process of spatial consolidation of interior sawmilling that had been at work in the 1960's shaped the pattern of the 1970's. Fewer mills are present, but average mill capacity has increased. As the map reveals, however, in 1971 there were still many more sawmills in the interior than on the coast, and average capacity was appreciably lower. Only one interior mill had a daily capacity in excess of 500,000 f.b.m., while there were ten such mills on the coast.

On the coast, the size of the logs and the availability of low-cost water transport made centralized, large-capacity plants practical. Improved extraction and transport technology meant that logging could be extended to the very headwaters of coastal streams. The logging railway gave way to truck roads. Many of these utilized old railway grades, but they could also be extended into more difficult terrain. Telescoping steel spar-trees that could be moved under their own power and diesel-engined loading machines increased extraction efficiency, and the self-dumping log barge improved the capability for log transport over the longer water hauls.

Other factors that help account for the differences between coast and interior include geographic inertia, changing resource availability, and administrative policy. If small operations can continue to acquire timber, there will probably continue to be portable sawmilling in the interior, but on a much more limited scale than in the past. Most of the lumber output comes from the larger, stationary mills whose capacities have grown in some cases to rival those on the coast. The largest coastal mills may be somewhat outdated, since they were planned and developed at a time when a continuous supply of large logs seemed assured. By contrast, the large interior mills are newer, more automated, and better able to handle a variety of log qualities and log sizes. Except in a few locations where large areas of high-volume timber exist, however, it seems doubtful that the logistics of timber processing in the interior will make it expedient to build large mills of the sort now prevalent on the coast.

In terms of the overall pattern of sawmilling in the province, it is conjectured that new industrial complexes will emerge in the northern interior to utilize presently undeveloped forest resources there. Thus, a dual expression of present trends can be envisioned — increasing centralization in existing nodes and northward expansion into a few new ones. Whatever the long-term outcome may be, it seems probable that, for the next decade at least, interior sawmilling will continue to show much less spatial concentration than is evident on the coast.

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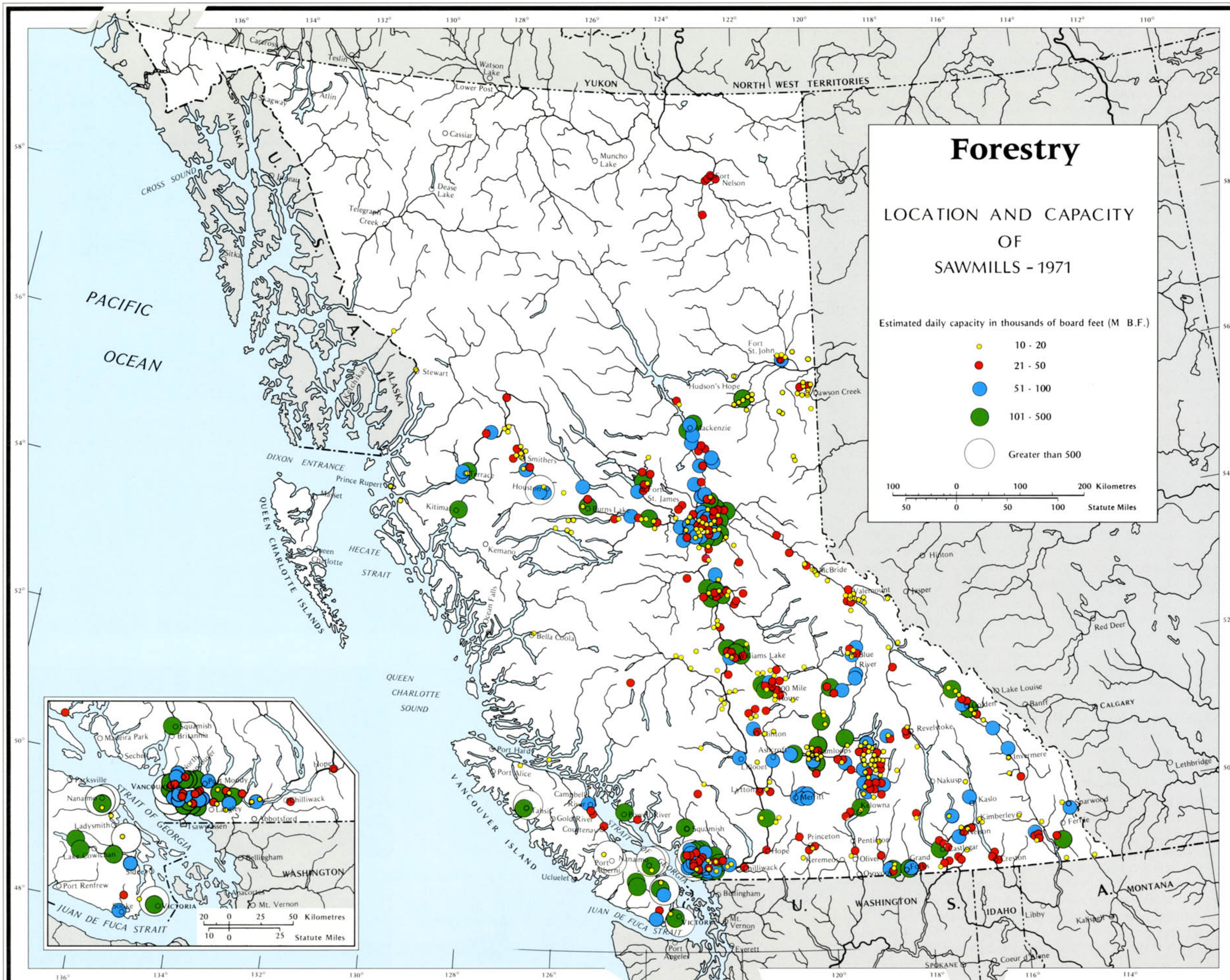
Sawyer operating headsaw at MacMillan-Bloedel plant at Somass.

This large complex near Victoria is typical of integrated lumber mills.



Forestry
LOCATION AND CAPACITY OF SAWMILLS - 1971
Estimated daily capacity in thousands of board feet (M B.F.)
10 - 20
21 - 50
51 - 100
101 - 500
Greater than 500
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
CALGARY
Fort Nelson
Fort St. John
Hudson's Hope
Dawson Creek
Mackenzie
Prince Rupert
Terrace
Kitimat
Smithers
Houston
Burns Lake
Fort St. James
McBride
Valemount
Jasper
Hinton
Williams Lake
Blue River
100 Mile House
Golden
Lake Louise
Banff
Revelstoke
Clinton
Ashcroft
Kamloops
Lillooet
Lytton
Merritt
Kelowna
Nakusp
Kaslo
Invermere
Kimberley
Nelson
Castlegar
Trail
Creston
Fernie
Sparwood
Grand Forks
Oliver
Osoyoos
Keremeos
Penticton
Princeton
Hope
Chilliwack
Squamish
Powell River
Campbell River
Courtenay
Port Alberni
Nanaimo
Ucluelet
Tahsis
Gold River
Port Hardy
Port Alice
Bella Coola
Kemano
Stewart
Cassiar
Atlin
Teslin
Watson Lake
Lower Post
Muncho Lake
Dease Lake
Telegraph Creek
VICTORIA
Port Angeles
Bellingham
Mt. Vernon
Everett
SPOKANE
Lethbridge
Red Deer
Libby
Kalispell
Coeur d'Alene
Squamish
Britannia
Madeira Park
Sechelt
Parksville
VANCOUVER
Port Moody
Langley
Abbotsford
Chilliwack
Hope
Tsawwassen
Ladysmith
Lake Cowichan
Sidney
Sooke
Port Renfrew
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 32. Forestry, Historical: Pulp and Paper Mills, 1911–1961

The first Powell River mill under construction, 1911.

Present-day operations at Powell River are highly mechanized.

An early, if somewhat abortive, beginning was made in British Columbia's pulp and paper industry with the establishment of a mechanical conversion mill at Port Alberni in 1894. In the first decade of this century two other mills were constructed, one at Port Mellon on Howe Sound and one at Powell River. At the latter site, a remarkably convenient source of waterpower was linked to wood-grinding machinery to derive mechanical pulp or groundwood, a major ingredient in newsprint. Partly because of its site advantage, Powell River has continued to produce far more newsprint than any other mill in the province. The plant at Powell River was soon expanded, and consequently it is shown on the 1911 map as "under construction." In the same year, other mills were being built at Mill Creek (now Woodfibre), at Ocean Falls, and at Swanson Bay. The last was unsuccessful and had closed by 1918.

Aside from the construction of a plant at Port Alice on Vancouver Island in the period 1917–1918, the locational pattern of the industry remained unchanged for forty years and was entirely coastal. The small mechanical pulp mills that came into existence in Victoria and New Westminster were only minor embellishments, for they were not primary producers. Capacity was expanded at existing operations, but no new mills were built until after World War II. The critical location factors were tidewater access, energy, roundwood availability, and abundant supplies of chemically soft water. As with the early sawmills, tidewater location was important because markets were external and because supplies were brought in by sea. Among those supplies were heavy distillates of petroleum. These were used to fuel steam plants which, along with hydro-mechanical and hydro-electric plants, provided the energy needed in the manufacture of chemical pulp. The mills and the small communities that huddled around them were essentially isolated company operations, linked by sea to the outside world.

By 1951 significant changes reflecting both the sharp postwar increase in the demand for forest products and the increasing pressures on available wood had occurred. With roundwood supply limited, the advantages of linking pulp- and papermaking with sawmilling became apparent. Some of the waste from sawmills could be converted to wood chips suitable for pulping, while the sawdust and log bark could be used as an energy source (hog fuel) for generating electrical power and steam. Consequently, most new pulp mills were built at or near existing sawmills. All of the new capacity was developed on the coast, where wood, water, energy, and low-cost water transport were available. Water transport was advantageous in the movement not only of raw materials but also of finished product.

The 1961 map shows that, up to that time, the pulp- and paper-milling capacity in British Columbia was still overwhelmingly coastal in orientation. All but one of the fourteen operating plants were on the coast, and the one at Castlegar was also integrated with a sawmilling complex and had only recently been brought into production. Aside from the secondary mechanical mills built in the Vancouver area to reclaim pulp from paper waste, the only new coastal mill was at Crofton on Vancouver Island, but the capacity of existing plants had been greatly expanded. In response to the growing external market demand, the industry burgeoned. In the decade 1951–1961, total production capacity more than doubled. The pulp and paper component of the forest industry had attained major status as a source of employment and a generator of new wealth.

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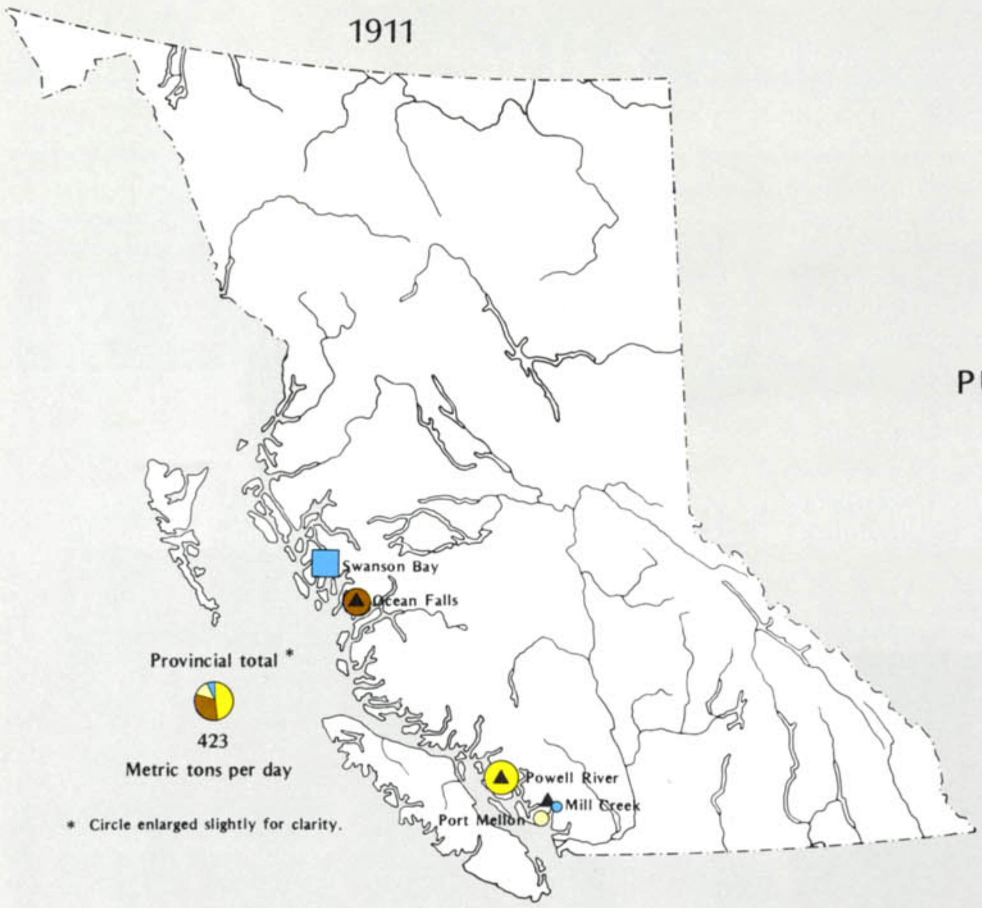
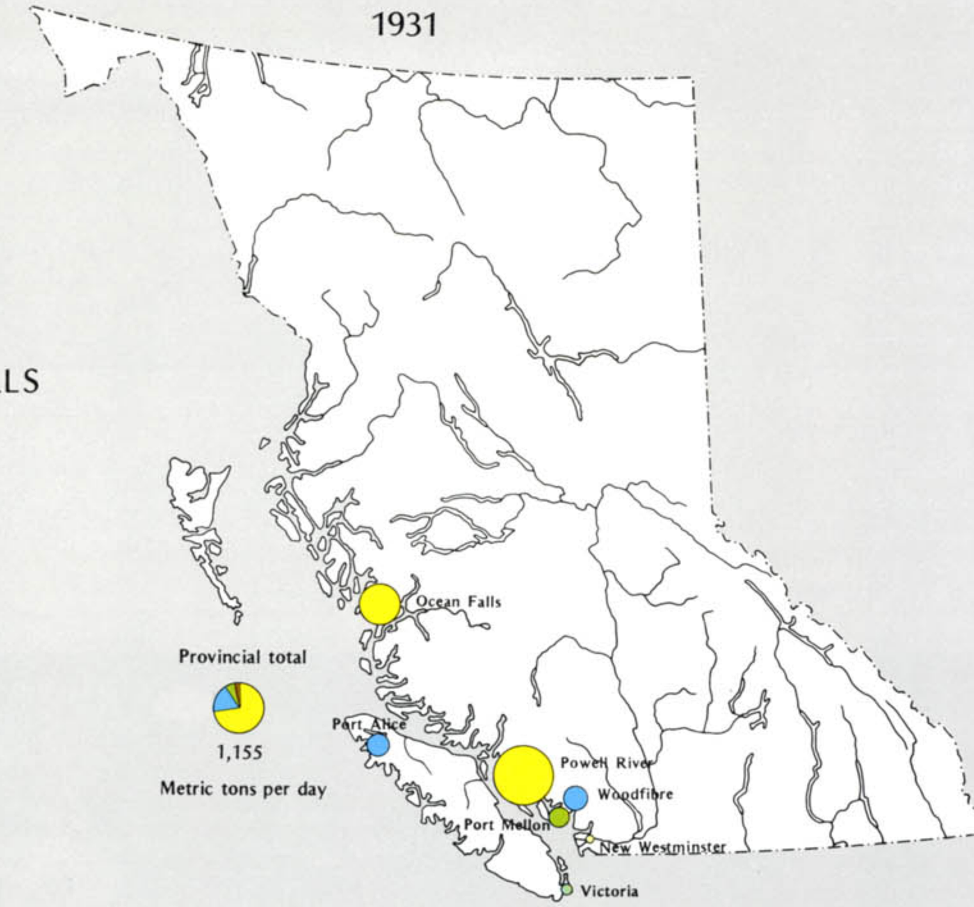
Forestry

HISTORICAL PULP AND PAPER MILLS 1911-1961



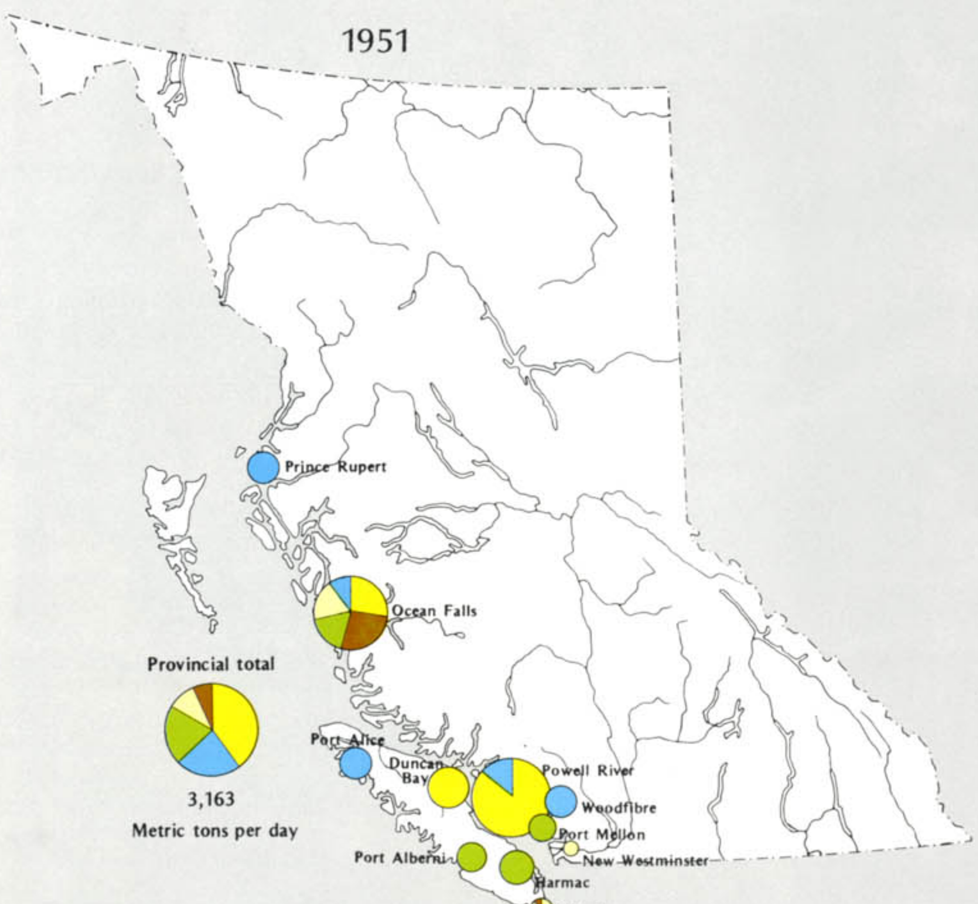


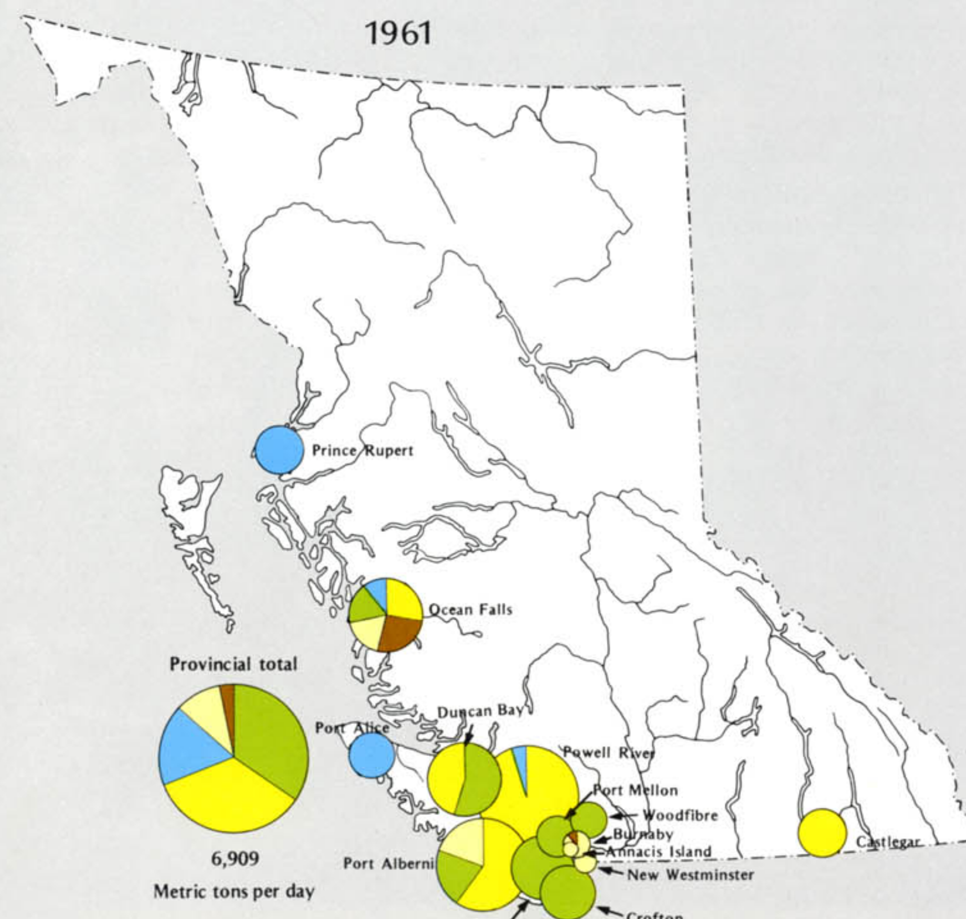
Pulp and paper

- Sulphite
- Sulphate
- Groundwood
- Newsprint
- Other
- ▲ Under construction
- □ Unknown capacity

Symbol size proportionate to total mill capacity.

100 0 100 200 Kilometres
50 0 50 100 Statute Miles





Map 33. Forestry: Pulp and Paper Mills and Plywood Plants, 1975

In the decade 1960–1970, pulp production in the province rose from just over 2 million to 4.5 million tonnes annually. British Columbia now accounts for over one-quarter of the national output of pulp and about 4.5 per cent of the world supply. Annual paper production is approximately 1.5 million tonnes, most of it in the form of newsprint — thus the pulp and paper industry in British Columbia is based mainly on the conversion of wood to chemical pulp. It ranks with sawmilling as a major contributor to the provincial economy. In the Canadian production of softwood plywood, British Columbia is by far the most important region. It manufactures nearly 90 per cent of the total.

Pulp and paper mills operate mainly on sawmill and plywood mill residue, and they require only about 15 per cent of the roundwood cut. Considerable volumes are needed, however, since a representative pulp mill uses about 6,500 m^3/day of wood chips (the equivalent of 1,500 tonnes of solid wood). Considering the amount of wood residue at interior sawmills and the advantages of proximity, it is not surprising that the 1960's witnessed a dramatic expansion of pulp and paper manufacturing there. In 1961, the only interior mill was at Castlegar. In 1971, nine out of a total of twenty-five plants were non-coastal. Significantly, all of the newer mills were equipped to produce pulp by the sulphate (kraft) process rather than by the sulphite, which is less suited to the pulping of resinous wood. This change reflects the trend toward utilization of a variety of woods, including lodgepole pine, and the shift in market demand toward strong papers for use in packaging. In addition to the new mills, total provincial capacity was increased by enlargement at existing sites. Since 1971 more new mills have been proposed, but none has been built. Wood residue surpluses still exist in the interior because of the amount of sawmilling, and additional roundwood supplies may be allocated. The shift toward the interior in the decade of the 1960's, then, has added a new dimension to the spatial pattern of the forest industry. The impact on regional economies has been great. Prince George, for example, experienced boom conditions with the construction of three pulp mills there, and Mackenzie was created as an instant community to house and serve the labour force of a milling complex at the southern end of the Peace River reservoir.

Lumber being planed to bring it to standard dimensions.

With the provision of rail or rail and water access, and under favourable market conditions, further expansion of pulp-milling will doubtless occur in the interior, especially in the north. Given the locational disadvantage, however, it is likely that special inducements would be necessary. As the map clearly reveals, plant capacity for pulp- and paper-milling remains heavily oriented to the coast. The reasons for this are many, but among the prime factors are raw material supplies and water transport. Coastal sawmills and plywood mills continue to generate usable residue, forest growth rates are high, suitable water for processing is abundant, and low-cost marine transport is at hand. The importance of the water resource in pulp- and paper-milling is often overlooked. In fact, the industry is water-intensive; upwards of 200 m^3 (200,000 litres) are needed per ton of pulp, depending on the industrial process. Thus, even a modest-sized mill uses enough water to supply the domestic requirements of a city of 100,000 people. Very little of the water input is actually consumed; most is discharged to the effluent sewers in the process of washing the pulp. Latterly, especially in the lower coastal area, serious questions have been raised concerning loss of environmental quality as a result of marine and atmospheric pollution from pulp mills. Substantial recycling of input water is possible, but the capital cost of doing so would lower the economic advantage. In comparison with the effluent problems and constraints associated with interior locations, however, those of coastal mills remain small.

Another notable component of wood processing is plywood manufacture. Since the 1930's, British Columbia has been a Canadian leader in plywood output because large-diameter, straight-grained Douglas-fir peeler logs have been available. As happened in sawmilling and pulp- and paper-making, there was rapid development of the industry after mid-century, accompanied by expansion to the interior. Out of a total of twenty-one major plants operating in 1975, ten were in the interior. As might have been expected, most of the plant capacity was centred on the coast, in this case in the Vancouver area, where it is closely integrated with sawmilling. Much of the plywood output is marketed in Canada, and the remainder is sold overseas, mainly to the United Kingdom and continental Europe.

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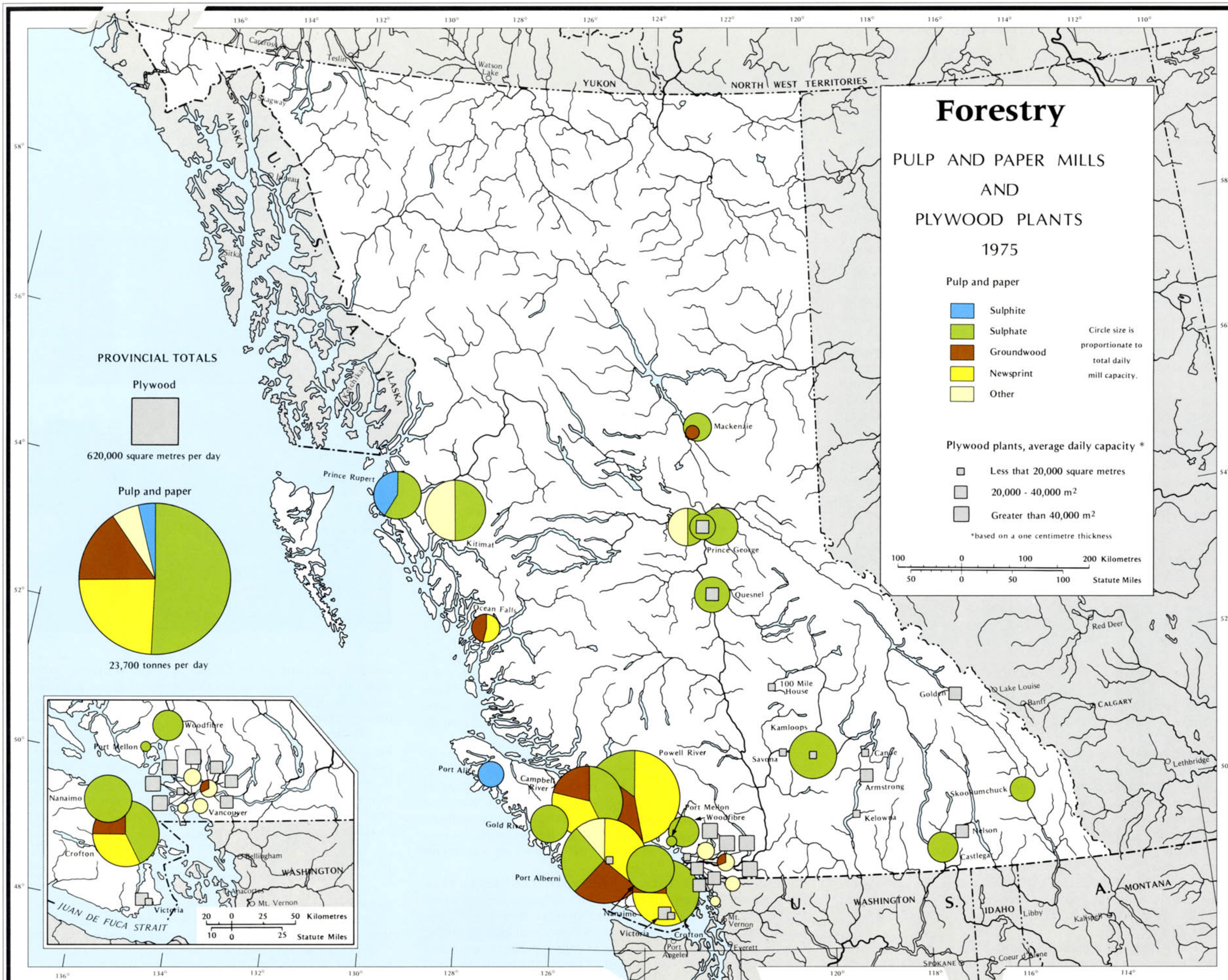

Forestry
PULP AND PAPER MILLS
AND
PLYWOOD PLANTS
1975
Pulp and paper
Sulphite
Sulphate
Groundwood
Newsprint
Other
Circle size is proportionate to total daily mill capacity.
Plywood plants, average daily capacity *
Less that 20,000 square metres
20,000 - 40,000 m2
Greater than 40,000 m2
*based on a one centimetre thickness
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PROVINCIAL TOTALS
Plywood
620,000 square metres per day
Pulp and paper
23,700 tonnes per day
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
Prince Rupert
Kitimat
Mackenzie
Prince George
Quesnel
Ocean Falls
100 Mile House
Golden
Kamloops
Savona
Canoe
Armstrong
Kelowna
Skookumchuck
Nelson
Castlegar
Powell River
Port Alice
Campbell River
Gold River
Port Alberni
Port Mellon
Woodfibre
Nanaimo
Crofton
Victoria
Vancouver
Port Angeles
Mt. Vernon
Everett
Bellingham
Anacortes
WASHINGTON
IDAHO
MONTANA
Red Deer
Lake Louise
Banff
CALGARY
Lethbridge
Spokane
Coeur d'Alene
Libby
Kalispell
Watson Lake
Teslin
Carcross
Skagway
Juneau
Sitka
Ketchikan
JUAN DE FUCA STRAIT
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 34. Mining: Historical, 1909–1973

Historically, mining has accounted for an important share of British Columbia's resource-based economy. Early in the colonial period, coal had both strategic and economic importance, for the Cretaceous coals of Vancouver Island were the only known deposits on the west coast of the Americas north of Chile. Since sail was giving way to steam as a source of marine propulsion, coal-mining became an economic mainstay. It was soon replaced in relative significance, however, by placer gold, and the political and administrative repercussions of the gold rush in the 1850's and 1860's led to British Columbia's establishment as a province in the Dominion of Canada. Since that time the provincial wealth contributed by mining has come mainly from lode minerals and fossil fuels.

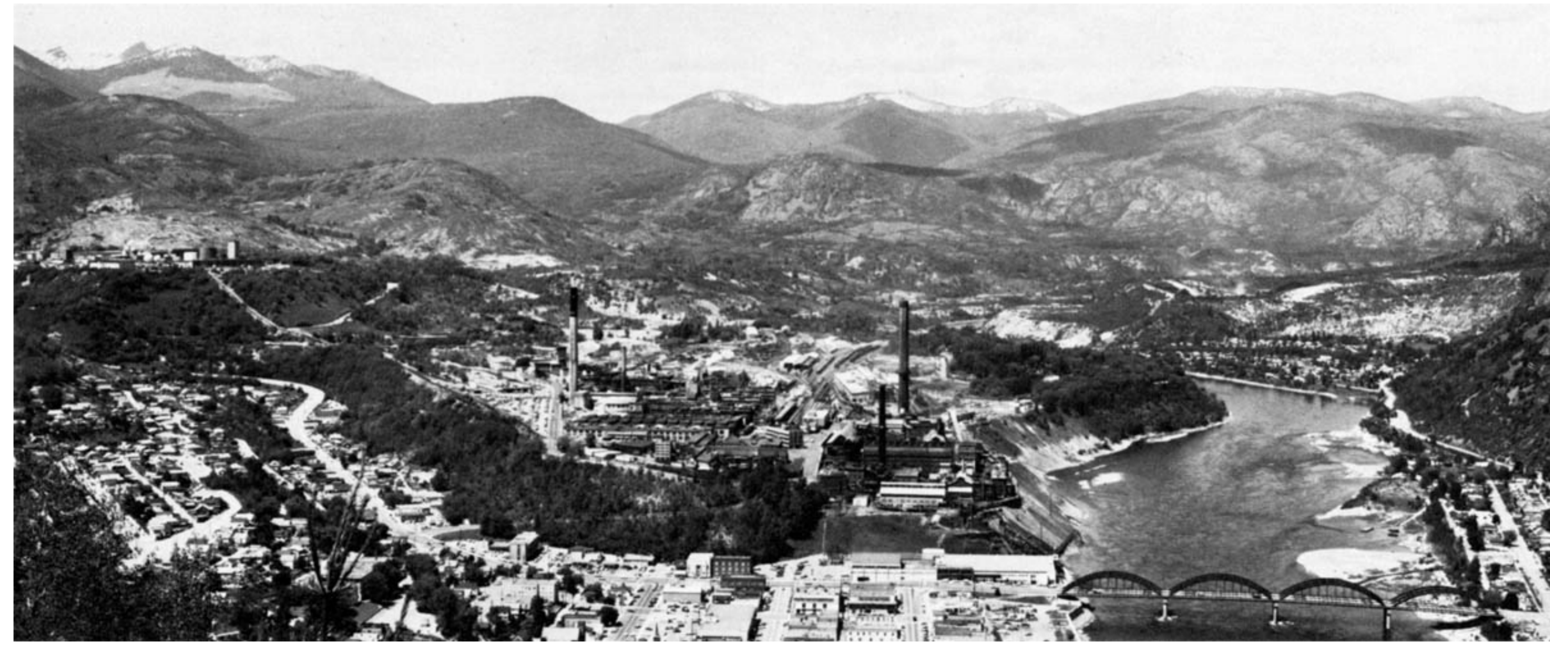
Unlike timber and fish, minerals are non-renewable. As a result, over the years, fluctuations in the annual wealth derived from mining have been partly attributable to exhaustion of available ore. They have also been the result of changes in world market conditions, since the difference of a cent or two per pound in metal prices often represents the difference between economic operation and the closure of a mine. Scale of operation and availability of capital have likewise been important. Until mid-century nearly all mining was underground. Only those ores that had sufficiently high mineral content to provide return sufficient to justify the enterprise were extracted. With burgeoning industrial demands for mineral and other resources during the 1950's and 1960's, however, major amounts of investment capital became available and large-scale production of lower-grade ores became possible. Contractual arrangements with overseas buyers for the production and export of large quantities of various minerals added a new dimension to the mining economy.

Open-pit production of iron, copper, and metallurgical coal has characterized the extractive phase of the industry over the past two decades. Unlike forest products, most of the minerals are exported in the form of raw or semi-processed material, with the notable exceptions of refined minerals from the smelter-refinery complex at Trail and the aluminum smelter at Kitimat (see Map 36).

The evolution of the general pattern of mining activity in British Columbia is represented in the accompanying maps. For ease of comparison, portrayal is based upon value rather than quantity of output. Thus, a small output of gold could be as significant as many tons of copper or coal. Further, the unit areas for which data are available are the Mining Divisions, and their boundaries have been changed significantly over the years. In general, Mining Divisions in the north have the largest areas, so that their apparent importance is sometimes exaggerated. Despite such statistical difficulties, however, the maps indicate the spatial units from which the province's mineral wealth has come.

In the period around 1911, the Coast District and the Boundary country were the main contributors; the activity in the former was based upon coal extraction and in the latter upon base metals, especially copper. The value contribution from the East Kootenay area came mainly from the Crowsnest coal fields at Fernie.

By 1931 the pattern had changed. Mining activity and production were still concentrated in the more accessible southern part of the province where rail transport was available. But nearly half of the total production value was now provided by the Fort Steele Division in southeastern British Columbia. Most of that proportion was attributable to extraction of complex silver-lead-zinc ore from the great Sullivan Mine at Kimberley.



Trail, with its prominent smelter, is the centre of mineral processing in the Kootenay country.

Early mining works at Centre Star Gulch, near Rossland.

Technological developments in smelting and refining had made practicable the use of such ores and paved the way for the emergence of the Kimberley (mining)–Trail (smelting) area not only as the keystone of the mineral industry in the province but also as one of the most notable base-metal producers in the world. Vancouver Island and Crowsnest coals maintained significant contributions to production value, and, for the province as a whole, these were supplemented by copper and lode gold. Much of the copper output was produced at Anyox, a company town near the head of Observatory Inlet, one of the more northerly points in coastal British Columbia.

In 1951 the Fort Steele Division continued to lead in value of output, now contributing over half of the provincial total, and the adjacent Nelson Division had re-emerged as a producer of some significance. But Vancouver Island, the lower mainland coast, and the Portland Canal area all showed relative declines. Largely these changes reflected the depletion of workable ores and the virtual exhaustion of the coal deposits on Vancouver Island.

The scene in 1971 was different again. The Sullivan Mine had declined in importance, open-pit copper-mining was well established in south-central British Columbia, iron ore and copper deposits were being exploited on Vancouver Island and the Queen Charlottes, and the long-time copper producer at Britannia, near Vancouver, had run out of ore. In the north the Liard Division, containing the Cassiar Asbestos property, precious metal and base metal mines in the Portland Canal area, and oil and gas fields in the Peace River country, accounted for nearly 20 per cent of the total.

The changing spatial patterns of mining suggest the vacillating fortunes of the industry, the non-renewable nature of the resource upon which it is based, and the vagaries of competition in international markets. Despite the spatial changes and the fluctuations in value added, mining remained a major component of the provincial economy, and it ranks second after forestry as a generator of provincial wealth.

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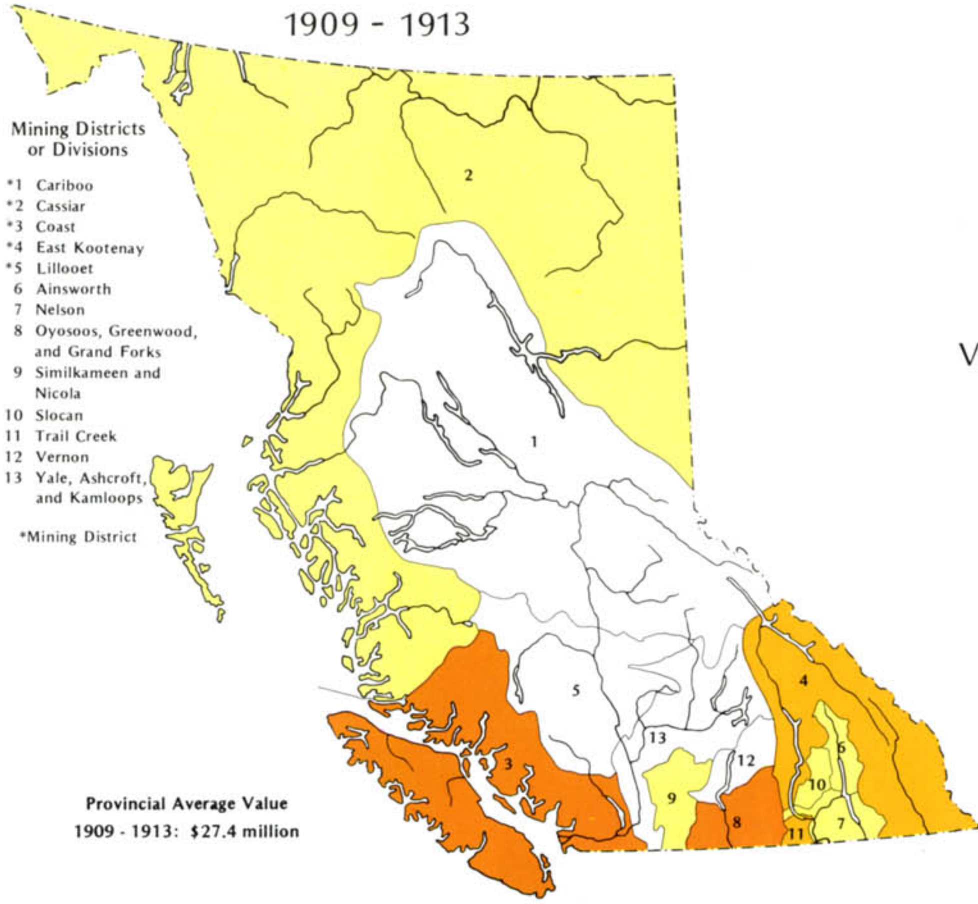
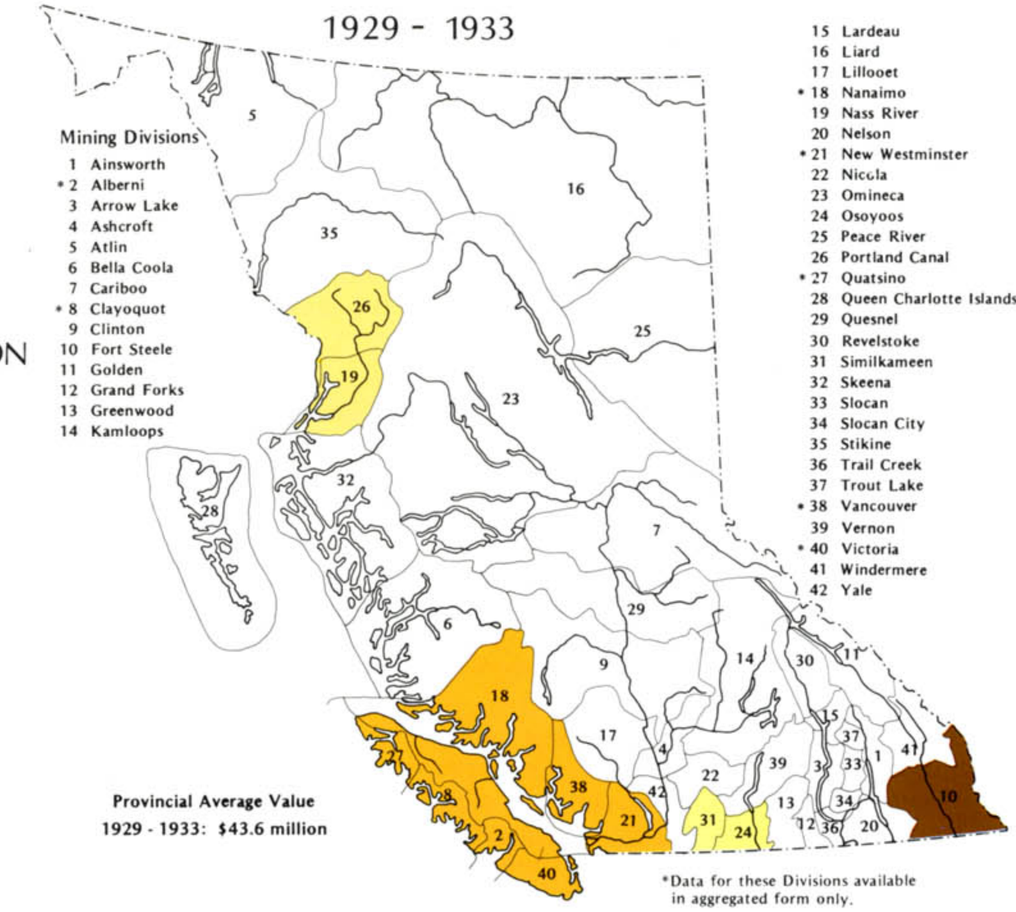
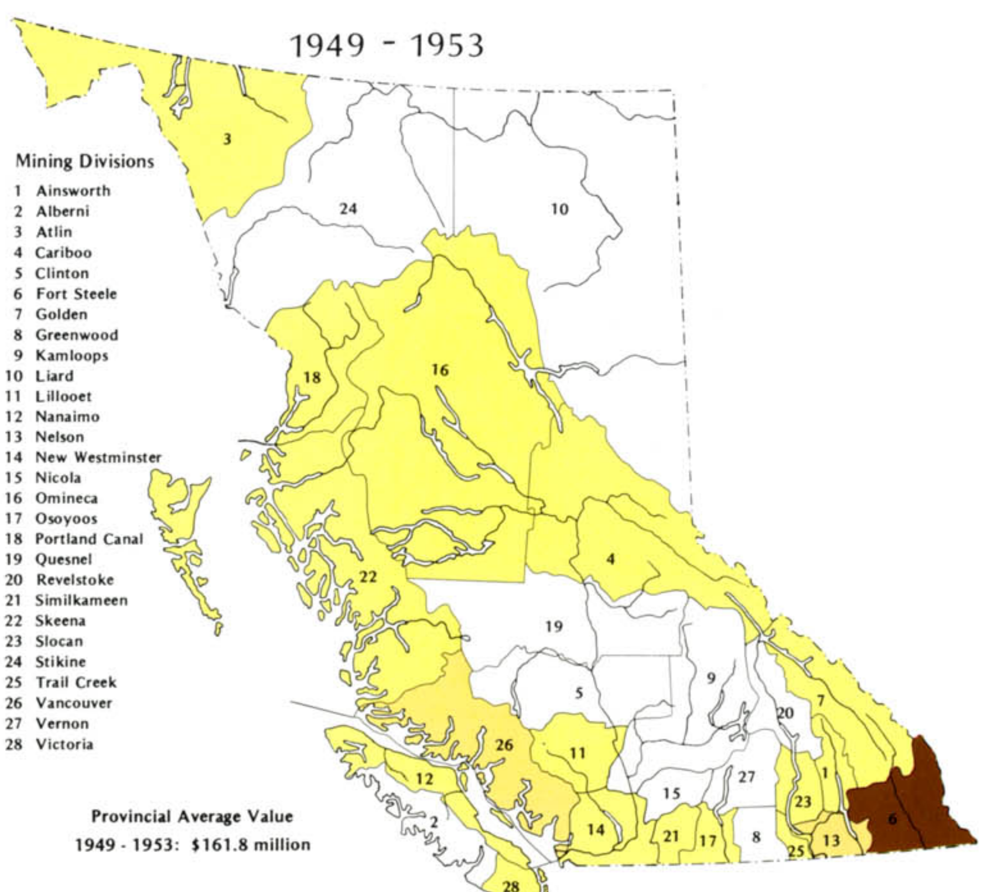
Mining

HISTORICAL
VALUE OF PRODUCTION
BY
MINING DIVISION
1909 - 1973



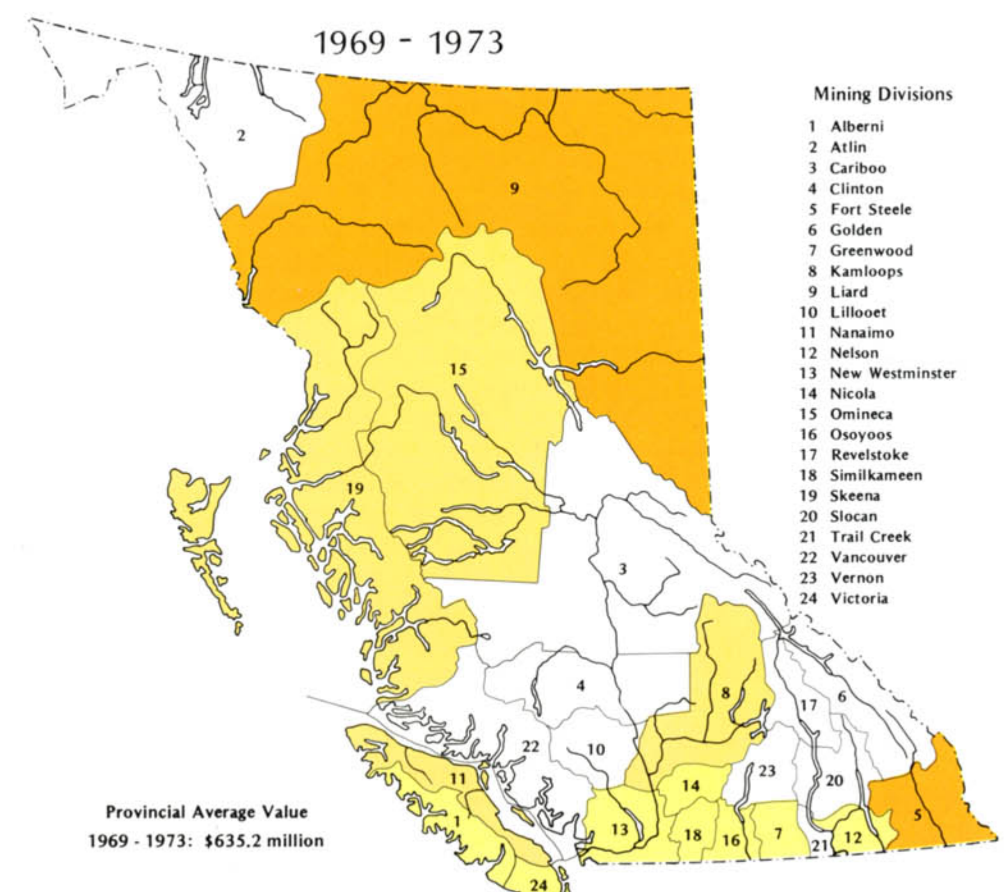




District or Division proportion
of provincial total

- Less than 1%
- 1 % - 5 %
- 5 % - 10 %
- 10 % - 20 %
- 20 % - 35 %
- Greater than 35%

100 0 100 200 Kilometres
50 0 50 100 Statute Miles



Map 35. Mining: Mineral Value by Mining Division, 1975

British Columbia's mining industry grew rapidly in the decade 1965–1975. Although its output is less than half the value of Ontario's, it now ranks close to that of Quebec in annual generation of mineral wealth. By the mid-1970's mining produced an added value of over $350 million annually and employed over twelve thousand people. The term "value added" indicates the value of the finished goods less the cost of production. Mineral processing (primary metals industries) employed another six thousand and contributed well over $150 million to the annual wealth.

The accompanying graph shows the relative importance of the main mineral groups for the province as a whole. The graph is based upon recorded value for each of the years represented and not constant dollars. Depending upon market conditions, prices may fluctuate considerably from year to year. The most notable example in recent years has been petroleum, which increased in value by 56 per cent between 1970 and 1975. In the same period, production declined by over 40 per cent, from approximately 4 million m^3 to about 2.3 million m^3. In this case the remarkable value increase is not only a reflection of monetary inflation but also of soaring world prices for oil.

In 1975 the metals group accounted for nearly half of the production value. Principal among the metals were copper, molybdenum, and zinc, with copper alone contributing nearly $332 million to the gross provincial mineral value of $1.296 billion (before the costs of production were deducted). Asbestos was the major industrial mineral and made up over three-quarters of the value for that group; sulphur, obtained in the processing of natural gas, was a distant second. Value of the structural materials group was mainly contributed by cement and sand and gravel. Taken together, the fossil fuels accounted for over $490 million. Thus almost 90 per cent of the 1975 gross provincial value of mineral production came from two major mineral groups, metals and fossil fuels.

The map on the facing page is based upon the total value of mineral production in each region. All metals (including precious metals), industrial minerals, structural materials, coal, petroleum, and natural gas are represented. It shows that by 1975 the Fort Steele Division had resumed its former relative importance, contributing over one-third of the total provincial mining value. Base metals, however, showed a relative decline; over three-quarters of the regional total being attributable to coal output. Most of the coal is destined for metallurgical uses, but considerable thermal coal and some coke is also produced. By the mid-1970's the long-term contracts negotiated with such overseas customers as Japan had given new impetus to coal-mining in British Columbia. In 1975 coal accounted for over one-quarter of the total value of mining. Strip-mining techniques have largely replaced the older, more expensive, underground methods of extraction, and the scale of output has been greatly increased. In order to take advantage of economies of scale and because markets are overseas, a special port facility was constructed at Roberts Bank, near Vancouver. It is capable of handling large bulk-carriers, and it is connected to the Crowsnest fields by specially designed hopper-cars linked in unit trains (see Map 59). In 1975 the port handled over eight million tons of coal and coke.

Next in order of regional importance is the Liard Mining Division, which derives the greatest part of its revenues from the petroleum and natural gas produced in the Fort St. John and Fort Nelson areas. Most of the remainder of the regional value comes from long-fibre asbestos mined at Cassiar. At some future time, the Liard Division may come to rival southeastern British Columbia in the production of fossil fuels. Large deposits of coal south of the Peace River are now under active consideration for development (see Map 47).

All other Mining Divisions individually accounted for less than 7 per cent of the total mineral value, but collectively they produced well over half. As the pie-graphs reveal, most of the mineral wealth from those divisions was derived from base metals. Copper was by far the most economically important among them, contributing 27 per cent of the total provincial value of mineral production. A considerable share of the copper output came from open-pit operations in the south-central part of the province where large-scale working of low-grade copper ore began in the late 1950's.

One aspect of mineral production that is frequently overlooked is that of structural materials — notably sand, gravel, and cement. In 1975 they provided about 8 per cent of the mining value. As the map indicates, they are regionally important only in southwestern British Columbia, but in the three Mining Divisions concerned, they constitute virtually all of the mineral output. Their relative importance in those areas is understandable because structural materials are comparatively low in value and high in bulk. Consequently, their production tends to centre near regional markets where transport costs can be minimized. In this context, the existence of Pleistocene deltas in various locations flanking the Strait of Georgia is important (see Map 16). Just as with the movement of forest products, the sheltered waters of the Strait of Georgia present a convenient and low-cost medium for mineral transport. A major source of sand and gravel is a large delta built by a former glacial meltwater stream near the present city of Victoria. Its magnitude and immediate proximity to water transport have made it the centre of one of the most long-lived quarrying operations in the province.

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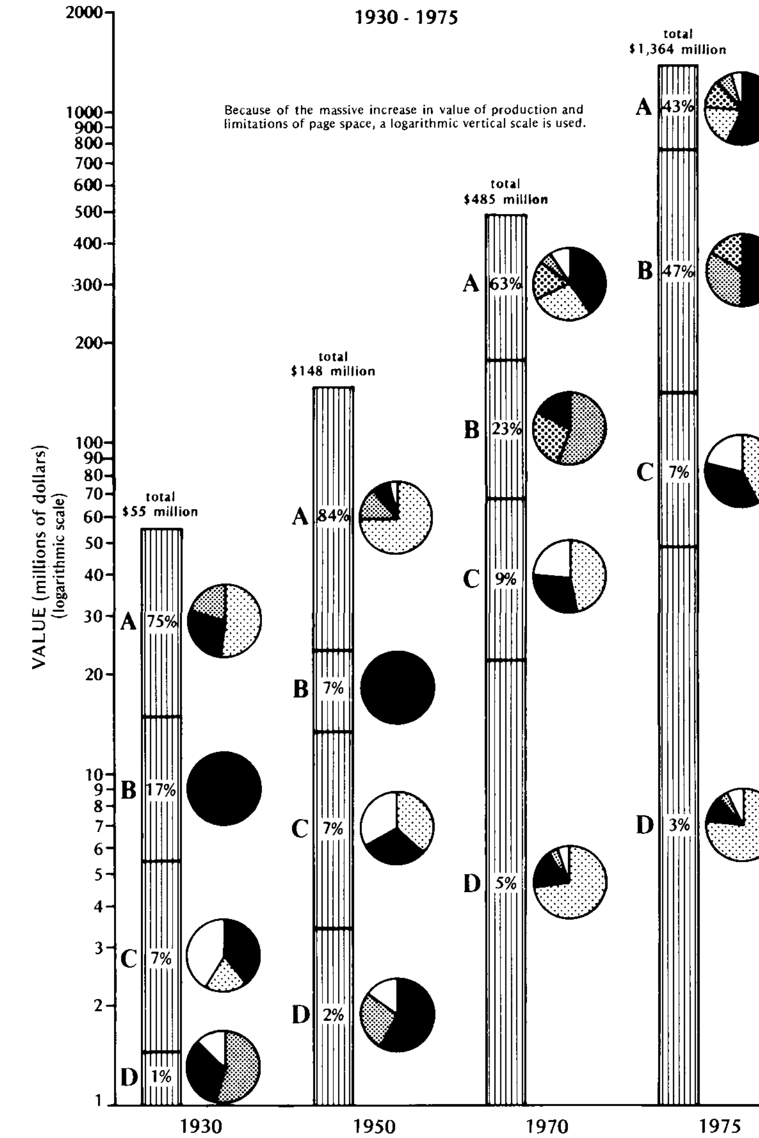
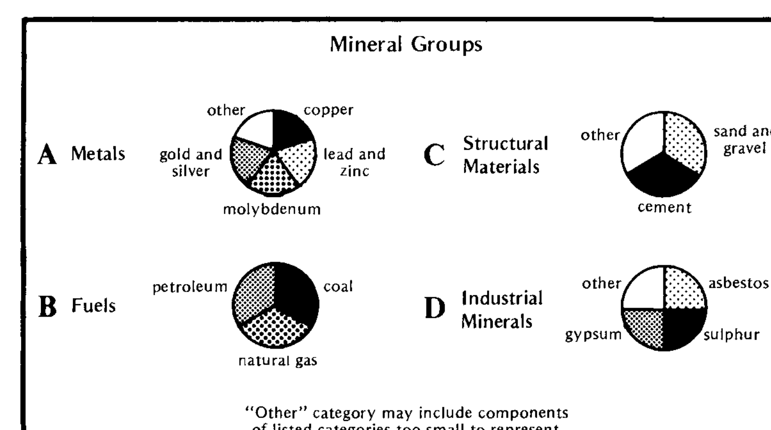
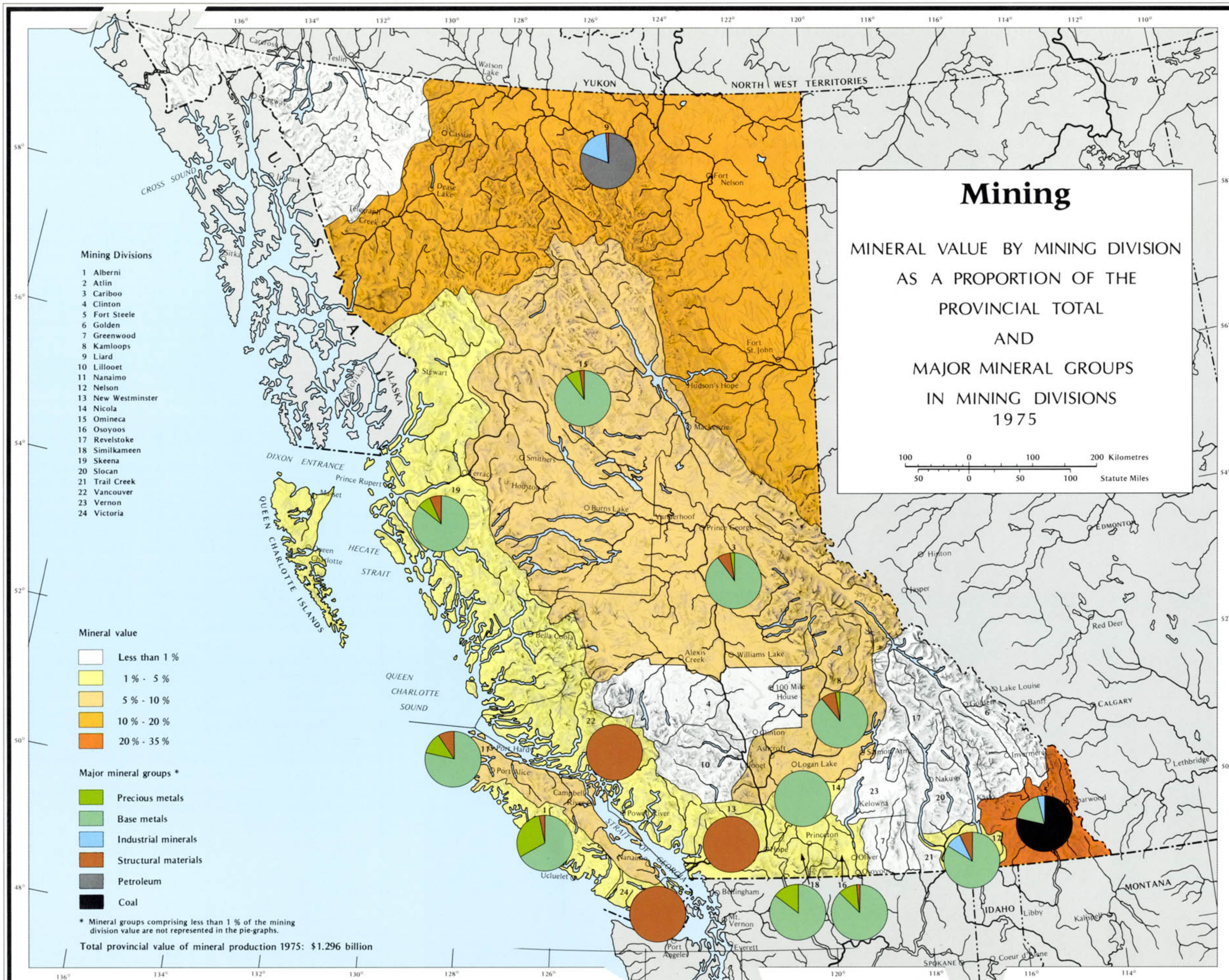
Precious metals such as gold now make up only a small proportion of British Columbia's mineral production. Frequently they are extracted in association with more abundant base metals.

TOTAL VALUE OF MINERAL PRODUCTION AND RELATIVE VALUE OF MINERAL GROUPS 1930 - 1975






Mining
MINERAL VALUE BY MINING DIVISION
AS A PROPORTION OF THE
PROVINCIAL TOTAL
AND
MAJOR MINERAL GROUPS
IN MINING DIVISIONS
1975
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Mining Divisions
1 Alberni
2 Atlin
3 Cariboo
4 Clinton
5 Fort Steele
6 Golden
7 Greenwood
8 Kamloops
9 Liard
10 Lillooet
11 Nanaimo
12 Nelson
13 New Westminster
14 Nicola
15 Omineca
16 Osoyoos
17 Revelstoke
18 Similkameen
19 Skeena
20 Slocan
21 Trail Creek
22 Vancouver
23 Vernon
24 Victoria
Mineral value
Less than 1 %
1 % - 5 %
5 % - 10 %
10 % - 20 %
20 % - 35 %
Major mineral groups *
Precious metals
Base metals
Industrial minerals
Structural materials
Petroleum
Coal
* Mineral groups comprising less than 1 % of the mining division value are not represented in the pie-graphs.
Total provincial value of mineral production 1975: $1.296 billion
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
STRAIT OF GEORGIA
MONTANA
IDAHO
Prince Rupert
Prince George
Fort Nelson
Fort St. John
Hudson's Hope
Williams Lake
Kamloops
Calgary
Edmonton
Jasper
Red Deer
Lethbridge
Spokane

Map 36. Mining: Mine Production, Producing and Potential Mines, and Smelters, 1976

Mine production refers to the output of mine operations only. Consequently, placer gold, structural materials, and petroleum products, which involve different methods of extraction and which are included in the data for the preceding maps, are excluded here. On the accompanying map, then, the intensity of background colour is proportionate to the 1976 value of the yield from mines in the respective Mining Divisions. The relative importance of the Fort Steele Division is again apparent; it produces more than 40 per cent of the total value of mine output. The Kamloops Division ranks second with 10 per cent, followed in turn by the Omineca and Nanaimo Divisions, each contributing about 8 per cent, and Cariboo producing about 6 per cent. All other divisions individually account for less than 5 per cent. As indicated in the preceding text, the largest share of the mine output is comprised of metal ores, copper being particularly significant. Coal-mining was important only in the Fort Steele Division.

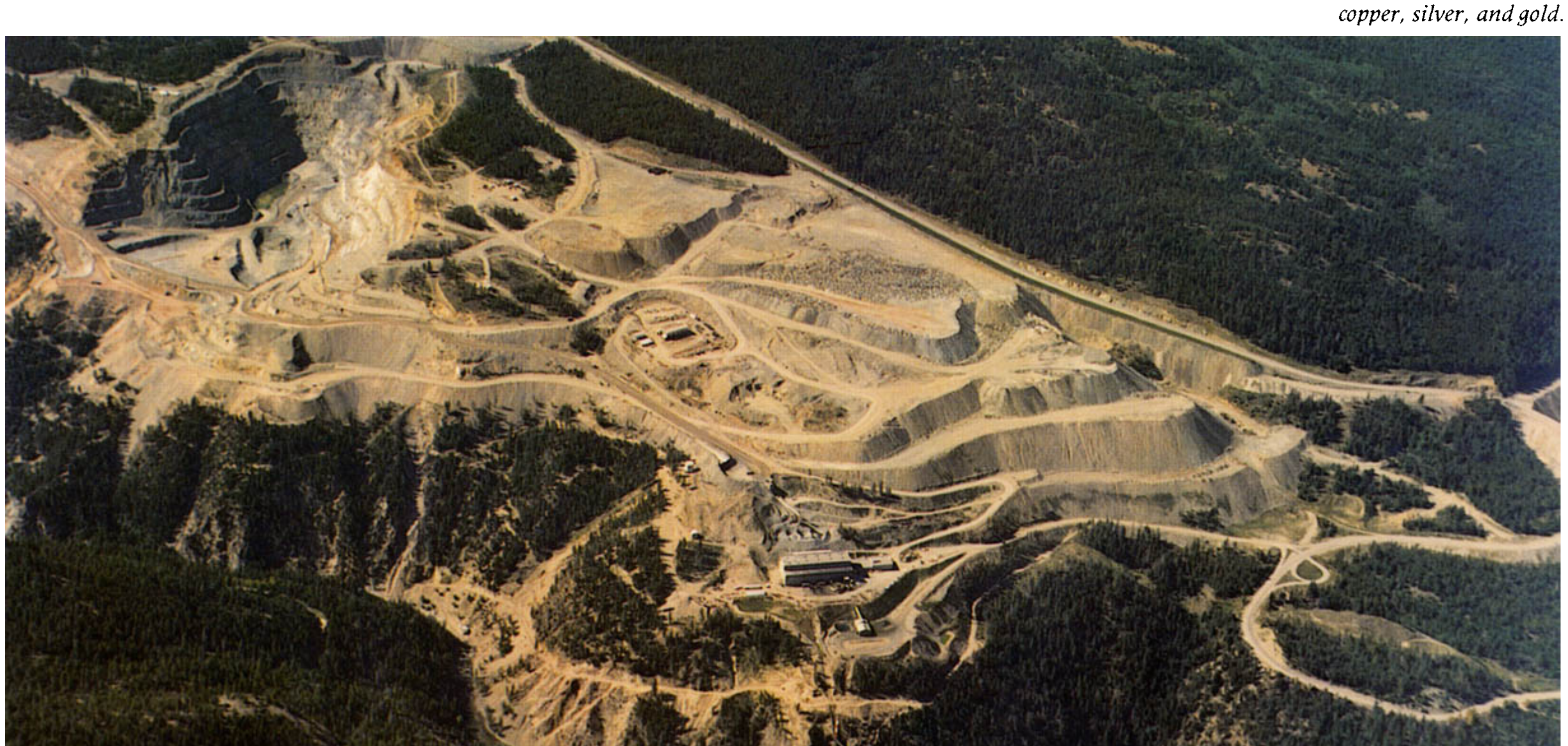
While the overall spatial pattern of mining as shown on the map may be expected to persist for some time, the detail reflects continuous change. To illustrate, the iron (and copper) mine shown on the map at Texada Island (Strait of Georgia area) closed in 1977 because recoverable reserves were depleted; the Afton mine west of Kamloops came into production late in the same year. The latter is the province's first new copper mine to come into operation since 1973, and it is expected to be a major producer.

An impression of the relative scale of production of metallic and non-metallic minerals is given by the graduated circle symbols denoting mill or concentrator capacity. These show clearly that, on a tonnage capacity basis, copper, molybdenum, and asbestos processing far exceeds that of lead and zinc, which had been dominant in earlier years. It should be borne in mind, however, that the map shows only the mine production and concentrator output using ores from British Columbia mines. It does not, for example, include the substantial amount of lead and zinc ore brought in from COMINCO's Pine Point operation at Great Slave Lake and processed at its Trail base-metal complex. Even if these had been included, a remarkable change in pattern from mid-century would still have been evident. The major difference is the movement of concentrator capacity away from the Kootenays to an axis through the central part of the province. In part the spatial shift to the central interior is the result of new mining technologies, investment capital, and markets, but it also reflects the basic resource endowment (see Map 13). The upland area south of Kamloops and east of the Fraser River has been of particular importance as the centre of much of the province's copper production. Four mining companies are active in the area, and one of them, Lornex, has developed a new planned townsite at Logan Lake, British Columbia's most recent instant community. The operation there, which began production in 1972, has the largest output. It converts over 50,000 tonnes of ore per day to concentrate, the equivalent of about 66,000 tonnes per year of elemental copper. Because the ore contains a small proportion of molybdenum, about 1,700 tonnes per year of that strategic metal are also produced. The output is trucked to Ashcroft for transhipment by rail to Vancouver. From there it goes via ship to external markets — mainly in Japan.

Little secondary mineral processing takes place in British Columbia. In 1978 a reduction plant at the Afton mine was beginning to produce blister copper in a mechanical/thermal process, but up to that time only two primary metallurgical plants were in operation. At Trail nearby mineral resources and hydro-electric potential were linked to form what is now the COMINCO facility. This has long been British Columbia's principal metallurgical centre, and it is one of the largest silver-lead-zinc smelter and refinery complexes in the world. Aside from silver and base metals, a variety of rare metals is recovered in the refining process. These include precious metals, cadmium, antimony, indium, and vanadium. To utilize a former waste product, one part of the industrial complex now uses sulphur in the manufacture of chemical fertilizer. Beginning in the early 1960's COMINCO also produced pig-iron and steel in connection with its operations at Kimberley. There a large volume of iron sulphides had accumulated as tailings from the base metal concentrator and constituted an iron-rich supply of raw material. Escalating costs and the discontinuation of a government subsidy led to the closure of those operations, though the company's subsidiary, Western Canada Steel, produces secondary (scrap recovery) steel in its Vancouver plant.

The Aluminum Company of Canada plant at Kitimat (now Alcan Smelters and Chemicals Ltd.) was built in the 1950's to take advantage of a large block of potential hydro-electric energy, a suitable terrain site with tidewater access, and offshore supplies of raw materials. With the exception of energy, the major raw materials come from non-provincial sources, and most of the finished product (aluminum ingot) is exported by sea to markets in the United States and elsewhere. A limited number of aluminum products are manufactured regionally, mainly in the Vancouver area. The chief item imported is aluminum oxide (alumina), about two tonnes of which are required per tonne of smelted metal. The rated capacity of the Kitimat plant is approximately 295,000 tonnes annually, which makes it one of the largest aluminum smelters in the world. Consequently, an alumina supply of about 600,000 tonnes per year would be needed if the plant were run to capacity. Since most of the alumina is obtained from Australia, low-cost water transport of raw materials is an important locational advantage. From 13 to 20 kilowatt hours are needed in the smelting process for every kilogram of refined metal, because the chemical bond between aluminum and oxygen is strong. The power for the electrolytic furnaces used is derived from the Tweedsmuir lake chain (Nechako Reservoir) and developed at Kemano for transmission to Kitimat (see Map 46). The townsite of Kitimat, now accommodating about twelve thousand people, was laid out as one of the first planned communities in the province and continues to provide an attractive environment for the Alcan labour force and for that of the nearby Eurocan pulp mill.

The Similkameen mine, south of Princeton, produces copper, silver, and gold.



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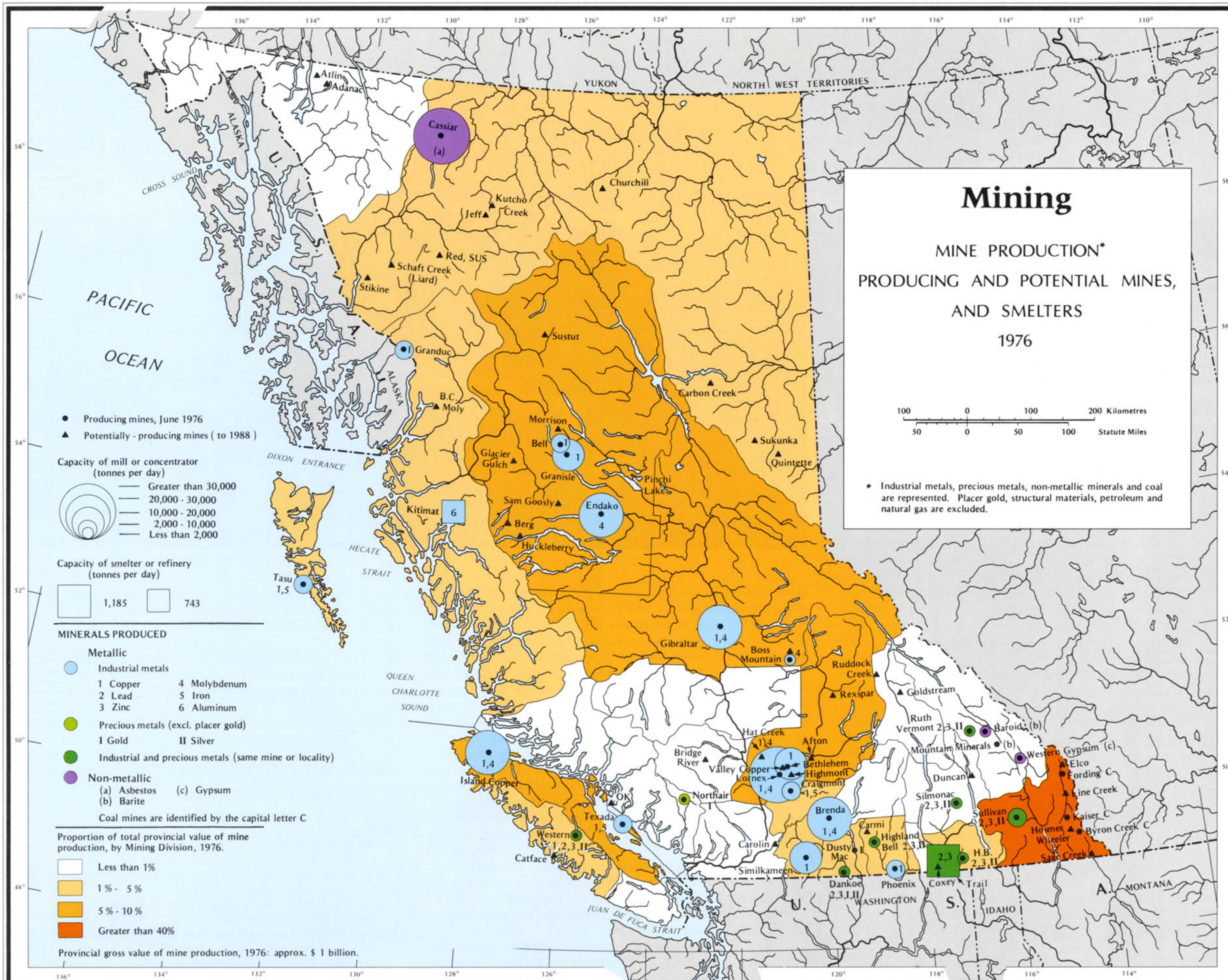
Mining
MINE PRODUCTION*
PRODUCING AND POTENTIAL MINES, AND SMELTERS
1976
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
* Industrial metals, precious metals, non-metallic minerals and coal are represented. Placer gold, structural materials, petroleum and natural gas are excluded.
Producing mines, June 1976
Potentially - producing mines (to 1988)
Capacity of mill or concentrator (tonnes per day)
Greater than 30,000
20,000 - 30,000
10,000 - 20,000
2,000 - 10,000
Less than 2,000
Capacity of smelter or refinery (tonnes per day)
1,185
743
MINERALS PRODUCED
Metallic
Industrial metals
1 Copper
2 Lead
3 Zinc
4 Molybdenum
5 Iron
6 Aluminum
Precious metals (excl. placer gold)
I Gold
II Silver
Industrial and precious metals (same mine or locality)
Non-metallic
(a) Asbestos
(b) Barite
(c) Gypsum
Coal mines are identified by the capital letter C
Proportion of total provincial value of mine production, by Mining Division, 1976.
Less than 1%
1% - 5%
5% - 10%
Greater than 40%
Provincial gross value of mine production, 1976: approx. $ 1 billion.
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE SOUND
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
Atlin
Adanac
Cassiar (a)
Churchill
Kutcho Creek
Jeff
Red, SUS
Schaft Creek (Liard)
Stikine
Sustut
Granduc
B.C. Moly
Carbon Creek
Morrison
Bell
Granisle
Glacier Gulch
Sukunka
Quintette
Pinchi Lake
Sam Goosly
Endako 4
Berg
Huckleberry
Kitimat 6
Tasu 1,5
Gibraltar 1,4
Boss Mountain 4
Ruddock Creek
Rexspar
Goldstream
Ruth Vermont 2,3,II
Baroid (b)
Mountain Minerals (b)
Western Gypsum (c)
Elco
Fording C
Line Creek
Kaiser C
Byron Creek C
Hosmer Wheeler
Sage Creek
Sullivan 2,3,II
Duncan
Silmonac 2,3,II
Hat Creek
Afton
Bethlehem
Highmont
Craigmont 1,5
Valley Copper
Lornex 1,4
Bridge River
Northair I
Brenda 1,4
Carmi
Highland Bell 2,3,II
H.B. 2,3,II
2,3 Trail
Coxey
Phoenix
Dankoe 2,3,I,II
Dusty Mac I
Similkameen 1
Carolin
Island Copper 1,4
OK
Texada 1,5
Western 1,2,3,II
Catface

Map 37. Agriculture: Historical, 1911–1971

Agriculture has long been important to British Columbia's economy, traditionally ranking after forestry and mining (see Historical and Statistical Summary). Although it is a significant source of employment, agriculture ranks well below the two major resource-based industries in annual production value. It may be argued, however, that dollar value is not a good measure of the importance of a basic, food-producing industry. Further, while the rural lifestyle is difficult to assess in economic terms, it has obvious appeal to many people. The secondary stage of the industry is also important, both in numbers employed and in value added, but much of the agricultural processing done in British Columbia is based upon imported materials. In addition to local produce, it uses such items as cereal grains, grain products, raw sugar, and meat that are brought in from other provinces or from overseas.

The maps on the opposite page show the evolution of the spatial pattern of primary agriculture since the first decade of this century. As the population has grown and the agricultural sector of the provincial economy has expanded, there have been many changes in administrative (statistical) boundaries. These circumstances make detailed areal comparisons difficult. But the fact that the smaller administrative units on the 1911 map generally coincide with what were then the most productive agricultural areas directs attention to the core localities from which the industry expanded.

Especially in earlier years, agriculture was heavily dependent upon local markets and upon relatively simple agricultural technologies. Further, the main population centres were in the more climatically favourable areas. In retrospect, it is not surprising to find that much of the agricultural production in 1911 was clustered in the immediate vicinities of Vancouver and Victoria. The map shows that the Yale-Cariboo electoral district had great agricultural importance. But all of the production from that vast area had about the same dollar value as the total from the much smaller New Westminster District. Within Yale-Cariboo, production came from comparatively few localities, notably from ranches along the historic wagon road to the Cariboo, in nodes along the Dewdney Trail leading to the East Kootenay, and along parts of the main C.P.R. line westward from Revelstoke. Although ranching and grain growing had been established in the interior for decades, transport links to urban markets were poorly developed except for the main rail line. The central interior and the Peace River country lacked any suitable transport ties, for it was not until 1914 that the northern branch, Grand Trunk Pacific (now C.N.R.) was extended westward from Yellowhead Pass to Prince George and Prince Rupert, and not until 1915 that the Pacific Great Eastern (now B.C.R.) completed its first tentative link from Squamish to Lillooet. As a result, the size of each agricultural district on the 1911 map is more or less inversely proportional to its agricultural importance at that time.

The maps for 1931 and 1951 are more readily comparable than the others on the page because the statistical units (Census Divisions) were unchanged over the period. Along with the 1911 map, they show that the agricultural heartland of British Columbia has long been in the lower Fraser Valley. Over the decades, it has contributed about half of the total value of production. Next in economic importance were the Okanagan region (principally the Okanagan and lower Similkameen valleys), the south-central interior, and Vancouver Island (essentially the east coast lowland). Changes from the 1911 pattern are apparent and are to be expected, not so much because the statistical units are smaller but rather because the population had grown and transport connections had improved, especially with the interior of the province. The background colour shown for the Okanagan area, for example, reflects the emergence of tree fruit horticulture as an important agricultural enterprise and the development of major irrigation systems to provide the necessary water.

The horse-drawn plough was a technique of pioneer agriculture in British Columbia.

The pie-graphs are proportionately scaled in accordance with the total value of agricultural production. Thus, the value of production in 1951 is twice that of 1931 and four times that of 1911. Caution should be exercised in interpreting their dimensions, however, for they are based upon actual recorded values, not constant dollars. Relative importance (as measured by dollar value) of different agricultural enterprises at the different dates is represented by the sizes of the graph segments. These show that, for the province as a whole, livestock husbandry and its associated grain and fodder crops provided the backbone of British Columbia's agricultural economy, despite the local importance of horticulture and specialty products.

The statistical units by which agricultural data are available in 1971 coincide with Regional District boundaries. These units do not provide a ready means for historical comparison, but they do provide a much better opportunity for identifying key areas. A distinct pattern change is apparent on the 1971 map; region 23 (Peace River) now appears as a significant contributor. Other maps in the agriculture suite indicate the relative importance of cereal grain agriculture there. In several respects, that area represents the last major agricultural frontier in British Columbia. Both historically and in the present, however, the centre of provincial agricultural output is the lower Fraser Valley. Given its persistence through time, its physical endowments, and its locational advantages, this region seems destined to continue to dominate the spatial pattern of British Columbia agriculture.

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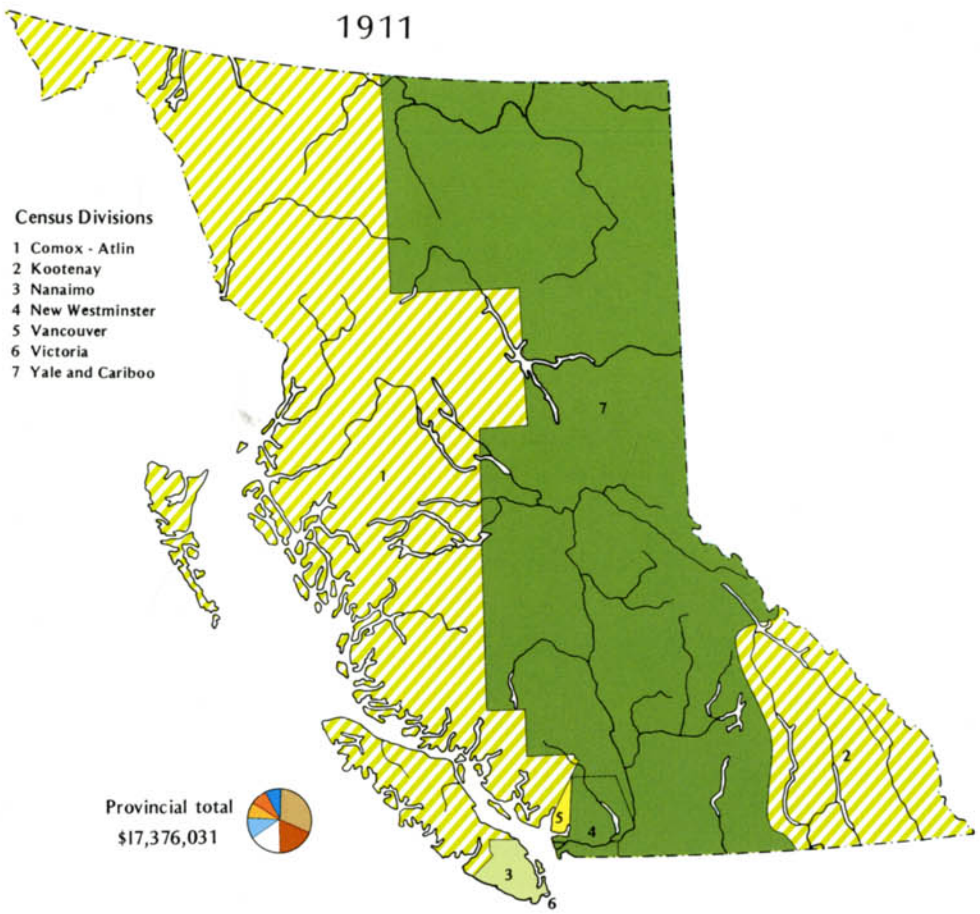
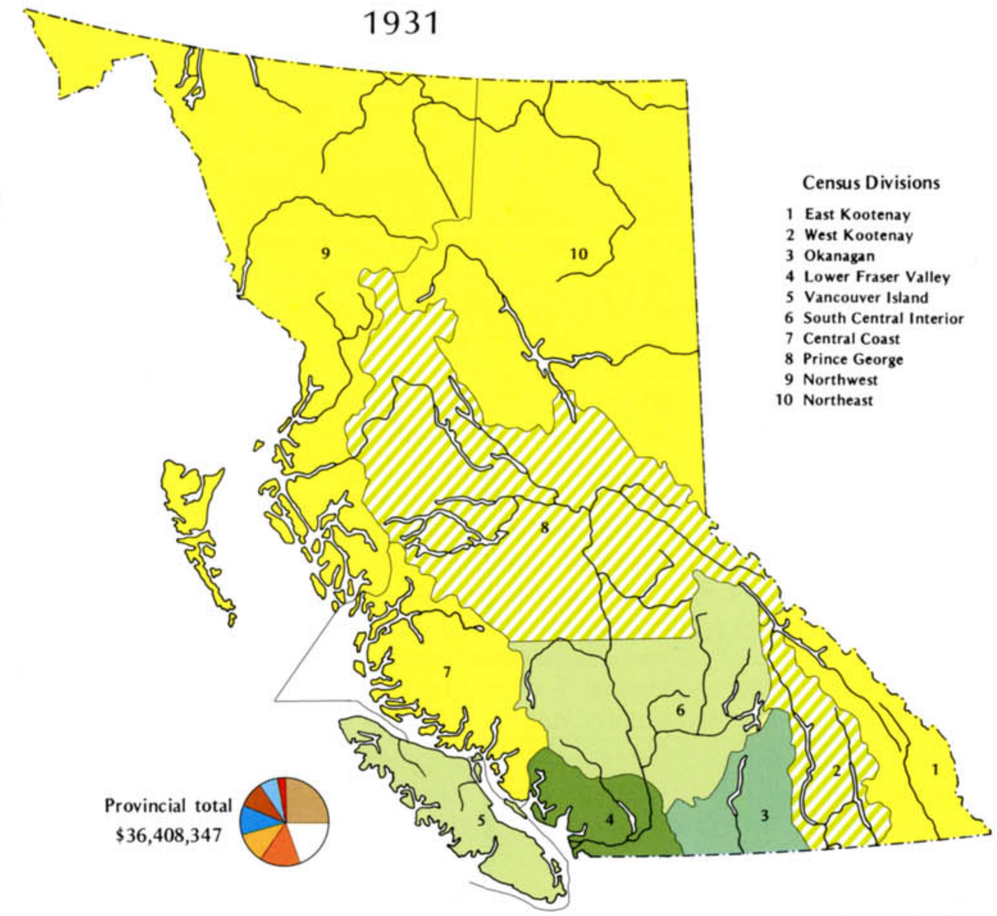
Agriculture

HISTORICAL 1911-1971





Value of Production by Census Division as a Proportion of the Provincial Total

- Less than 5%
- 5% - 10%
- 10% - 15%
- 15% - 30%
- 30% - 50%
- 50% - 60%

Pie-graphs show Relative Value of Different Enterprises (% of Provincial Total)

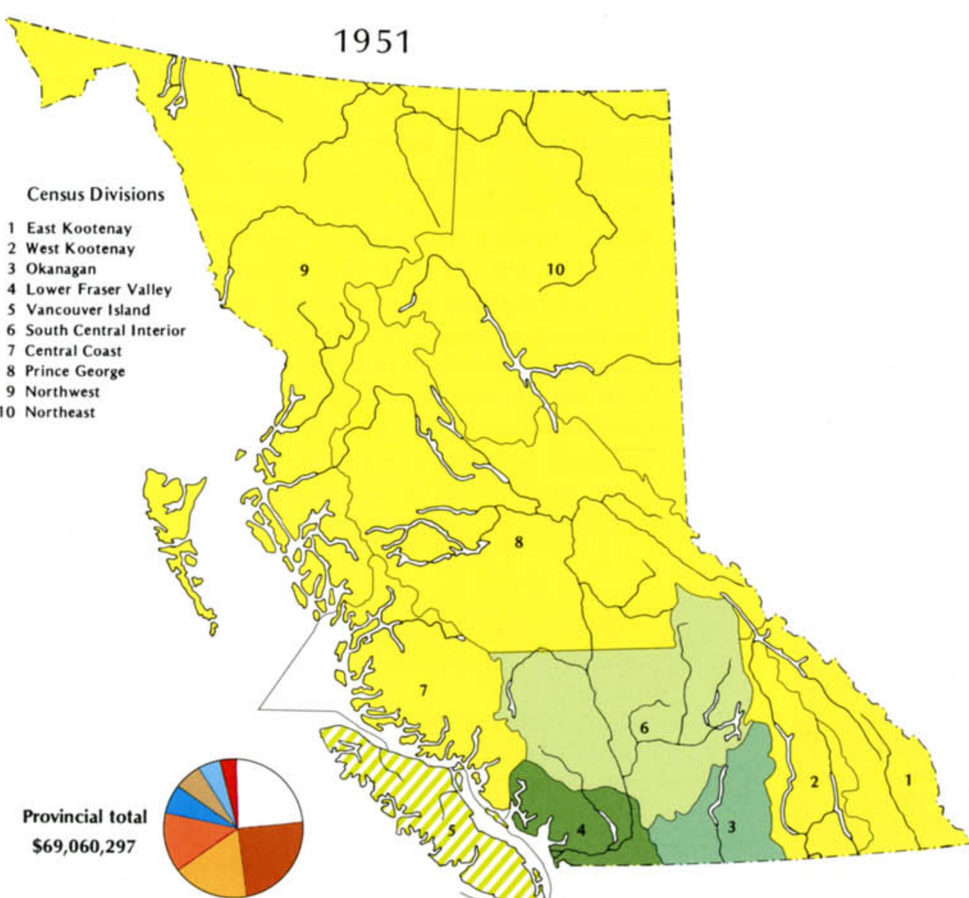
- Livestock
- Dairy
- Poultry and eggs
- Grains and fodder
- Field crops
- Vegetables
- Fruits
- Miscellaneous

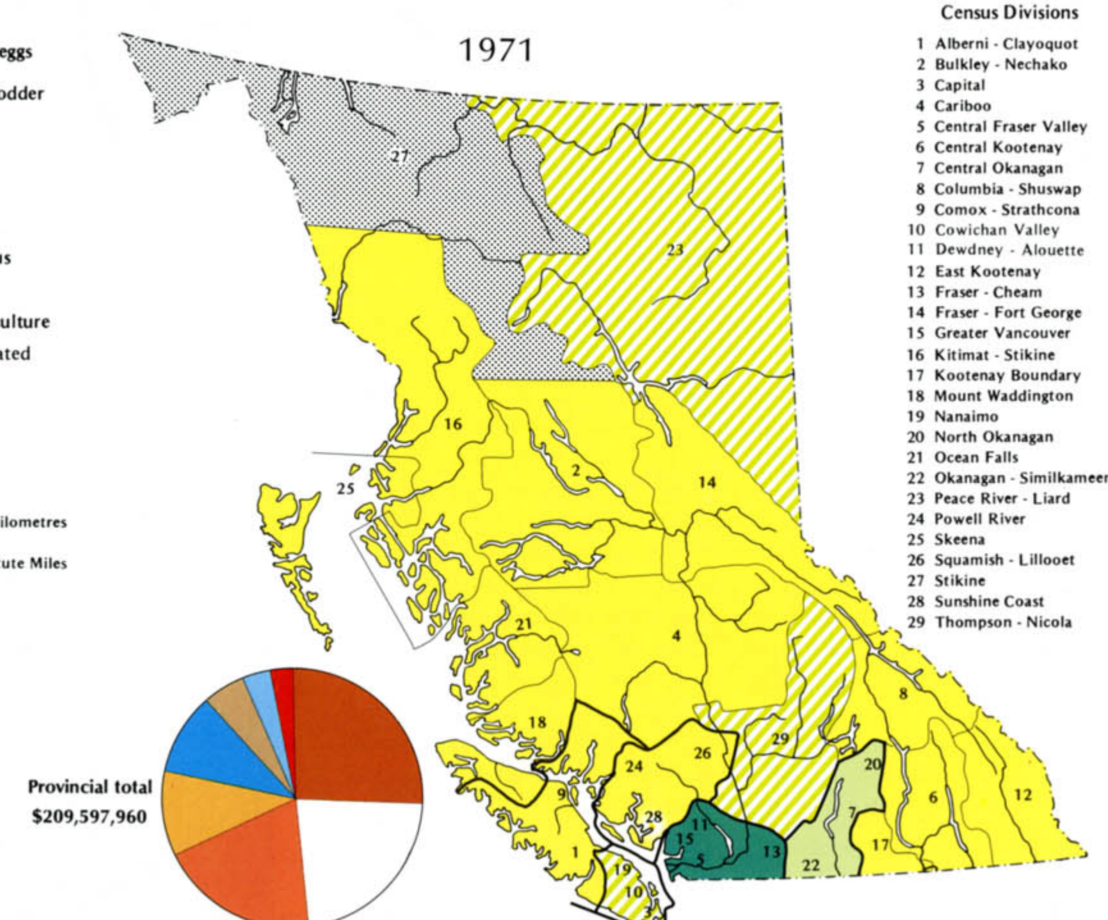
No appreciable agriculture

Boundary of aggregated Census Divisions

100 0 100 200 Kilometres

50 0 50 100 Statute Miles





Map 38. Agriculture: Agricultural Land Reserves and Livestock Distribution, 1975

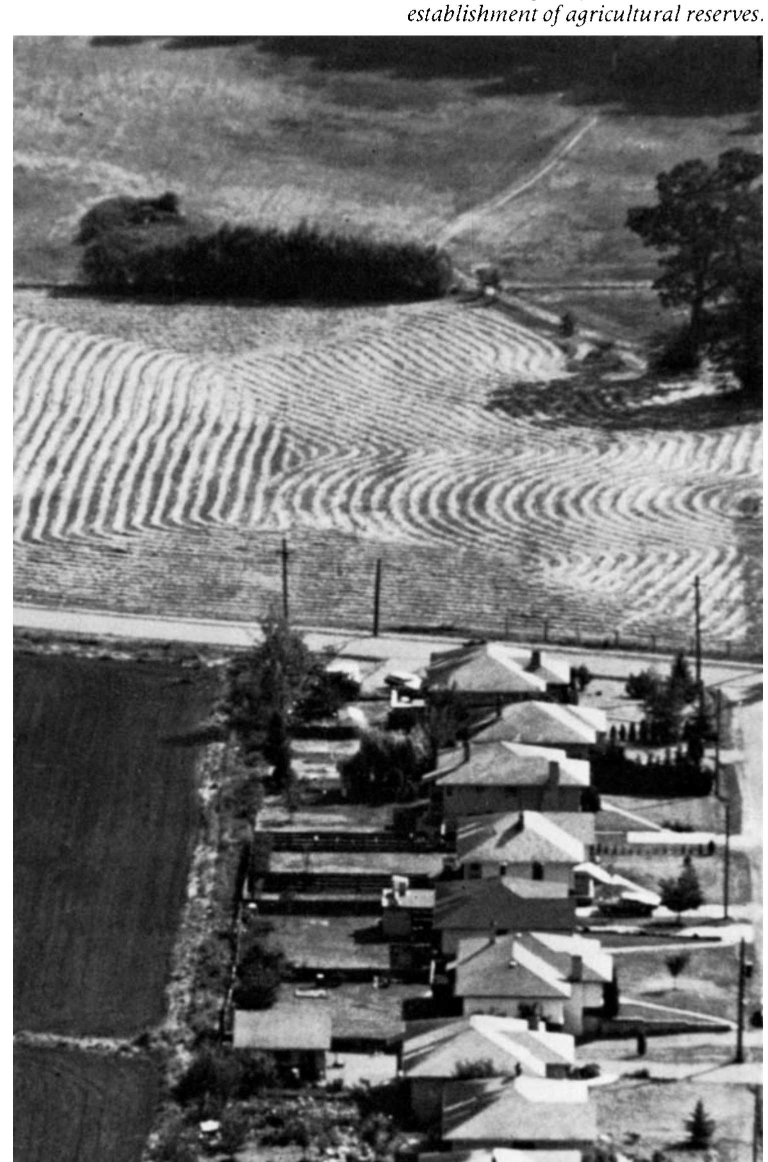
It has become apparent that the juxtaposition of the areas of greatest agricultural productivity in British Columbia and the areas of greatest population concentration (see Maps 1, 2, and 37) inevitably leads to conflict of land use. In earlier years, the closeness of urban markets was an incentive to agricultural expansion and thus to clearing the forest and developing new land. As would be expected, the best soils in the most favourably situated areas were developed first. By mid-century, however, it had become clear that appreciable expansion into less desirable areas was economically impractical because the marginal areas were not sufficiently productive. While the amount of usable agricultural land was limited, the major urban centres grew quickly. Successively greater amounts of formerly rural land were taken up for residential and industrial use in the proliferation of urban sprawl. Because land used for urban purposes represents potentially higher economic returns than agricultural land, the loss of farmland was rapid. Local governments often face conflicting priorities in this regard. In order to increase revenue, development policies that will expand the tax base are usually emphasized. Thus, though the processes that brought about conversion from agricultural to urban/industrial land use were by no means simple, the underlying cause was city growth.

The situation was most acute in the lower Fraser Valley, in the Okanagan area, and on southeastern Vancouver Island, which are at once the most important areas of agricultural production and the most populous parts of the province. The rapid loss of prime agricultural land through urban encroachment was partly ameliorated as direct costs to municipal governments stemming from uncontrolled urban sprawl escalated. In general, the costs of providing electrical, water, sewerage, and other essential services is inversely proportionate to the density of settlement. Regulations were introduced that encouraged infilling and sequential, controlled land-subdivision, but still much of the new urban development was onto prime agricultural land. Further, increased population mobility and changing Canadian lifestyles, especially in the 1960's, led to local migrational trends away from the city centre and into smaller neighbouring communities and surrounding farmlands. The traditional gap between farm and city was being bridged by the suburb.

It has been estimated that by the late 1960's and early 1970's an average of over 4,000 hectares per year of arable land were being converted to other uses. In a province with a very limited agricultural land base, this loss was generally recognized as a serious problem. Public concern led to provincial government action, and in 1973, legislation was enacted placing a freeze on agricultural land dealings and establishing a provincial Land Commission. Among its responsibilities, the commission was charged with the task of delineating the extent of lands to be reserved for agricultural purposes. In this work, the commission drew upon information from the Canada Land Inventory and grouped all lands in Inventory Classes 1 to 4 within the Agricultural Land Reserve (see Map 24). This amounted to a total of about 4.7 million hectares.

Portions of certain other classes of land were also included in order to establish areal continuity and to achieve a manageable system. The commission's work was based upon solid technical information supported by input from local governments and from the general public. By 1975 most of the farmland in the province had been placed under the Agricultural Land Reserve Act. Questions have been raised about the long-term implications of the land reserve system for future urban growth. Regardless of the ways in which those questions may eventually be resolved, the establishment of the system has been a major step in British Columbia's resource management. Out of a provincial total area of approximately 95 million hectares, only about 3 per cent is capable of growing crops. Another 14 per cent is considered to have some capability for forage and grazing of livestock — about half of it in natural grassland. While total land in farm amounts to some 2.3 million hectares, the best lands, potentially capable of producing a wide range of crops, total less than 500,000 ha, or .5 per cent of the provincial total. Despite their relatively small total area, agricultural lands provide a livelihood for an estimated 23,000 people and generate an annual return to farmers of over $220 million.

Suburban sprawl onto good farmland led to the establishment of agricultural reserves.



By showing the Agricultural Land Reserves, the map portrays the distribution of agricultural land in the province. Comparison with the preceding page emphasizes the fact that most of the province's agricultural output comes from a small proportion of the available agricultural land. Reasons for this are many, but among them are the climatic, edaphic, and biotic characteristics of the different areas (see Maps 16, 17, 22, and 23).

The pattern of livestock distribution indicates the areas in which livestock grazing is practised. To a large extent they overlap the land reserves, but for clarity of visual presentation the two categories are symbolized differently on the map. Strong similarities to the pattern of land capability for wildlife are apparent (see Map 24). This is not surprising, because domestic stock and wild ungulates require generally similar forage conditions. Since there is relatively little open grassland in the province, much of the 9.3 million hectare livestock grazing area is within forested land. Most of the livestock grazed are cattle breeds; sheep are much less numerous (see Map 41).

As noted elsewhere in this atlas, natural grassland is largely confined to the lower elevations in the southern interior; above about 450–500 m, available moisture is sufficient to support tree growth. Ranchers graze cattle on the open range in April and May soon after calving. When conditions on the lower range deteriorate with the onset of summer, the animals move farther upslope into the timber and reach the alpine meadows by September. With the onset of cooler weather and the first snowfalls, the process is reversed and the cattle seek successively lower grazing areas. Most of the summer range used by ranchers is crown land, and because much of it is forested, carrying capacities are low. An average of up to twenty ha is needed for each animal. It has been argued that, in the past, frequent wildfires created extensive open areas suitable for grazing. There is evidence, though, that while forest fire protection and control has reduced the number and size of such fires, logging activity continues to create open space. Current logging practice involves clear-cutting, which encourages the regrowth of natural grasses and forbs. The availability of suitable natural forage is obviously important in a ranching economy that requires extensive land use in the raising of calves and yearlings before they are sold to feedlots in Alberta and elsewhere for grain finishing. But it is also critically important to the survival of wildlife populations. Potential conflict between the needs of domestic and wild animals can be resolved only through a clear understanding of requirements of the various species and an equally clear definition and popular acceptance of land-use priorities.

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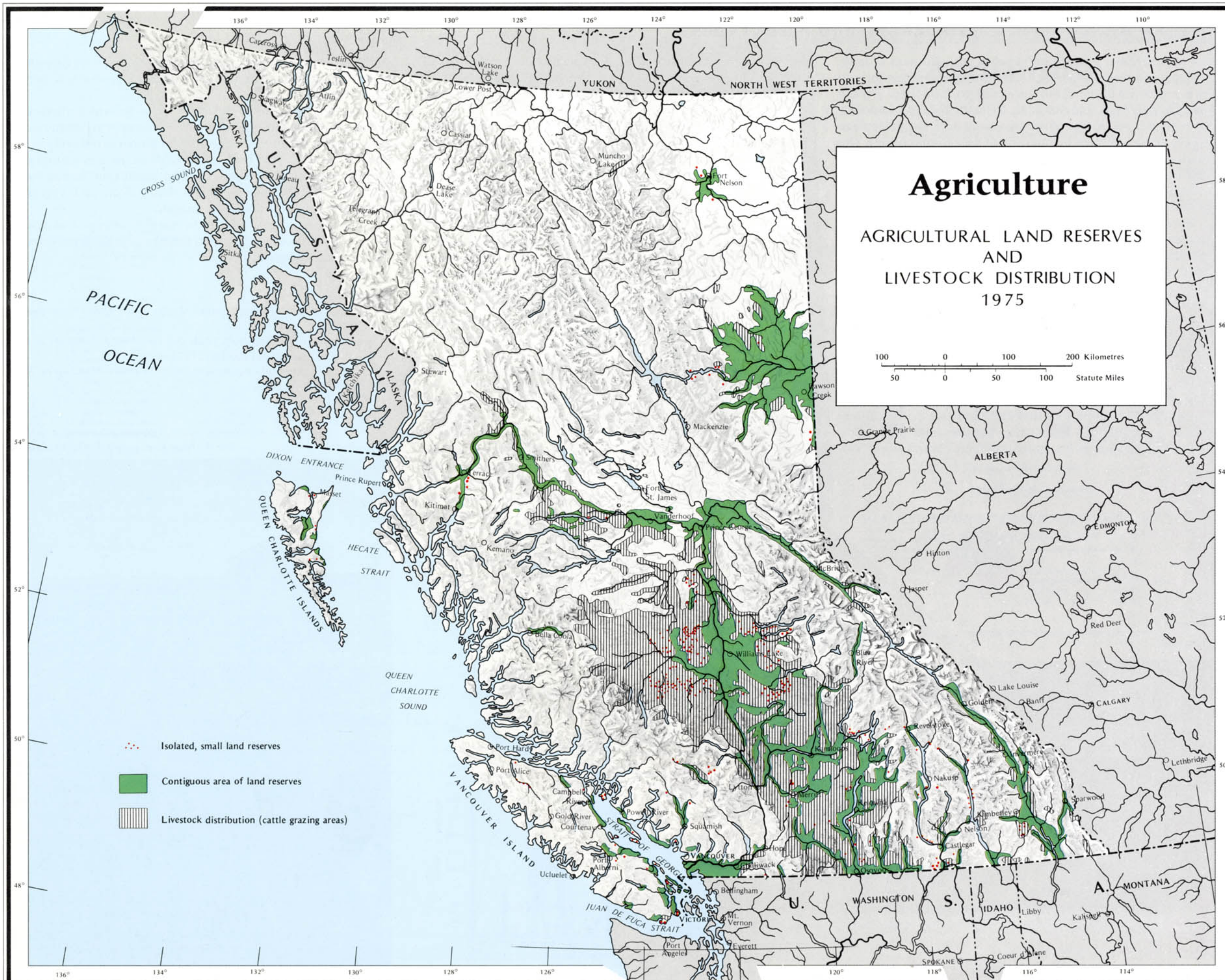


Agriculture
AGRICULTURAL LAND RESERVES
AND
LIVESTOCK DISTRIBUTION
1975
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Isolated, small land reserves
Contiguous area of land reserves
Livestock distribution (cattle grazing areas)
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
U. S. A.
ALASKA
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE
STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN
CHARLOTTE
SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
Carcross
Teslin
Watson Lake
Lower Post
Atlin
Skagway
Cassiar
Muncho Lake
Fort Nelson
Juneau
Dease Lake
Telegraph Creek
Sitka
Stewart
Ketchikan
Dawson Creek
Grande Prairie
Mackenzie
Prince Rupert
Masset
Terrace
Smithers
Kitimat
Fort St. James
Vanderhoof
Prince George
Kemano
Edmonton
Hinton
McBride
Jasper
Bella Coola
Williams Lake
Blue River
Red Deer
Lake Louise
Golden
Banff
Calgary
Revelstoke
Kamloops
Port Hardy
Port Alice
Campbell River
Gold River
Courtenay
Powell River
Squamish
Lytton
Merritt
Nakusp
Invermere
Lethbridge
Sparwood
Kimberley
Nelson
Castlegar
Hope
Vancouver
Chilliwack
Osoyoos
Port Alberni
Ucluelet
Victoria
Bellingham
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell
136° 134° 132° 130° 128° 126° 124° 122° 120° 118° 116° 114° 112° 110°
58° 56° 54° 52° 50° 48°

Map 39. Agriculture: Capitalization and Farm Types

Farm capitalization is based upon value of investment in land, buildings, and machinery. The total farm capitalization for any area is a measure of the importance of agriculture there. On the accompanying map, capitalization in each Census Division is expressed as a percentage of the provincial total, the percentage category being indicated by intensity of background colour. The pattern may be compared with that shown on Map 37, which is based upon total production value. The importance of south-eastern Vancouver Island, the lower Fraser Valley, the Okanagan and Kamloops districts, and the Peace River region is evident.

By contrast, much of the mainland coast and Vancouver Island and the Queen Charlotte Islands are areas of relatively low capitalization. Despite the mild, humid climatic conditions that prevail in the coastal zone (see Maps 21 and 22), arable land is limited and low-cost services suitable for transporting agricultural products are infrequent.

The inset map provides detail for the populous southwestern part of the province. Here, although the Census Divisions are in general much smaller than those elsewhere, farm capitalization within the individual divisions is sufficiently high to rank some of them in the highest range on the percentage scale. The alluvial lowland extending seaward from Hope is particularly important. Even within that limited area, however, there are marked differences. It is notable that the Census Division with the highest relative capitalization in the entire province, Central Fraser Valley, is also the smallest in area. If all of the Census Divisions in British Columbia were of equal size, the importance of the Central Fraser Valley in terms of farm capitalization would be even more apparent.

The accompanying bar graphs complement the information conveyed by the map. Graph 1 shows total population and farm population by Census Division (Regional District). Because of the considerable differences between divisions, population is shown on a logarithmic scale. The graph indicates that farm population is highest in Divisions 5 and 15, namely, the Fraser lowland. Considerable numbers are also found in Divisions 22 and 23, the Okanagan and Peace River areas. In general, the areas of highest farm capitalization also have high farm populations. In comparison with total Census Division population, however, it is clear that the proportion of farmers in the Fraser lowland is relatively small, whereas in the Peace River area and the Okanagan Valley it is relatively high. On this basis, agriculture is regionally more important through much of interior British Columbia than it is in the lower Fraser Valley.

Graph 2 indicates average farm size and number of farms in each division. The number of farms is highest in the southwestern mainland and in the Okanagan area, but in these areas the average size of farms is small. Arithmetically, the inverse relationship between number of farms and average size of farm is not surprising, but it emphasizes the fact that smaller holdings are spatially concentrated near the urbanized areas. The graph also indicates those Census Divisions in which relatively large farms exist. Districts 4, 23, and 29 (respectively, Cariboo, Peace River, and Thompson-Nicola) are among them, and as other maps in the agricultural suite emphasize, they are associated with livestock ranching and cereal grain agriculture.

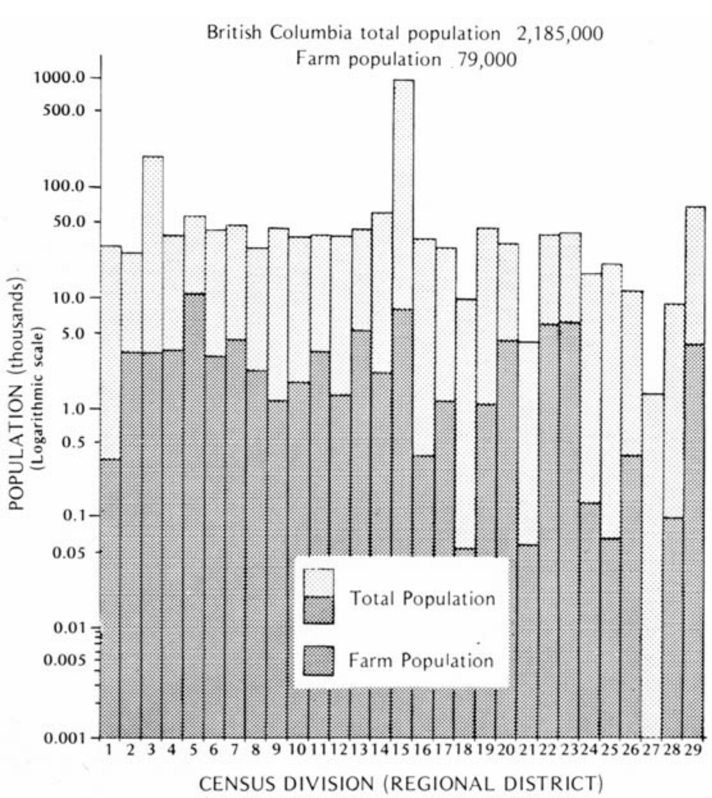
The pie-graphs on the map show the range of major farm types to be found in each Census Division. The determination of major farm type is based upon Census value of production of various enterprises within the region, not farm cash receipts. In central Vancouver Island, for example, dairying can be seen to be an important agricultural pursuit. As the level of farm capitalization in that area suggests, though, total dairy production there is rather modest.

Dairying is common in many areas in which there is a demand for fluid milk, but beef cattle enterprises are dominant in most regions. Because cereal grains are grown extensively in the Peace River area, field crops are notable in the agricultural mix for that locality, and they are also significant in the West Kootenay and Squamish-Lillooet areas. Fruit and vegetable growing is dominant in the Okanagan.

Greater detail concerning the spatial patterns and associations of the various crop and livestock enterprises is provided in the two succeeding maps.

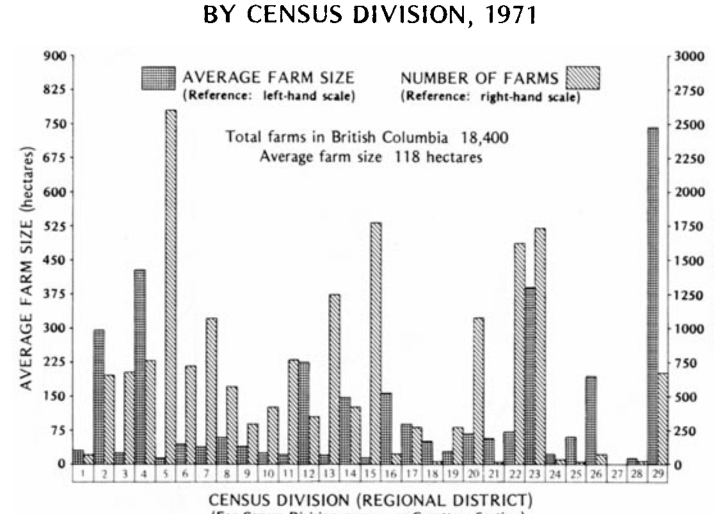
GRAPH 1:

FARM POPULATION AND TOTAL POPULATION BY CENSUS DIVISION, 1971



GRAPH 2:

AVERAGE FARM SIZE AND NUMBER OF FARMS BY CENSUS DIVISION, 1971



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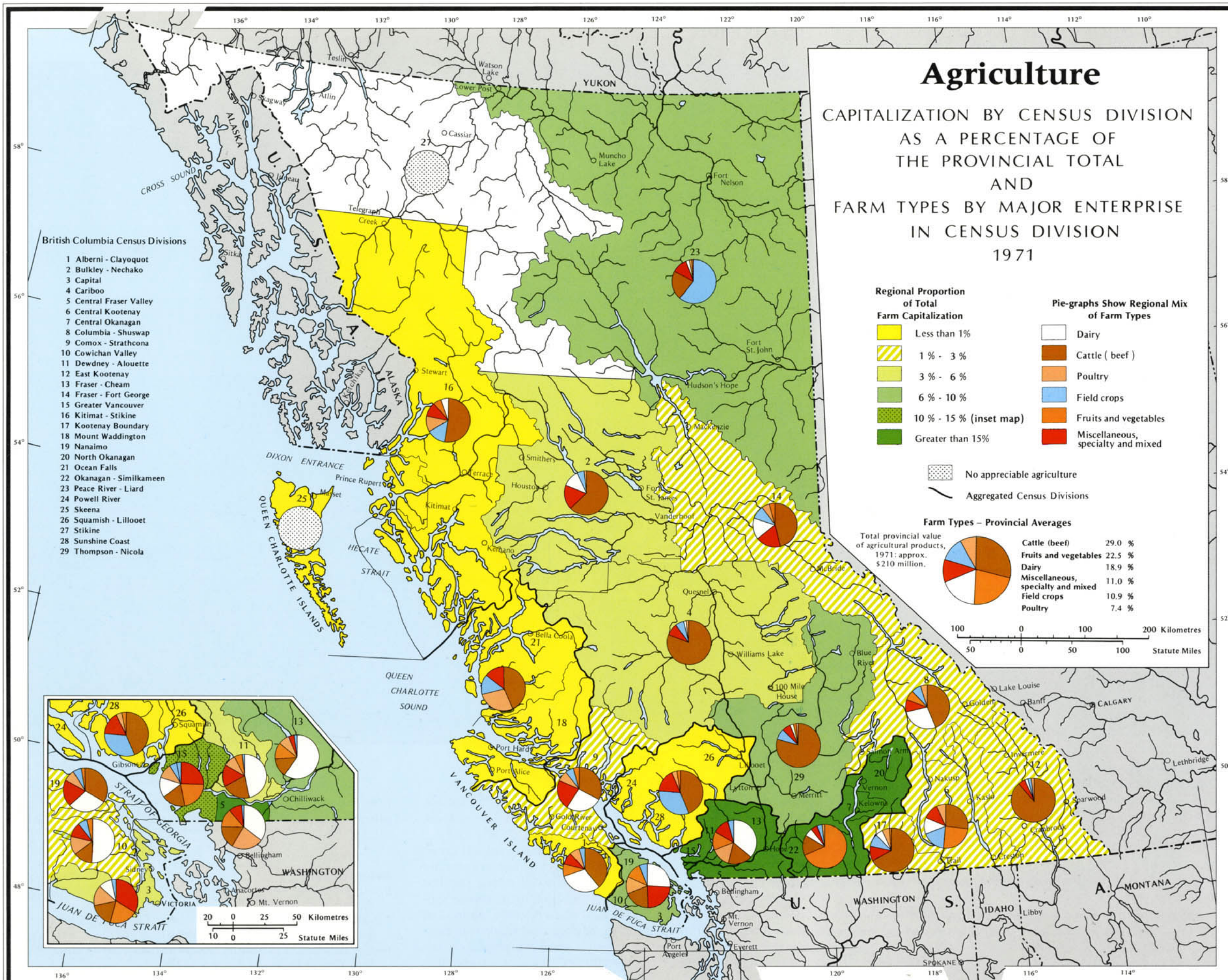
Flat terrain, typical of the Canadian prairies, extends into the Peace River region of British Columbia.


Agriculture
CAPITALIZATION BY CENSUS DIVISION AS A PERCENTAGE OF THE PROVINCIAL TOTAL AND FARM TYPES BY MAJOR ENTERPRISE IN CENSUS DIVISION 1971
Regional Proportion of Total Farm Capitalization
Less than 1%
1 % - 3 %
3 % - 6 %
6 % - 10 %
10 % - 15 % (inset map)
Greater than 15%
Pie-graphs Show Regional Mix of Farm Types
Dairy
Cattle (beef)
Poultry
Field crops
Fruits and vegetables
Miscellaneous, specialty and mixed
No appreciable agriculture
Aggregated Census Divisions
Farm Types – Provincial Averages
Total provincial value of agricultural products, 1971: approx. $210 million.
Cattle (beef) 29.0 %
Fruits and vegetables 22.5 %
Dairy 18.9 %
Miscellaneous, specialty and mixed 11.0 %
Field crops 10.9 %
Poultry 7.4 %
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
British Columbia Census Divisions
1 Alberni - Clayoquot
2 Bulkley - Nechako
3 Capital
4 Cariboo
5 Central Fraser Valley
6 Central Kootenay
7 Central Okanagan
8 Columbia - Shuswap
9 Comox - Strathcona
10 Cowichan Valley
11 Dewdney - Alouette
12 East Kootenay
13 Fraser - Cheam
14 Fraser - Fort George
15 Greater Vancouver
16 Kitimat - Stikine
17 Kootenay Boundary
18 Mount Waddington
19 Nanaimo
20 North Okanagan
21 Ocean Falls
22 Okanagan - Similkameen
23 Peace River - Liard
24 Powell River
25 Skeena
26 Squamish - Lillooet
27 Stikine
28 Sunshine Coast
29 Thompson - Nicola
20 0 25 50 Kilometres
10 0 25 Statute Miles
YUKON
ALASKA
U.S.A.
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
JUAN DE FUCA STRAIT
STRAIT OF GEORGIA
CALGARY
Lethbridge
SPOKANE

Map 40. Agriculture: Crop Value by Census Division

Crops provide over $60 million annually or about one-third of the total value of agricultural production in British Columbia. Of the 710,000 hectares of improved land in the province 62 per cent is cropped. Nearly 95 per cent of the latter is in field crops, of which hay and fodder account for well over half. The remainder is devoted to horticulture, mainly tree fruits. While most of the land is in field crops, much of the value of production comes from horticulture, principally tree fruits, small fruits, and vegetables.

As the preceding map suggests, the lower Fraser Valley and the Okanagan-Similkameen area dominate. The Greater Vancouver Regional District leads the province, in 1971 accounting for nearly one-quarter of the total crop value. For simplicity of map portrayal, data for the smaller Census Divisions are aggregated, but detail for the Victoria-Vancouver area is shown in the inset. Okanagan-Similkameen contributed 15 per cent, Central Okanagan 13 per cent, Peace River-Liard 12 per cent, and Central Fraser Valley 11 per cent. All other Census Divisions individually accounted for less than 6 per cent. Once again, with the exception of the Peace River country, the juxtaposition of high value agricultural land and urban concentrations is apparent.

The pie-graphs show the relative importance of the various agricultural products grown in each division. In order to emphasize regional differences, field crops and horticultural crops are subdivided. Field crops include the cereal grains, forage seed and oilseed, hay and fodder, potatoes, and sugar beet. Horticulture includes tree fruits, small fruits, vegetables, and nursery and specialty crops. As the pie-graphs indicate, fruit horticulture is regionally important in the Okanagan-Similkameen District and in the Lower Mainland, especially the Central Fraser Valley. Tree fruits have been commercially grown in the Okanagan since the 1890's. The combination of warm, dry summer weather and abundant sunshine found there is important to the development of sugars and colouring in the fruit. Apples are the main crop, an annual average of about 160 million kg having been produced in recent years. Over the past twenty years, viticulture has become an important element of regional agriculture, and most of the output is channelled to wineries in Kelowna and Penticton. What the climate of the Okanagan is to the growing of tree fruits and grapes, that of the southern coastal trough is for small fruits, greenhouse horticulture, and specialty crops. A long frostless season, mild winters, and cool, sunny summer weather suit the growing of raspberries, strawberries, and a variety of nursery and specialty crops.

Regionally, cereal grains are important in the central Kootenay and in the Peace River country. In the former, however, total agricultural output is modest, and cereal grain yield is small in comparison to that from the Peace River, which is British Columbia's principal grain-growing area. Since it is physically an extension of the Canadian prairies, this regional importance is not surprising, but the cultivated area is comparatively small, so that the region cannot be considered a major Canadian grain producer.

The pie-graphs also show that while most of the value of crop production in the Thompson-Nicola Census Division comes from hay and fodder, much of that on southern Vancouver Island is gained from nursery, greenhouse, and other specialty horticulture. The difference in emphasis is attributable to many factors, but climatic and soil characteristics are important among them (see Maps 17 and 22).

In the Thompson-Nicola country, which has natural grassland and associated livestock ranching, hay and fodder crops are raised for winter feed. In the Victoria area, the long frostless season, light, friable soils, and high sunshine totals favour specialty crops such as bulbs, holly, and nursery stock. Spring-cut flowers and Christmas holly find ready seasonal markets in eastern Canada. Though they make only a small contribution to the total provincial value of crop production, these two areas illustrate the diversity of climatic conditions and agricultural enterprises in British Columbia, a diversity that is unique in Canada.

Dawson Creek is the largest population centre of northeastern British Columbia and services an extensive agricultural area.

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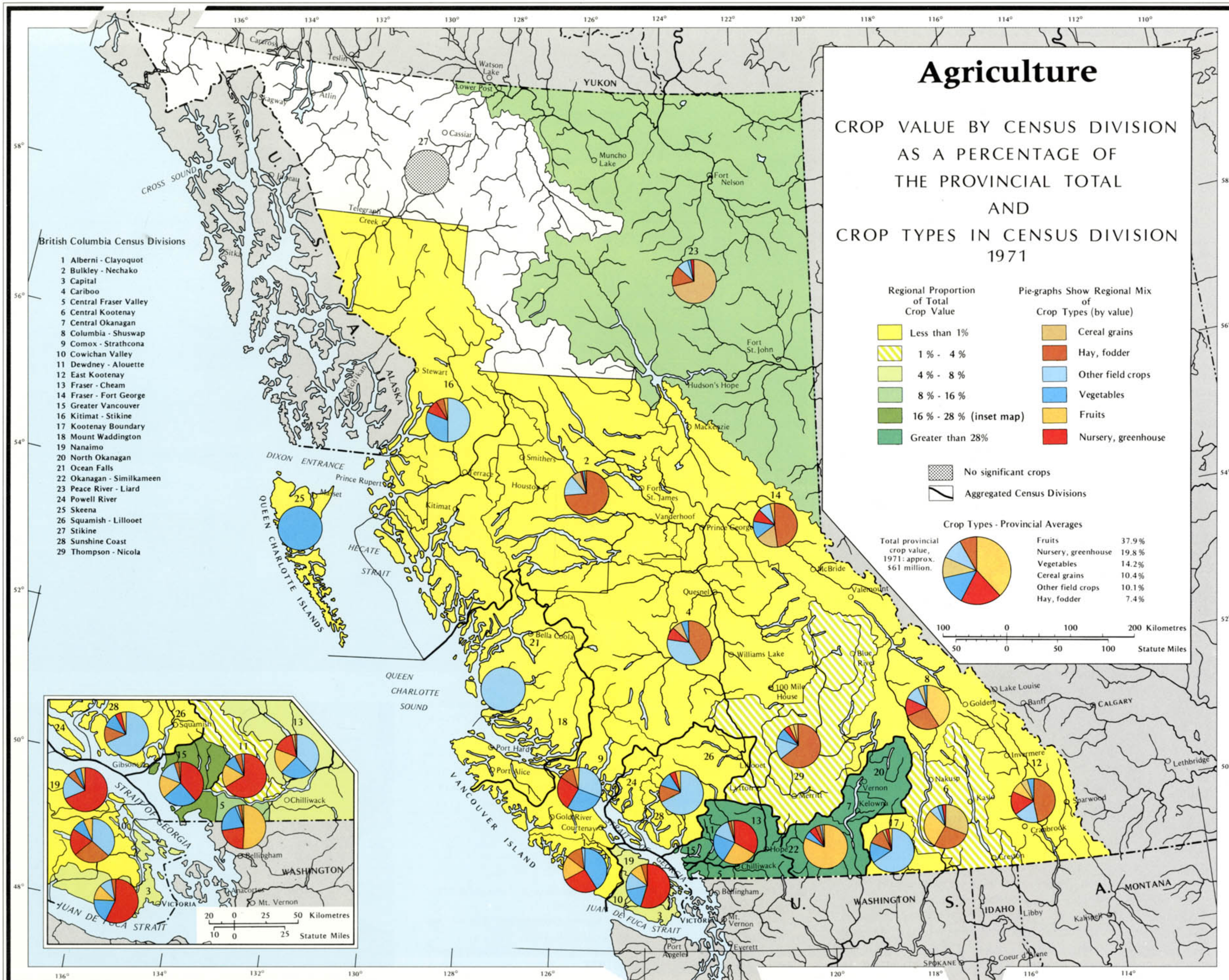
Agriculture
CROP VALUE BY CENSUS DIVISION AS A PERCENTAGE OF THE PROVINCIAL TOTAL AND CROP TYPES IN CENSUS DIVISION 1971
Regional Proportion of Total Crop Value
Less than 1%
1 % - 4 %
4 % - 8 %
8 % - 16 %
16 % - 28 % (inset map)
Greater than 28%
Pie-graphs Show Regional Mix of Crop Types (by value)
Cereal grains
Hay, fodder
Other field crops
Vegetables
Fruits
Nursery, greenhouse
No significant crops
Aggregated Census Divisions
Crop Types - Provincial Averages
Total provincial crop value, 1971: approx. $61 million.
Fruits 37.9 %
Nursery, greenhouse 19.8 %
Vegetables 14.2 %
Cereal grains 10.4 %
Other field crops 10.1 %
Hay, fodder 7.4 %
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
British Columbia Census Divisions
1 Alberni - Clayoquot
2 Bulkley - Nechako
3 Capital
4 Cariboo
5 Central Fraser Valley
6 Central Kootenay
7 Central Okanagan
8 Columbia - Shuswap
9 Comox - Strathcona
10 Cowichan Valley
11 Dewdney - Alouette
12 East Kootenay
13 Fraser - Cheam
14 Fraser - Fort George
15 Greater Vancouver
16 Kitimat - Stikine
17 Kootenay Boundary
18 Mount Waddington
19 Nanaimo
20 North Okanagan
21 Ocean Falls
22 Okanagan - Similkameen
23 Peace River - Liard
24 Powell River
25 Skeena
26 Squamish - Lillooet
27 Stikine
28 Sunshine Coast
29 Thompson - Nicola
YUKON
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
QUEEN CHARLOTTE ISLANDS
VANCOUVER ISLAND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE SOUND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 41. Agriculture: Livestock Value and Livestock Enterprises

A number of differences are apparent between the provincial pattern of livestock value and that of crops. The lower Fraser Valley is again foremost; in aggregate it represents over 60 per cent of the livestock total. All of the other regions contribute significantly less. The Thompson-Nicola Census Division occupies second place, though it accounts for little more than 7 per cent. In marked contrast to its relative importance in crop production, the Okanagan-Similkameen is only a minor livestock producer, and the Peace River-Liard Division has less than 2 per cent of the total provincial value. Its percentage suggests that not much of the regional field crop output goes to livestock enterprises within the Peace River-Liard district. Distance from markets and the long winter-feeding period are among the reasons. The Cariboo country is more significant, contributing about 5 per cent of the total. Collectively, the three regions of southern Vancouver Island make up nearly 7 per cent of the total, but partly because of the small area involved, they are individually of little importance.

Taken together, livestock enterprises make up over two-thirds of the total value of British Columbia agriculture. Beef cattle and dairying alone provide over 40 per cent. However, these statistics can be misleading, since most of the hay and forage crops are not sold off the farm and hence their value is measured only indirectly, in returns to the livestock industry. While dairying and beef-raising dominate, poultry and egg production are also important, generating a farm value of over $45 million in 1971. Within the key Central Fraser Valley Census Division, which is one of Canada's major poultry producers, eggs and poultry generate half of the regional livestock value. Proximity to urban markets has been an important factor in that phase of the livestock industry. In contrast to some other areas of Canada and of the northwestern United States, sheep-ranching is not widely practised in British Columbia. Competition from outside producers, losses through predators, and suitability of available range land for other purposes, including game management, have been among the limiting factors.

The pie-graphs indicate that beef cattle dominate livestock production in about half of the Census Divisions, dairy enterprises in most of the remainder. The main beef-cattle operations are located in a zone extending from the international border, through the Okanagan Valley and Kamloops area, northward to Williams Lake. The cattle industry has been historically associated with this zone because natural grassland and open forest are at hand (see Maps 23 and 38). In many ways, the pie-graph representing the lower Fraser Valley and that for the Thompson-Nicola region epitomize the contrasts that exist between coastal and interior environments. In the lower Fraser Valley, where the growing season is long and the climate is humid, hay and pasture crops thrive. The urban demand for dairy products, eggs, and poultry is high, and agri-business based upon these livestock enterprises is extensive. In the Kamloops-Nicola country, by contrast, the growing season is much shorter and winters are more severe. While beef animals can forage on home range during the winter, such conditions would be difficult for dairy animals. In addition, transport distance to major urban markets is considerably greater, which is a disadvantage to fluid-milk producers. On the other hand, where irrigation is available, the higher summer temperatures in southern interior valleys facilitate the production of hay crops, and surplus hay is shipped from those locations to dairy herds on the coast.

Cattle drive to winter range, near Douglas Lake.

Cattle which graze together on common land can be identified by their brands.

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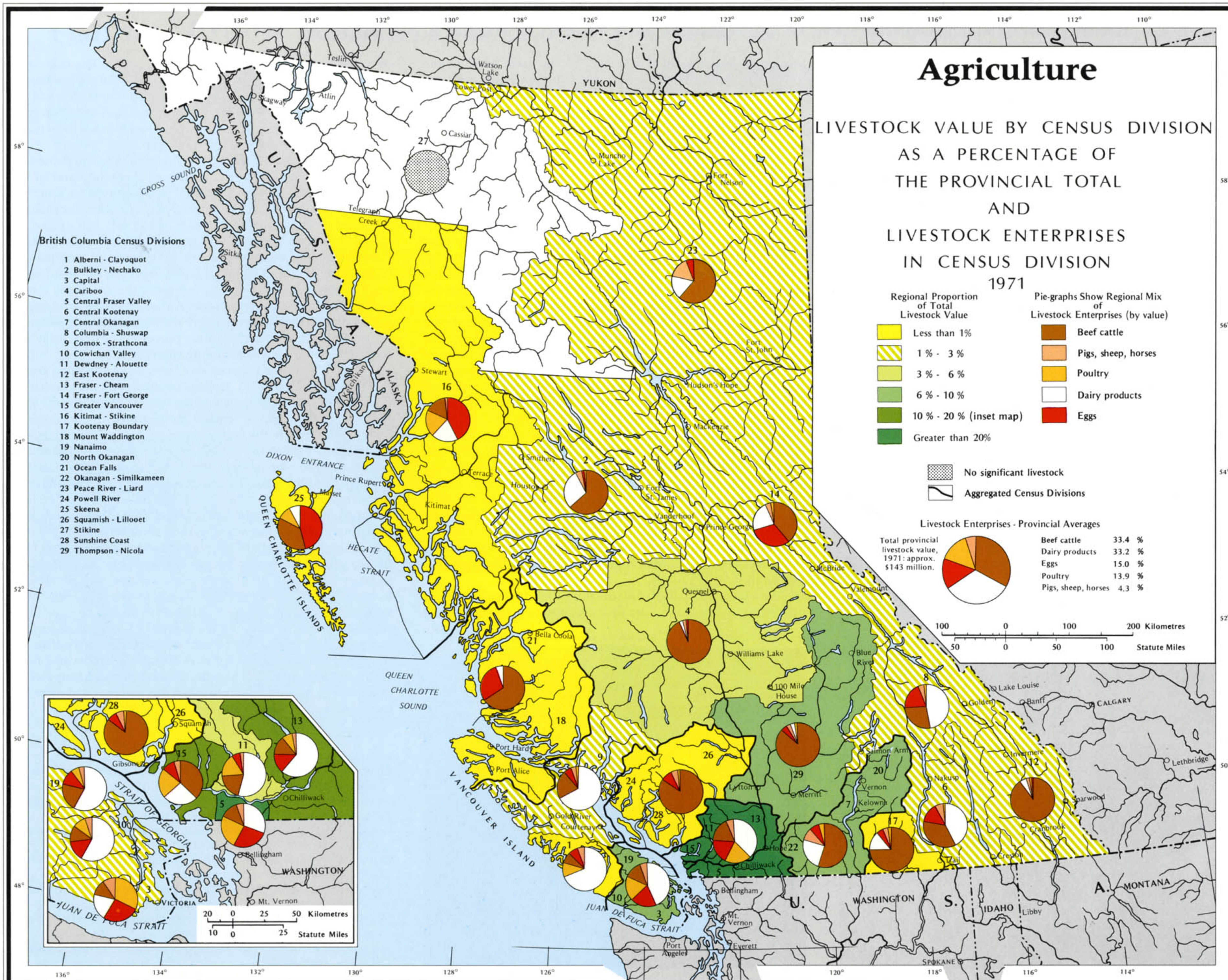
Agriculture
LIVESTOCK VALUE BY CENSUS DIVISION AS A PERCENTAGE OF THE PROVINCIAL TOTAL AND LIVESTOCK ENTERPRISES IN CENSUS DIVISION
1971
Regional Proportion of Total Livestock Value
Less than 1%
1 % - 3 %
3 % - 6 %
6 % - 10 %
10 % - 20 % (inset map)
Greater than 20%
Pie-graphs Show Regional Mix of Livestock Enterprises (by value)
Beef cattle
Pigs, sheep, horses
Poultry
Dairy products
Eggs
No significant livestock
Aggregated Census Divisions
Livestock Enterprises - Provincial Averages
Total provincial livestock value, 1971: approx. $143 million.
Beef cattle 33.4 %
Dairy products 33.2 %
Eggs 15.0 %
Poultry 13.9 %
Pigs, sheep, horses 4.3 %
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
British Columbia Census Divisions
1 Alberni - Clayoquot
2 Bulkley - Nechako
3 Capital
4 Cariboo
5 Central Fraser Valley
6 Central Kootenay
7 Central Okanagan
8 Columbia - Shuswap
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YUKON
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JUAN DE FUCA STRAIT
STRAIT OF GEORGIA
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Watson Lake
Lower Post
Atlin
Skagway
Cassiar
Muncho Lake
Fort Nelson
Telegraph Creek
Sitka
Fort St. John
Hudson's Hope
Stewart
Ketchikan
Mackenzie
Smithers
Prince Rupert
Masset
Terrace
Houston
Fort St. James
Kitimat
Vanderhoof
Prince George
McBride
Valemount
Quesnel
Bella Coola
Williams Lake
Blue River
100 Mile House
Lake Louise
Banff
Golden
Port Hardy
Port Alice
Invermere
Lethbridge
Salmon Arm
Vernon
Kelowna
Nakusp
Lytton
Merritt
Gold River
Courtenay
Hope
Chilliwack
Squamish
Gibsons
Sparwood
Cranbrook
Creston
Trail
Bellingham
Mt. Vernon
Everett
Port Angeles
Victoria
Libby
Spokane
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 42. Fishing, Historical: Distribution of Operating Fish Processing Plants and Canneries, 1911–1975

Historically, the fishing industry has ranked in fourth position among British Columbia's extractive industries, after forestry, mining, and agriculture. There are strong seasonal fluctuations in the labour force and variations on a year-to-year basis depending upon the relative abundance of fish stocks. In recent years, however, landed value of fish by British Columbia fishermen has approximated $160 million annually, and fishing has employed about eleven thousand people. There are also considerable numbers of associated shoreworkers in the fish processing plants.

The marketed value of fish and fish products is roughly double the landed value, of which salmon constitute about 75 per cent. Because fish stocks are a common property resource, one of the characteristics of the industry is that there is strong competition for the catch. This has led to heavy investment in vessels and gear of increasing sophistication to increase the catch efficiency. As a result, regulation has been necessary in order to assure the survival of sustaining populations. For example, a vessel-licensing system was introduced by the federal government in 1968 that has effectively controlled the size of the salmon-fishing fleet. The 200-mile (322 km) fishing limit was declared in order to achieve better control in the management of fish stocks and improved returns to Canadian fishermen. The Salmonid Enhancement Programme, established in 1977, is also designed to increase the annual catch, in this case by improving natural spawning channels and by restoring depleted runs to former levels of abundance. The programme is concerned only with anadromous fishes, notably Pacific salmon, but because of the value of the salmon catch, it is of major importance.

While management of the resource is a federal responsibility, the monitoring of fish processing plants is under provincial jurisdiction. For convenience, a distinction is made on the accompanying map page between fish processing, salmon canning, and shellfish processing. Generically, the term fish processing includes all forms, but because both catch and processing have become more diversified in recent years and because data are more complete, a distinction is made on the maps for 1951 and 1975. Only those plants that were operating in the year indicated by the map date are shown. Many non-operating plants may have been in existence. In cases where several plants were in close proximity, a pie-graph symbol is used, its size and segments proportionate to the number of plants represented, not capacity. Many of the shellfish plants, for example, are small operations.

Fishing has long been a mainstay with the successive native Indian populations who have occupied the area since pre-Columbian times (see Map 3). Early in the history of white settlement, Pacific salmon were taken not only as an immediate food source but also as an item for offshore trade in the form of salted, and later of canned, salmon. Commercial fishing in British Columbia was therefore predicated upon salmon from its beginnings, and by 1911 salmon canning was a well-established industry. As the first map indicates, there was a scattering of plants along the coast, but most of them were in the Fraser mouth and the Skeena estuary. This orientation came about because the Fraser and Skeena rivers are very important salmon streams and the fish migrating to them during the seasonal spawning runs could be intercepted in great numbers. Furthermore, boats and gear were comparatively primitive; the boats were mostly sail-powered, and they had no means of holding the catch for more than a few hours without spoilage. Since there was a growing market for canned salmon in America and in Europe, however, canneries were built at other locations along the coast where the resource was abundant and from which small craft could operate on a daily cycle. In a way somewhat comparable to the historical development of logging and sawmilling, salmon fishing and canning at first showed strong spatial association. The clustering of plants in the Smith Inlet–Rivers Inlet area is a reflection of the heavy runs of sockeye salmon (the preferred canning species) to that locality.

By 1928 the dispersal of plants along the coast had reached a maximum. Every major inlet near an important salmon stream or in strategic proximity to some point where the fish could readily be intercepted had a cannery. But by 1928 the pressure of fishing was being felt upon the available salmon stocks, and the number of plants at the Fraser mouth had declined. The great slide on the Fraser River at Hell's Gate had also led to a drastic reduction in the number of returning fish.

The map of 1951 shows both diversification and consolidation — diversification in the nature of processing and of the resource handled and consolidation in the sense of a return to centralization in two main nodes. Only four salmon canneries remained in the central portion of the coast. This change in pattern reflects new technology in the design of boats and gear. Innovations such as high-speed diesel engines and semi-planing hulls increased vessel mobility, while improved on-board holding facilities allowed boats to transport the catch for longer periods and over greater distances without spoilage. Also apparent on the 1951 map are the many shellfish processing plants on the lower coast. Most of these were processing oysters, for which the regional market was becoming appreciable by 1951.

The 1975 map illustrates an extension of the same trends that were at work in 1951. In this case, however, the gravitation is away from Prince Rupert and the central coast, toward Vancouver. Shellfish plants remain concentrated in the Strait of Georgia area, where the Pacific oyster is managed on a foreshore lease basis. By 1975 the fishing fleet was more diversified and better equipped with navigational, communication, fish-finding, and fish-handling gear. The centralization of processing has not, however, come solely from technological innovation. Institutional arrangements in the form of regulation of the fishery have been important. Management authorities determine in advance what fishing zones will be open and for what period, so that the fleet can move into position at virtually any point along the coast in accordance with anticipated catch success. The regulations have been developed most specifically in the management of salmon, but herring and some groundfish stocks are now under various forms of control. As the means of taking, transporting, and processing the resource have become increasingly efficient, so the need to manage the fisheries effectively has become more and more apparent. The benefits of good management will be expressed in future enhancement of the resource and increases in related income and employment.

Conveyor belts are now used to speed off-loading of catch.

Sails were a common sight during the early days of the inshore fishery.

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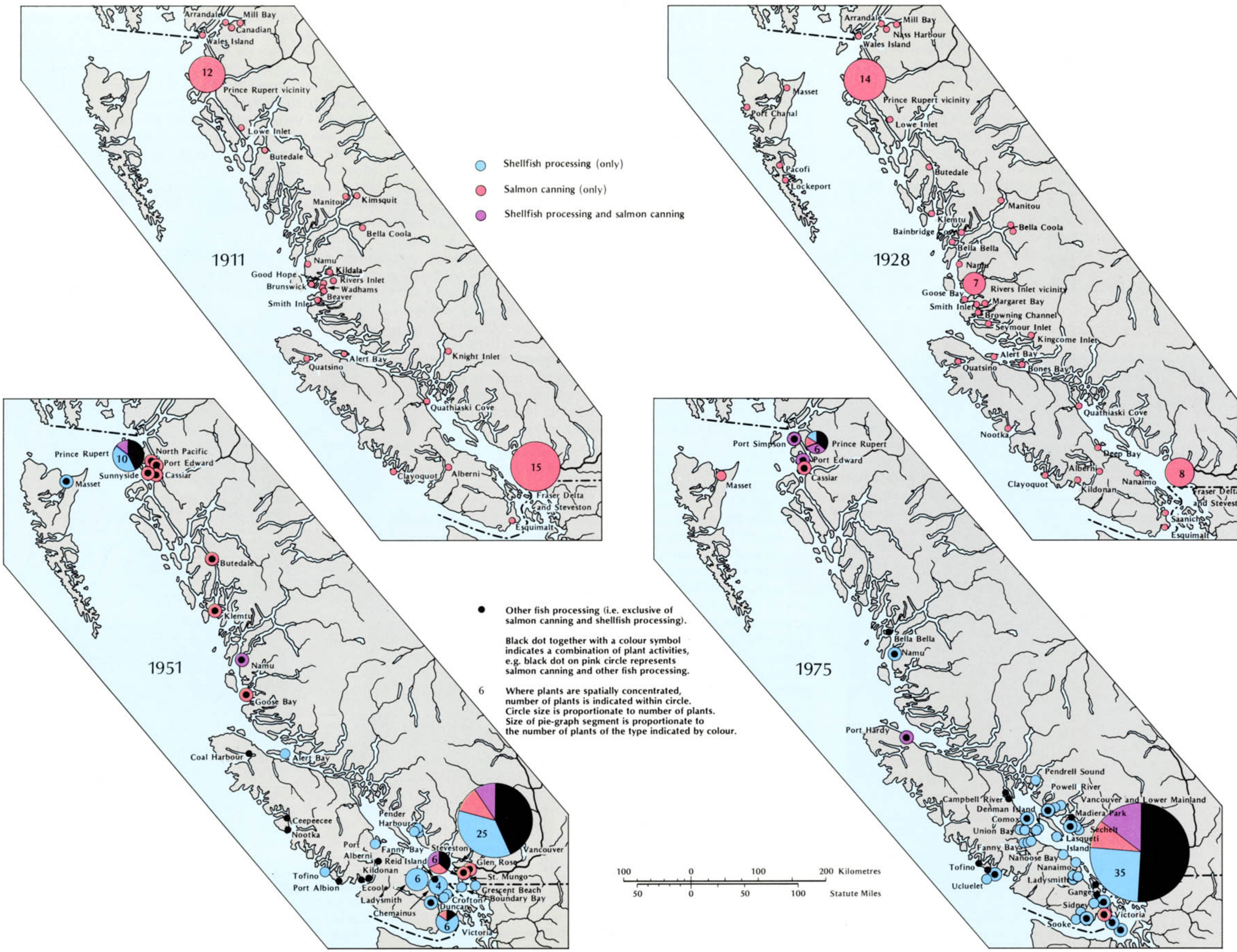
Fishing

HISTORICAL DISTRIBUTION OF OPERATING FISH PROCESSING PLANTS AND SALMON CANNERIES 1911–1975



Map 43. Fishing Average, 1971–1975

For many reasons, some of which are incompletely understood, the relative abundance of fish varies considerably from place to place and from year to year. Consequently, the data on which the accompanying maps are based have been averaged over the period 1971–1975. In that period, British Columbia's average annual catch of all species amounted to 135,886 tonnes. As its title indicates, however, the first map shows only the total catch of *major species*. It amounts to an average of 131,574 tonnes and excludes tuna, octopus, abalone, dog-fish, and non-food fishes. For this period the pinto abalone was of very minor commercial importance, but since 1975 it has added considerably to the value of shellfish production. On both maps the representation is based upon quantity, not value.

Traditionally, the main sources of income from British Columbia's fisheries have been salmon, halibut, herring, and groundfish other than halibut. The five species of Pacific salmon remain the most important component, accounting for nearly 50 per cent of the quantity and about 75 per cent of the landed value of the total fishery. Largely because of overfishing in international waters, the quantity of halibut taken has declined drastically, averaging less than 6 per cent of the total in 1971–1975. In value it has maintained a significant place, though in recent years income from halibut has been exceeded by that from herring. Most of the halibut are taken in the Gulf of Alaska beyond territorial limits, but the species was once abundant in the area of British Columbia's continental shelf. It is expected that establishment of the 200-mile fishing limit will help restore the fishery and enable Canadian fishermen to reap the benefits of sound management practices.

Although the catch is declining halibut remain important to the commercial fishery.

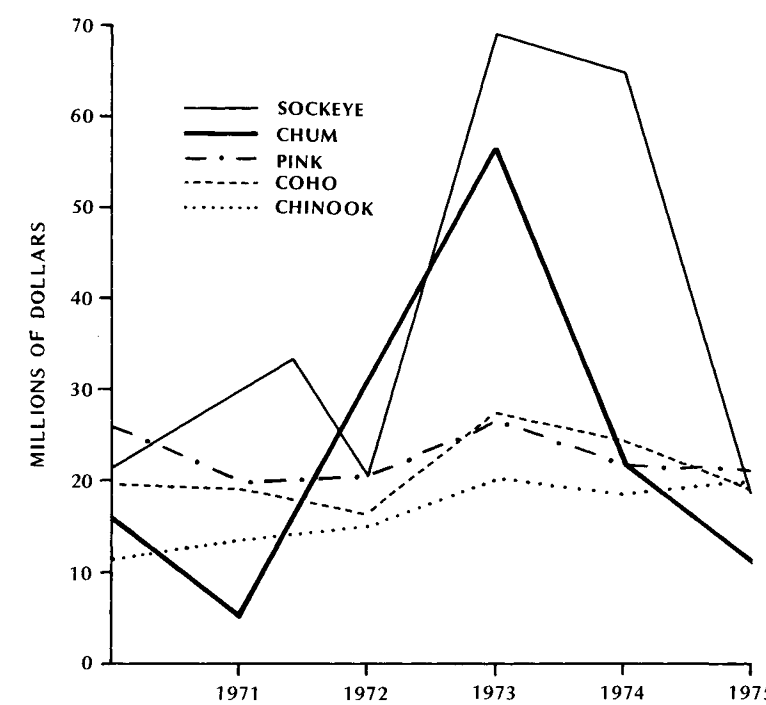
The annual take of herring has fluctuated widely, but it contributed an average of one-third of the tonnage and about 10 per cent of the marketed value in 1971–1975. In recent years its value has increased sharply in response to the Japanese demand for herring roe as a table delicacy. Formerly, most of the catch was processed into oil and fish meal; latterly the market has been for roe and, to some extent, for whole herring. About 12 per cent of the landed tonnage, all species, was contributed by various kinds of bottom-dwelling fish, collectively referred to as groundfish. Halibut is one of the groundfishes, but its commercial importance is such that it is given separate consideration. Groundfish are taken mainly by trawling, and much of the catch comes from international waters. As with halibut, and to some extent salmon, the new fishing limit will likely foster a more productive fishery in British Columbian waters.

The first map indicates, by intensity of background colour, the relative importance of the various Fisheries Statistical Areas. Individually, none of these areas recorded an average of 10 per cent or more of the total quantity, but Area 23, Barkley Sound, leads with over 9 per cent. It was followed by areas 2 East, 4, 7, and 12, each accounting for about 7 per cent. In general, the Strait of Georgia and immediately adjacent waters are of modest importance; the areas there individually contribute less than 4 per cent. As the pie-graphs indicate, however, an appreciable share of the harvest of molluscs and crustaceans, particularly oysters and shrimp, comes from that region. In most of the areas, salmon are the most dominant species, but herring are prominent in many, especially along the central west coast of Vancouver Island and in the Queen Charlottes. The catch landed at Alaskan ports but attributed to British Columbian fishermen (represented by the most northerly pie-graph symbol), is almost exclusively halibut. It amounts to about 3 per cent of the provincial total. The harvest in United States waters to the south allocated to British Columbia (Area C) is almost exclusively salmon. It contributes about .5 per cent to the average total quantity landed. For convenience of representation, very small proportions of individual area landings have been omitted from some of the pie-graphs, but they have been included in the total.

The map portraying areal distribution of average salmon catch has some general similarities to that for total catch, but there are also distinct differences. Statistical Area 12 (N.E. Vancouver Island) leads the province, with over 11 per cent of the average landings. Area 20 (Strait of Juan de Fuca) follows, with 10 per cent, and Areas 4, 7, and 23 each have about 7 per cent. Interestingly, Area 29 (Fraser River) accounts for less than 4 per cent of average total fish landings but over 7 per cent of the salmon. The anadromous nature of Pacific salmon and the importance of the Fraser River as a spawning system are clearly reflected in the catch for Areas 12 and 20 as well as for Area 29.

Among the five species of Pacific salmon, pink, chum, and sockeye each make up about 25 per cent of the 1971–1975 average quantity landed. Coho contributed 15 per cent and chinook 10 per cent. Steelhead are also taken as part of the salmon catch, but while they are important in the sports fishery, they account for less than .1 per cent of the salmon total (see Map 26). Most of the fish are canned. Sockeye is the prime species processed because of its colour and flavour characteristics. Chinook salmon, the largest species, is marketed fresh or frozen, much of the catch being sold to the restaurant trade in the Victoria-Vancouver area. A large number of the coho are also sold fresh. As the graph shows, considerable variation occurs from year to year in wholesale value of the different salmon species. However, it is the quantity of catch rather than the market demand that fluctuates.

WHOLESALE VALUE OF SALMON BY SPECIES
1971 - 1975



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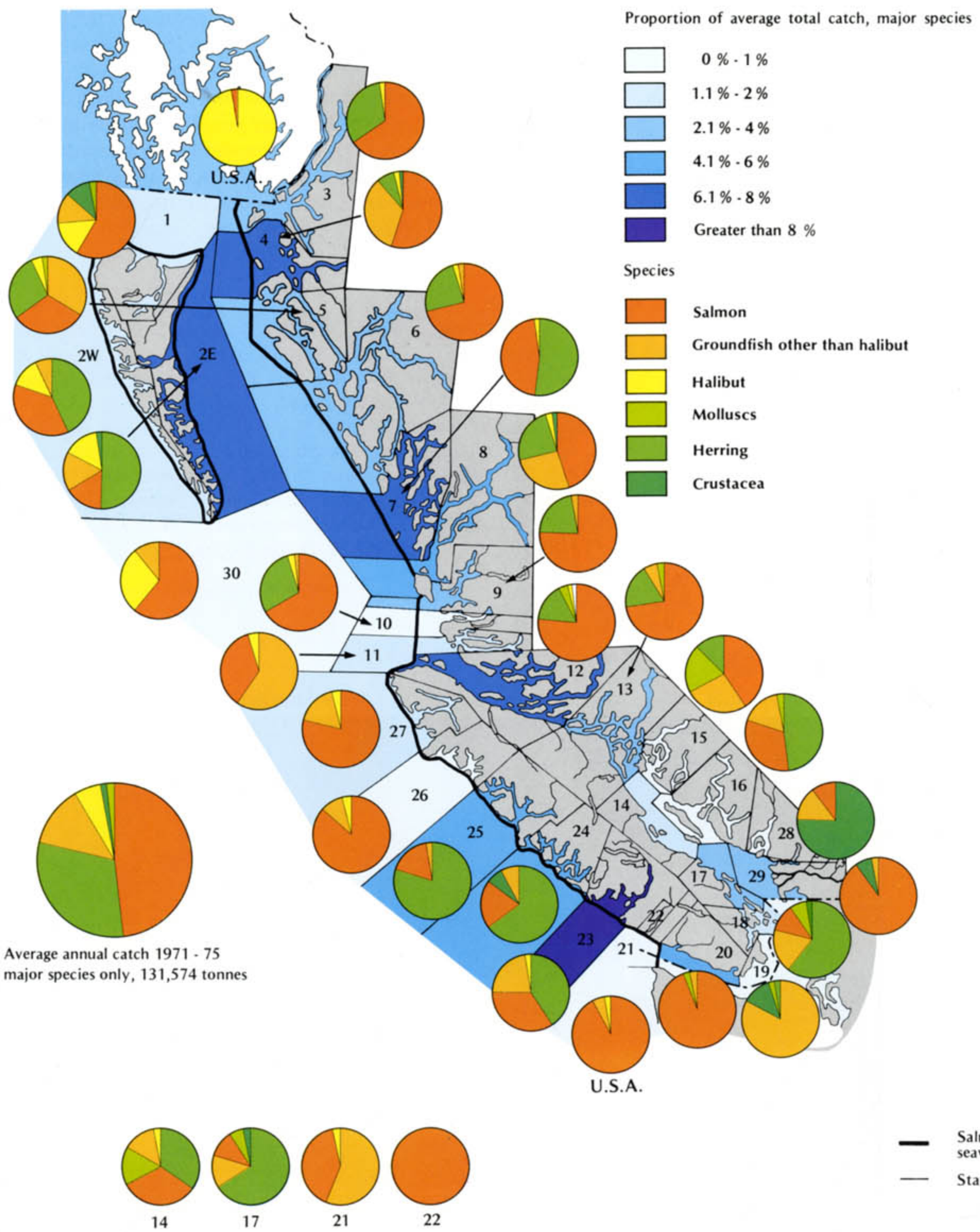
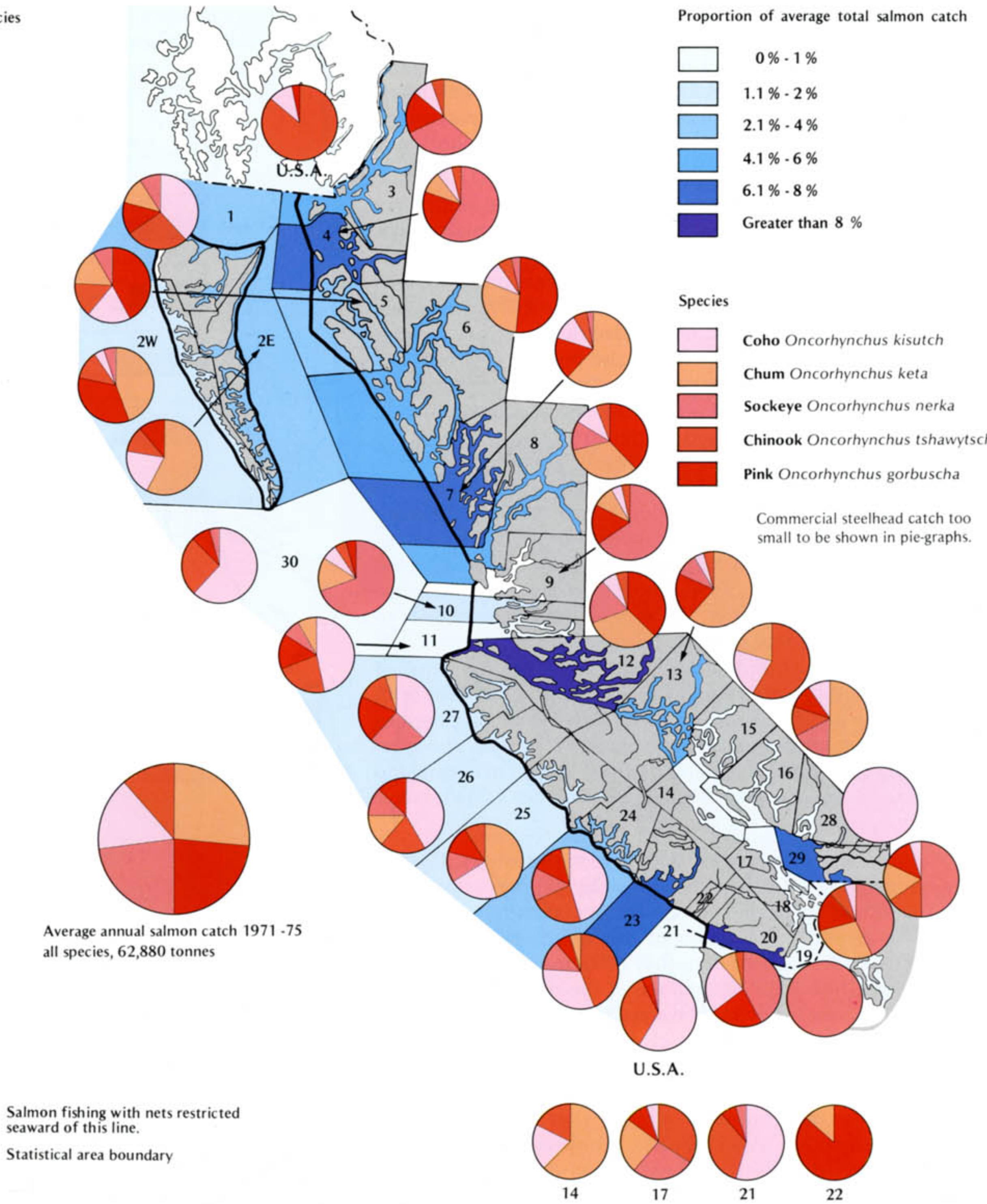
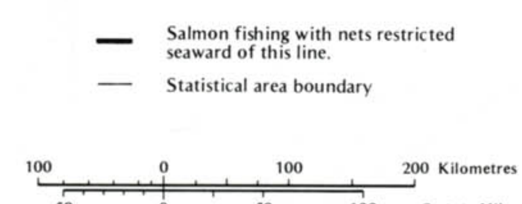
Fishing Average 1971-1975

TOTAL CATCH BY MAJOR SPECIES AND PERCENTAGE OF MAJOR SPECIES CAUGHT BY AREA



SALMON CATCH BY FISHING AREA AND PERCENTAGE OF SALMON SPECIES CAUGHT BY AREA





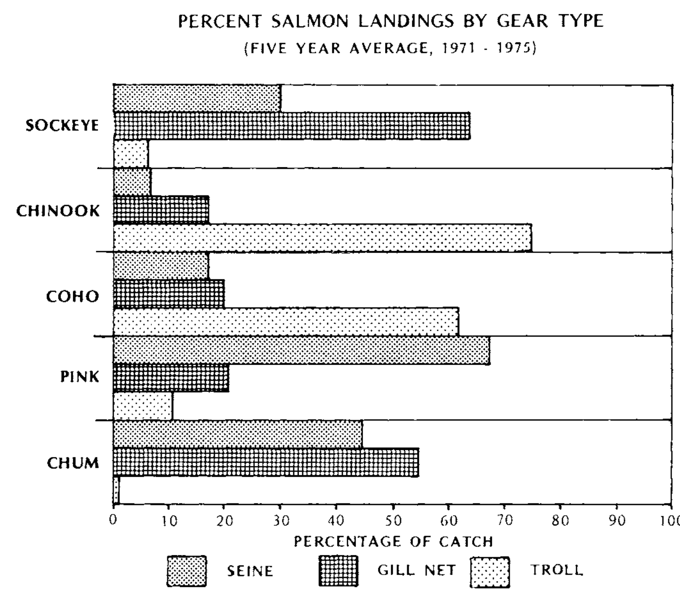
Map 44. Salmon Net and Troll Fishing and Major Salmon Spawning Streams

Since salmon constitute such a large share of the value of British Columbia's fisheries, their successful management is critically important to the future of the industry. Management is complicated, however, partly because Pacific salmon spend much of their lives in the sea and return to freshwater to spawn. Unlike the true salmons, the adults die after spawning. The juveniles of separate species spend differing lengths of time in freshwater before migrating to the sea, and there are variations in this regard between separate populations of a given species. Depending upon the length of time they spend in freshwater, some stocks are especially vulnerable to changes in water quantity and quality. Consequently, natural events such as landslides and forest fires, as well as diverse human activities, may have impact on the spawning success and the survival rate of a particular stock in a particular year.

As the map on the opposite page illustrates, most of the river basins in British Columbia that drain to the Pacific contain major salmon-spawning streams. The notable exception is the Columbia system. Although important spawning areas are associated with its lower reaches, that stream has been so heavily modified by the construction of major hydro-electric dams that no migratory salmon survive to spawn in the portion above Grand Coulee Dam. Another exception is the Tweedsmuir lake-chain forming the Nechako Reservoir. At the site of Kenney Dam a waterfall had formed a natural barrier to migrating salmon, so that in this case construction of the artificial barrage seems to have had little effect. Escapements to major salmon-spawning streams probably account for about 90 per cent of all British Columbia spawners. Relative spawning importance of sub-basins within the different drainage systems is suggested by the sizes of the circle symbols. Each symbol is coloured in accordance with the species represented. The symbols are proportionate to the estimated number of spawners of a *given species*. Thus, though the actual number of pink salmon spawners far exceeds that of coho and spring, the rank-order of symbol size is constant from one species to another — the most important spawning streams for each species are designated by the largest symbols. The symbols make evident the great variation from stream to stream and emphasize the importance of some of the province's smaller river systems.

Net fishing and trolling are both used in the fishery. Historically, most of the catch has been taken by gill nets or by seine nets. The former are employed near the river mouths where they are strung across the direction of fish travel. When the fish attempt to pass through the nets, they become enmeshed by their gill coverings, hence the designation of the net type. Partly because they operate in sheltered waters, gill-netters are comparatively small, one or two-man vessels employing a power drum to stream and retrieve the lengths of net. Purse-seiners also operate close to stream mouths and estuaries, but they may also travel farther afield to intercept the fish runs. They are much larger, more expensive craft, requiring a five-man crew and employing elaborate gear for fish-detection and net-handling. When a school of fish is located, the vessel is steered in a circular path and the net is paid out. Once the school is encircled, the base of the net is drawn tight or pursed; thus the fish are completely contained. In order that only mature fish be taken, the mesh-size of all nets is closely regulated.

In general, trollers operate to seaward of the net-fishing areas. The vessels are comparatively small but sturdy, and generally they carry a two-man crew. The fishing method involves the use of many lines to which are attached lures, usually artificial. On the fishing grounds the lines are streamed at different depths and the speed of the vessel is adjusted to impart correct action to the lures. Depending upon weather and fishing conditions, trollers commonly return to sheltered water at the end of each day.



As the accompanying graph indicates, most of the sockeye and chum salmon are taken by gill-netters, pinks by seiners, and chinook and coho by trollers. In recent years there has been a sharp increase in the share of pink and sockeye salmon taken by trollers.

Some argue that the fishing industry could be much more efficiently conducted by abandoning much of the present heavy emphasis on refined technology and expensive boats and gear. Since all mature salmon must return to freshwater to spawn, all that would be necessary to catch the allowable limit would be a series of salmon traps (nets) at the mouths of the more productive streams. Operation would be carefully controlled to ensure adequate escapement. While greater economic efficiencies could be realized, it is doubtful that the idea would have popular appeal among fishermen for whom fishing is not only a form of employment but also a way of life. Besides, to the successful fisherman, the financial reward is considerable.

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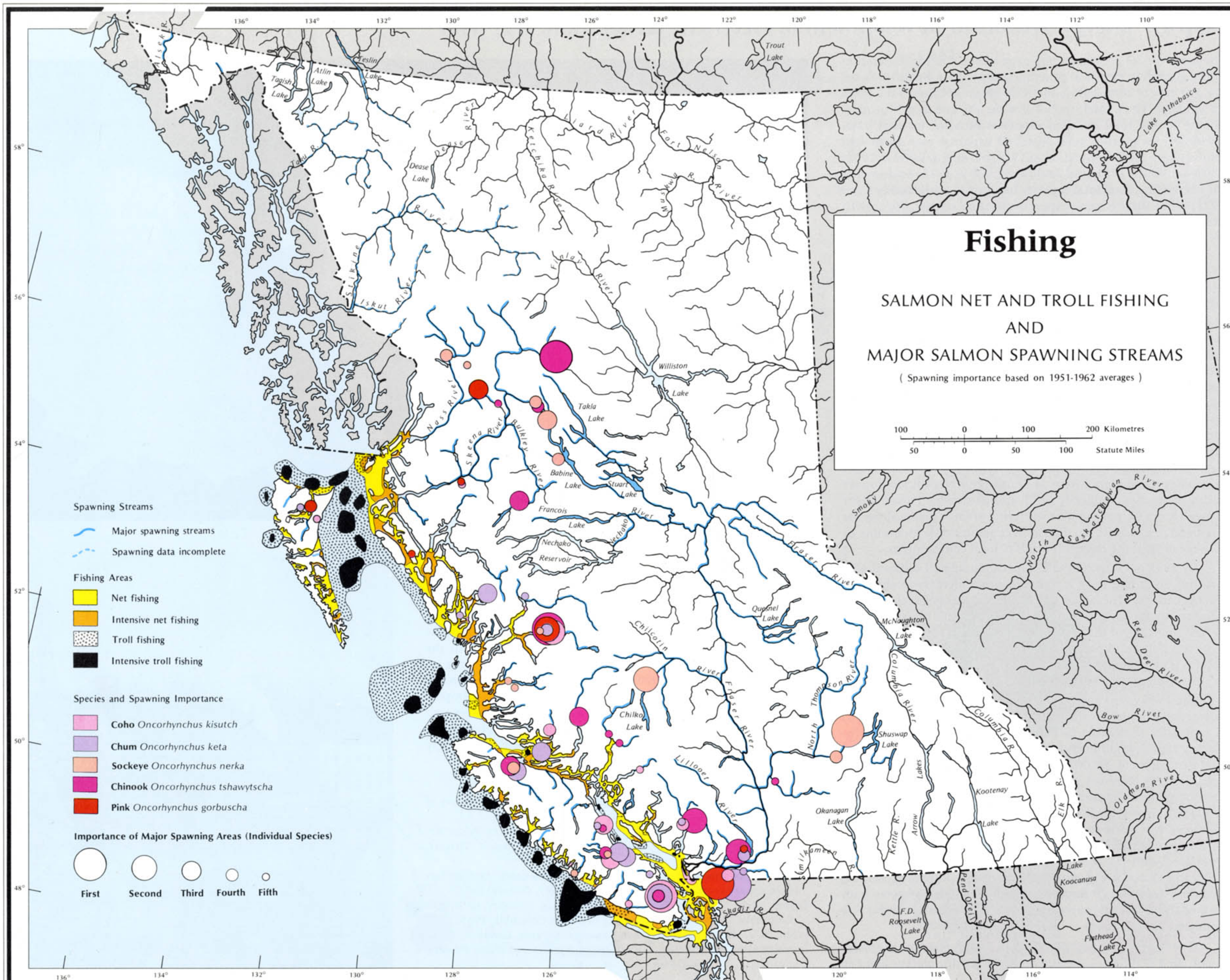
Seiner, with its tender alongside, completing a set.



Fishing
SALMON NET AND TROLL FISHING
AND
MAJOR SALMON SPAWNING STREAMS
(Spawning importance based on 1951-1962 averages)
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Spawning Streams
Major spawning streams
Spawning data incomplete
Fishing Areas
Net fishing
Intensive net fishing
Troll fishing
Intensive troll fishing
Species and Spawning Importance
Coho Oncorhynchus kisutch
Chum Oncorhynchus keta
Sockeye Oncorhynchus nerka
Chinook Oncorhynchus tshawytscha
Pink Oncorhynchus gorbuscha
Importance of Major Spawning Areas (Individual Species)
First
Second
Third
Fourth
Fifth
Williston Lake
Takla Lake
Babine Lake
Stuart Lake
Francois Lake
Nechako Reservoir
Quesnel Lake
Chilko Lake
Shuswap Lake
Okanagan Lake
Dease Lake
Atlin Lake
Tagish Lake
Teslin Lake
Trout Lake
McNaughton Lake
Kootenay Lake
Lake Koocanusa
Flathead Lake
Arrow Lakes
F.D. Roosevelt Lake
Nass River
Skeena River
Bulkley River
Stikine
Iskut River
Dease River
Liard River
Fort Nelson River
Finlay River
Fraser River
Chilcotin River
North Thompson River
Columbia River
Lillooet River
Peace River
Hay River
Smoky
North Saskatchewan River
Red Deer River
Bow River
Oldman River
Kettle R.
Elk R.
Skagit R.
Lake Athabasca

Map 45. Energy: Historical Development of Electricity Generation, 1911–1971

The maps on the accompanying page offer a striking illustration of the growth in electrical generating capacity in British Columbia. For ease of comparison, the scale of symbol sizes is the same for all maps. Thus, total symbol area on any one map is proportionate to the total installed electrical capacity for that date. Expressed as a ratio, total installed capacity rose from 240 kilowatts per 1,000 population in 1911, to 740 kw/1,000 in 1931, 950 kw/1,000 in 1951, and 2,600 kw/1,000 in 1971. As shown in the succeeding map, total capacity has grown considerably since 1971. While there is some export of electrical energy, the growth has mainly been in response to the provincial electricity demand for industrial, residential, and commercial use.

In each of the time periods the spatial pattern of generating sites is strongly oriented toward the southwestern and southeastern parts of the province. That orientation persists through 1971, despite the addition of large blocks of generating capacity in the west-central and northeastern portions. The areal concentration largely reflects the relative positions of the main residential and industrial load centres and the availability of nearby power sites. All of the larger plants in 1911 were hydro-electric and independently owned. The largest were the Buntzen (B.C. Electric Railway Company) and Stave Falls (Western Canada Power Company) plants near Vancouver and the Upper Bonnington (West Kootenay Power and Light Company) plant near Trail. These were essentially public utility companies, though a large part of the power market was industrial. Two of the larger privately owned plants were at Puntledge River on Vancouver Island (Canadian Collieries Ltd.) and at nearby Powell River (Powell River Company). The scattering of small plants along the coast and in the southern interior was associated with mining or forestry or with the electrical needs of local communities.

By 1931 not only had total capacity increased substantially, but also there had been a commensurate increase in thermal-electric capacity. The largest of the thermal plants was the 14,000 kilowatt steam facility at Ocean Falls (Pacific Mills Ltd.), its output and that of the nearby hydro-electric plant being used in at-site pulp- and paper-milling. As noted, the overall spatial pattern is very similar to that of 1911, but the southwestern and southeastern nodes have burgeoned.

The 1951 map suggests the impact of the rapidly increasing power demand and the decreasing number of sites available. This is especially noticeable in the southwest where new hydro-electric capacity had been installed on Vancouver Island (John Hart development, 80,000 kw) and in the Bridge River area. The John Hart facility was the first major publicly owned power development in the province, and it was undertaken to meet the escalating power needs of Vancouver Island — by 1971 part of that need was being supplied by undersea cable from the mainland. Expanded thermal capacity on the coast was almost entirely associated with the forest industry, the most notable addition being the 15,000 kw steam plant near Prince Rupert (Columbia Cellulose Ltd.). Since imported heavy distillates of petroleum formed the main fuel source for these plants, coastal location was important for transport.

Three impressive additions to generating capacity are apparent on the 1971 map — the 800 megawatt hydro-electric plant at Kemano (Aluminum Company of Canada Ltd.), the 1,360 MW Peace River hydro development, and the 750 MW Burrard thermal plant near Vancouver (1 megawatt = 1,000 kw). In the strategy of introducing new plant capacity and developing an energy system to meet increasing power needs, fossil fuels, in this case petroleum derivatives, were obviously of growing importance. Other hydro-electric sites were available for development, but under the law of diminishing returns, they would be expensive — alternative forms of energy were becoming increasingly attractive.

This tailrace at Mica dam indicates the hydraulic force that generates hydroelectric power.

The pulp mill at Powell River used this plant to generate its own power.

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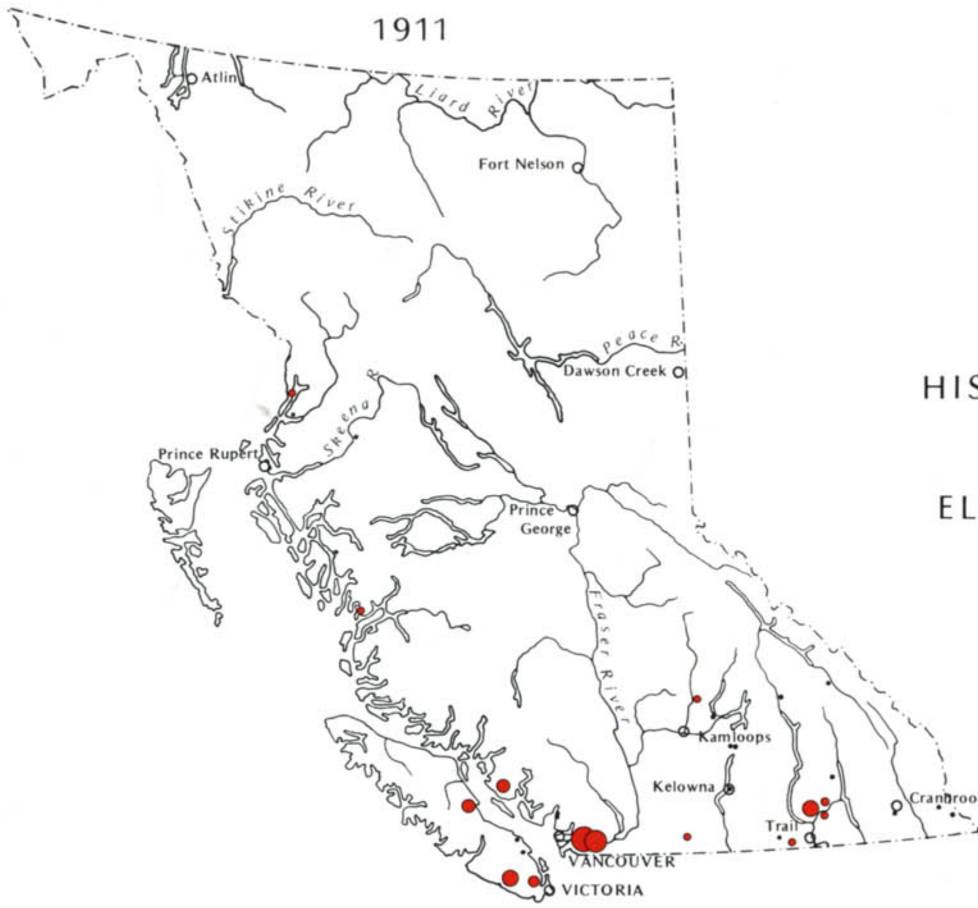
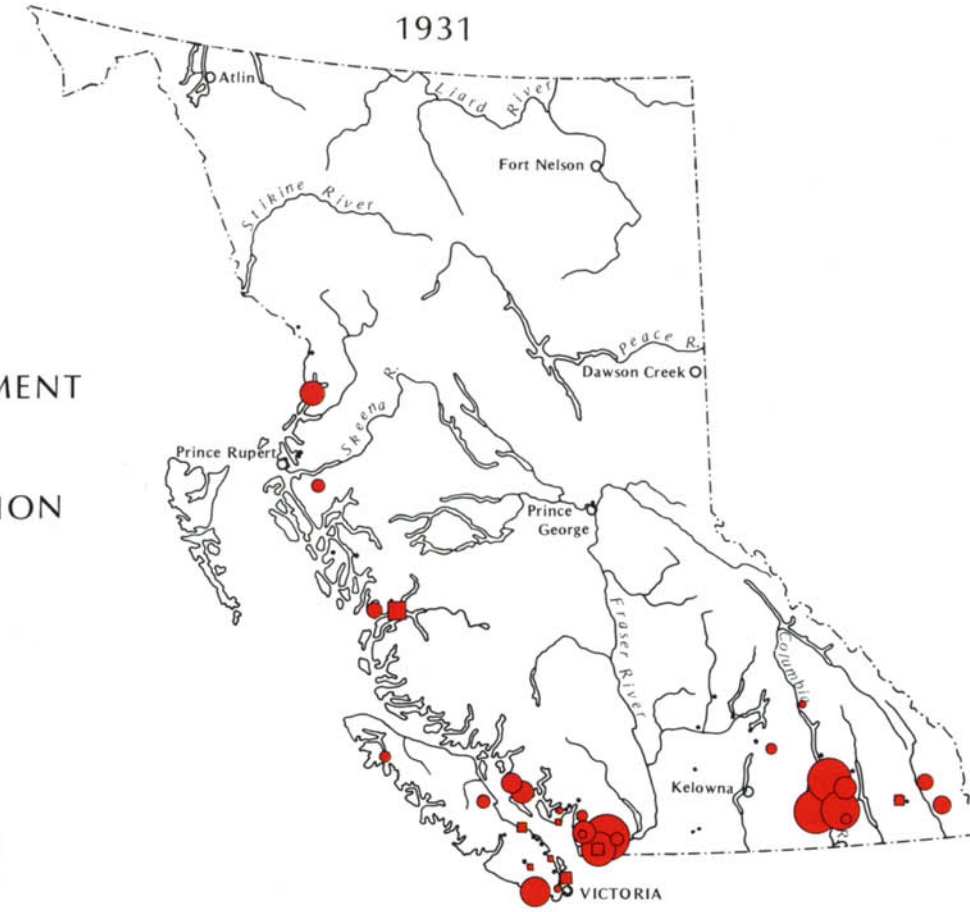
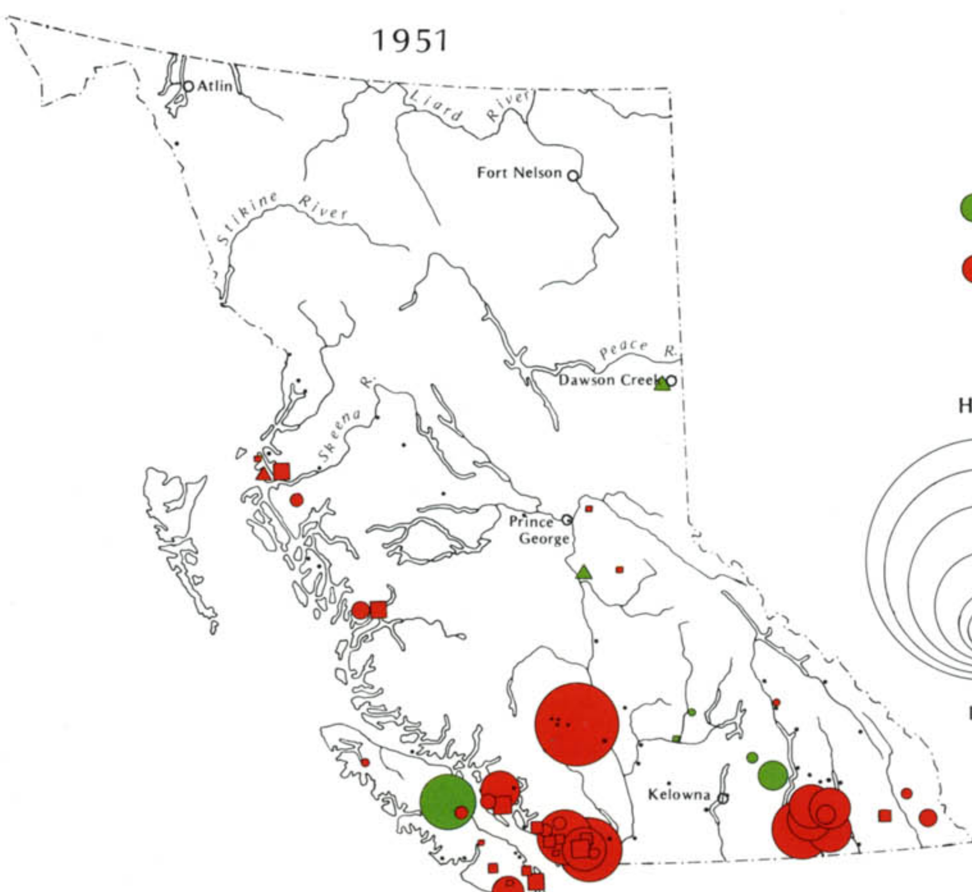
Energy

HISTORICAL DEVELOPMENT
OF
ELECTRICITY GENERATION
1911 - 1971





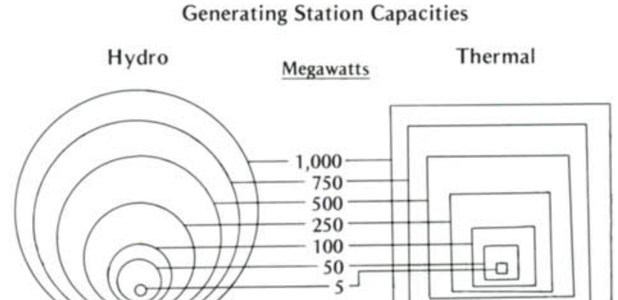


Generating Station Ownership

B. C. Hydro and Power Authority

Other ownership

Generating Station Capacities

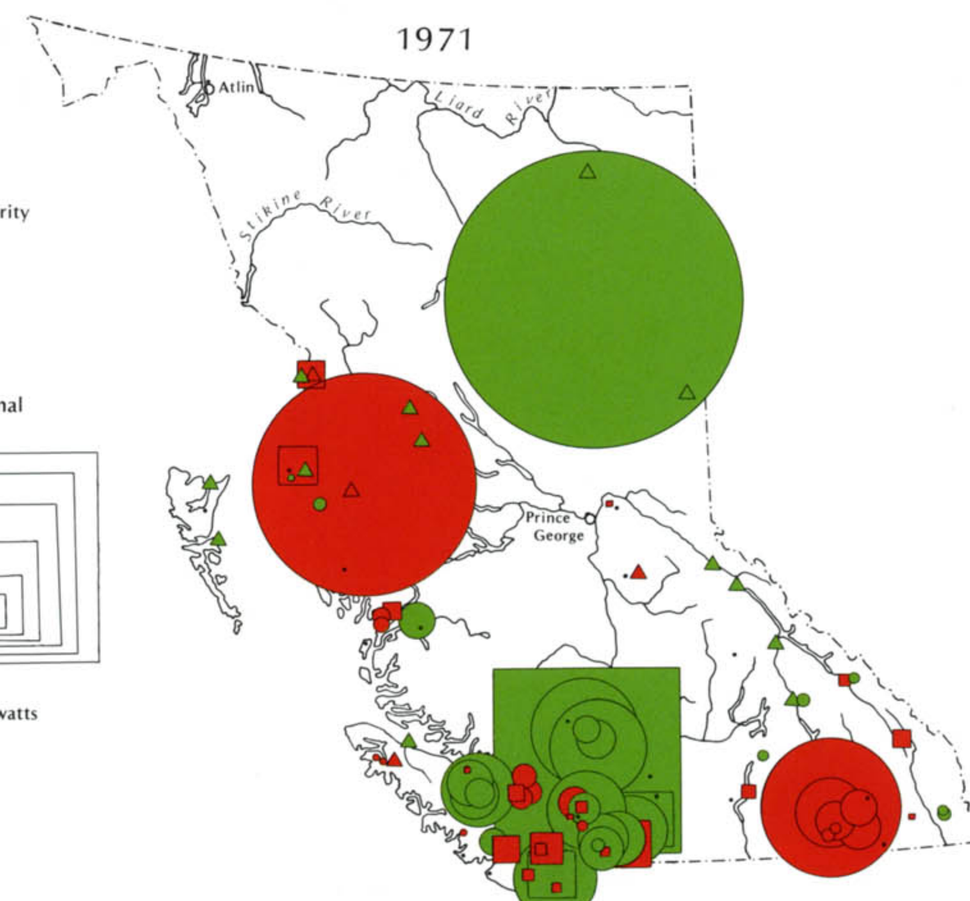


Diesel △ Capacities greater than 1.5 Megawatts

All stations with capacity less than 1.5 Megawatts

100 0 100 200 Kilometres

50 0 50 100 Statute Miles



Map 46. Energy: Electricity Generation and Transmission, 1975

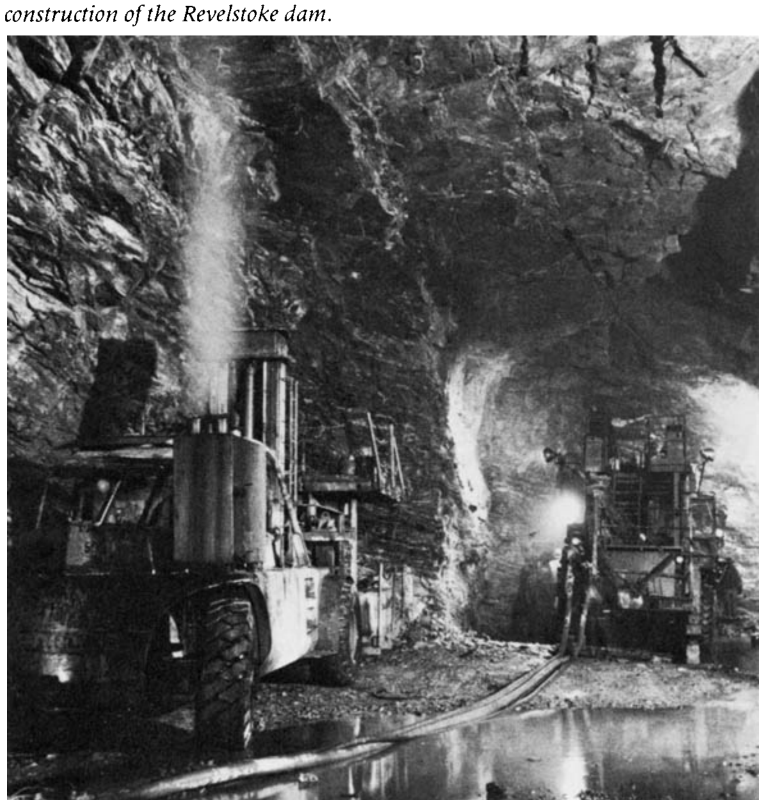
The accompanying map shows the location, ownership, and comparative sizes of electric power generating stations and main transmission lines in British Columbia as of 1975. Because of limitations of scale, only the general form of the transmission network is shown.

The Peace River development, which began delivering power in 1968, dominates the spatial pattern of electrical capacity in British Columbia. This project involved impoundment of the Peace River at a point near Hudson's Hope on the eastern flank of the Rocky Mountains to create a 1,750 km² reservoir (Williston Lake) extending into the Rocky Mountain Trench (Map 14). The reservoir is the largest freshwater body in the province, since it is more than twice the size of the Nechako Reservoir and three times the area of Atlin Lake, the largest natural lake in British Columbia (see Historical and Statistical Summary).

With a capacity of 2,116 megawatts in 1975, the Peace River installation was one of the two largest hydro power producers in Canada, exceeded only by the Churchill Falls project in Labrador. Electrical output in 1975 was more than enough to meet the total provincial residential requirement, but the centre of the residential and industrial demand lies some 950 kilometres away in the Lower Mainland. Linkage with Vancouver and with an intertie to the State of Washington was achieved via two 500-kilovolt transmission lines.

As the following table indicates, the second largest block of generating capacity exists in the Vancouver area. Power is provided by a mixture of hydro-electric and conventional thermal-electric plants, and the largest single component in 1975 was the 912.5 MW Burrard steam plant at Port Moody, on an extension of Burrard Inlet. Both this plant and the smaller installation at nearby Port Mann on the Fraser River utilize petroleum distillates or natural gas as the energy source. They are located close to markets and available energy, and their outputs can be adjusted to accommodate peak electricity demands. The hydro plants are essentially baseload plants, and the map shows clearly that hydro-electric is the major form of electrical energy developed in British Columbia.

Excavation of the diversion tunnel prior to construction of the Revelstoke dam.



MAJOR HYDRO-ELECTRIC AND THERMAL-ELECTRIC PLANTS, 1975

No. on map	Location	Name	Type	Capacity (MW)	Aggregate Capacity (MW)	% of total B.C. capacity
1	Peace River	Gordon Shrum	hydro	2,116.0		30.2
2	Vancouver	Burrard	thermal	912.5		
		Port Mann	thermal	100.0	1,089.2	15.6
		Buntzen	hydro	76.7		
3	Kemano	Kemano	hydro	812.8		11.6
4	West Kootenay	Waneta	hydro	360.0		
		Kootenay Canal	hydro	264.6		
		Brilliant	hydro	108.8		
		Upper Bonnington	hydro	55.1		
		South Slocan	hydro	47.3	927.0	13.2
		Lower Bonnington	hydro	42.0		
		Corra Linn	hydro	40.5		
		City of Nelson	hydro	8.7		
5	Bridge River	Bridge River #2	hydro	248.0		
		Bridge River #1	hydro	180.0		
		Seton	hydro	42.0	492.0	7.1
		La Joie	hydro	22.0		
6	Campbell River	John Hart	hydro	120.0		
		Strathcona	hydro	67.5	241.5	3.5
		Ladore	hydro	54.0		
7	Victoria	Jordan River	hydro	150.0		2.2
8	Squamish	Cheakamus	hydro	140.0		2.0
9	Stave River	Ruskin	hydro	105.6		
		Stave Falls	hydro	52.5	166.1	2.4
		Alouette	hydro	8.0		
10	Prince Rupert	Watson Island	thermal	57.2		
		Prince Rupert	thermal	26.6	94.7	1.4
		Falls River	hydro	9.6		
		Shawatlans	hydro	1.3		
11	Chemainus	Georgia	thermal	75.5		1.1
12	Fraser Valley	Wahleach	hydro	60.0		0.9
13	Arrow Lakes	Whatshan	hydro	50.0		0.7
14	Port Hardy	Keogh	thermal	40.5		0.6

Total, major plants only, 6,455.3 MW. Total installed capacity all plants 7,004.8 MW, of which 5,512.8 (79 per cent) was in hydro plants, 1,492.0 (21 per cent) in thermal plants, and 59.6 in diesel units. Of the total capacity, 27 per cent was in industrial ownership.

The Aluminum Company of Canada plant at Kemano came into operation in 1954. Until development of the Peace River project, it was the biggest hydro-electric installation, and perhaps the most innovative, in the province. By means of a dam on the Nechako River, water was impounded in the lake chain extending through Tweedsmuir Park, then diverted through the Coast Mountains via a 16-km tunnel and dropped to tidewater at the Kemano generating site. The purpose of the development is to produce a large quantity of low-cost electrical energy for the aluminum smelter at nearby Kitimat. Physical site constraints at Kemano necessitated location of the metallurgical plant elsewhere. Kitimat was chosen both because its topography was suitable and because a facility could be developed comparatively easily for handling deepwater vessels for raw material supplies and product exports.

The other major hydro-power development associated with smelting and mineral processing in British Columbia is that of the COMINCO complex near Trail. For many years the combined plants on the Kootenay and Pend d'Oreille rivers represented the largest block of generating capacity in the province. While the Lower Bonnington plant is a public utility for south-central British Columbia (West Kootenay Power and Light), the bulk of the power from COMINCO plants is fed to the silver-lead-zinc smelter and refinery at Trail. The remainder is transmitted to COMINCO operations at Kimberley (see Map 36). Hydrologically, the 35 km of Kootenay River between the West Arm of Kootenay Lake and its confluence with the Columbia is well suited to the production of electricity. The combination of substantial hydraulic head and streamflow, a large natural reservoir, and proximity to industrial raw materials represents a decided site advantage. In 1975 the B.C. Hydro Kootenay Canal plant, also utilizing Kootenay River waters, was brought into service with an initial capacity of 264.6 MW.

As the map illustrates, other major nodes of generating capacity have been established on the Bridge River (near Lillooet), on the Campbell River system (Vancouver Island), in the vicinity of Victoria, and in the Lower Mainland outside of Vancouver. In general, as energy requirements in the main population and industrial concentrations have grown, those advantageous hydro-power sites nearest the load centres have been developed. Harnessing of more distant sites awaited accelerating power demands, advancements in transmission technology, and evolution of an integrated transmission grid.

The majority of the thermal-electric plants in British Columbia are privately owned and used for industrial purposes. Industries processing forest products are the major users. Most of these are steam plants designed to handle a mixture of fuels, mainly heavy distillates of petroleum and hog fuel, which consists of bark and other waste produced in the conversion of logs to sawn lumber and pulp. Utilization of hog fuel as an energy source is one aspect of the integration that has come to characterize the British Columbia forest industry within the past twenty years.

The diesel-electric and gas turbine stations are dispersed. Many are portable units and are designed to supply domestic or industrial needs in areas not easily linked with existing transmission lines. Because fuel costs are comparatively high, diesel-electric power is expensive, and whenever practicable it is replaced by alternative forms.

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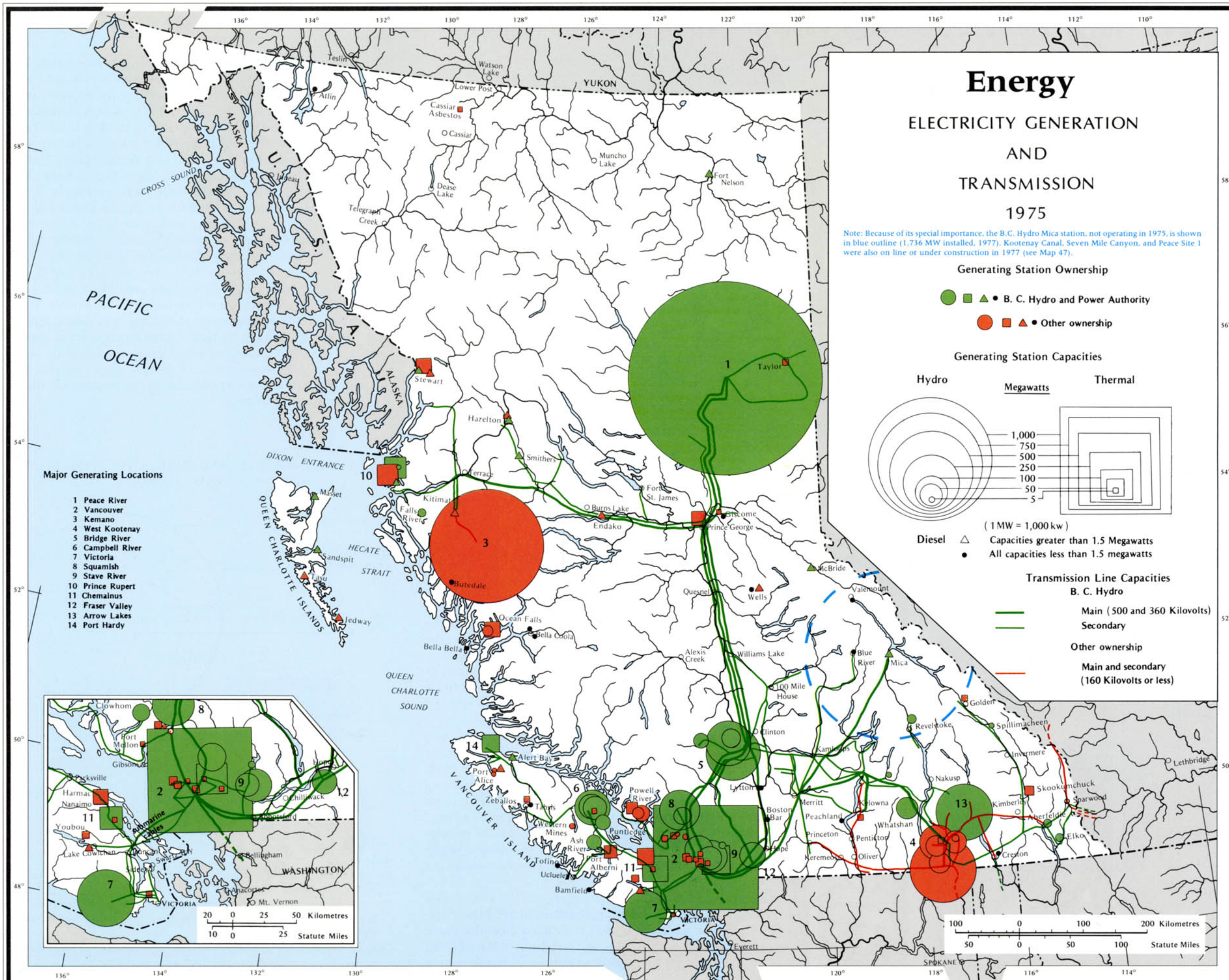

Energy
ELECTRICITY GENERATION
AND
TRANSMISSION
1975
Note: Because of its special importance, the B.C. Hydro Mica station, not operating in 1975, is shown in blue outline (1,736 MW installed, 1977). Kootenay Canal, Seven Mile Canyon, and Peace Site 1 were also on line or under construction in 1977 (see Map 47).
Generating Station Ownership
B. C. Hydro and Power Authority
Other ownership
Generating Station Capacities
Hydro
Megawatts
Thermal
1,000
750
500
250
100
50
5
(1 MW = 1,000 kw)
Diesel
Capacities greater than 1.5 Megawatts
All capacities less than 1.5 megawatts
Transmission Line Capacities
B. C. Hydro
Main (500 and 360 Kilovolts)
Secondary
Other ownership
Main and secondary
(160 Kilovolts or less)
Major Generating Locations
1 Peace River
2 Vancouver
3 Kemano
4 West Kootenay
5 Bridge River
6 Campbell River
7 Victoria
8 Squamish
9 Stave River
10 Prince Rupert
11 Chemainus
12 Fraser Valley
13 Arrow Lakes
14 Port Hardy
PACIFIC
OCEAN
YUKON
WASHINGTON
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 47. Energy: Potential Generation Capacities, Fossil Fuels, and Pipelines

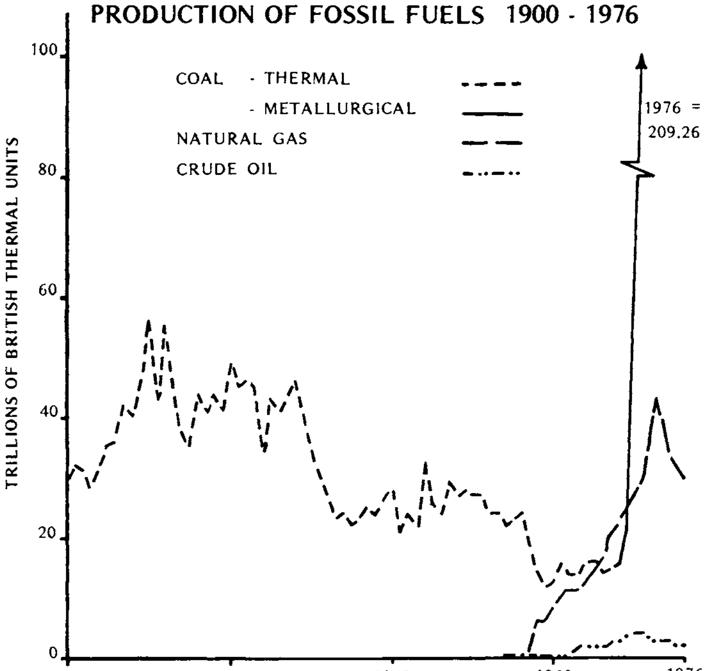
British Columbia possesses considerable potential energy wealth in the form of known but undeveloped hydro-electric sites and fossil-fuel resources. The assessment of potential is based upon individual resource characteristics, but it is also conditioned by social, economic, and technological conditions prevailing at the time of appraisal. Consequently, different values may be allocated to the same site depending upon when the assessments were made and what development possibilities were considered. Also, within a given period some resources have a greater likelihood than others of being developed. Assuming that it is environmentally acceptable, the thermal-electric site at Hat Creek, for example, has a higher probability of being brought into production within the next decade than has the Yukon-Taku hydro-electric site. Further, when development in a given area proceeds, not all of the indicated capacity is necessarily realized at the same time.

The map is based upon 1976 estimates of potential electricity generating capacity. Some of this capacity would stem from expansion of existing structures, but much of it would derive from new site development. Since 1976 a large block of potential has been realized at Mica Creek (No. 12 on the map), and work is well advanced on the development of at least two other hydro sites. Fossil fuel deposits are included on the map, but while these form a very significant part of the total energy inventory, they are not necessarily associated with electricity generation.

Because of its topography and its generous endowment of water resources, British Columbia has derived the bulk of its electricity requirement from hydro-electric plants. The following table lists the estimated total potential capacities of the important undeveloped hydro sites as well as the presently developed sites which could be expanded. In a few congested locations on the map, more than one site is represented by a single symbol.

FIGURE 1:

PRODUCTION OF FOSSIL FUELS 1900 - 1976



POTENTIAL ELECTRICITY GENERATING CAPACITY

Map Number (General Location)	River Basin and Site Designation	Estimated Total Potential Capacity (Megawatts)
1	Yukon-Taku Basin (Nakonake and Taku sites)	3,692
2	Liard Basin (Sites A, E, and G)	3,846
3	Stikine Basin (Little Canyon, Sites A, C, D, F, and Iskut Site B)	3,025
4	Skeena Basin (Cutoff Mountain)	1,080
5	Peace River (Site 1*; Sites C and E)	2,350
6	Upper Fraser Basin (Lower McGregor)	650
7	Fraser Basin (Cottonwood Canyon)	800
8	Coastal Basins (Kemano II, including Dean, Nanika, and Morice diversions)	1,200
9	Coastal Basins (Homathko-Tatlayoko, including Chilko and Taseko diversions; Nude Canyon, Waddington Canyon, and Mosley Creek sites)	1,410
10	Fraser Basin (Moran Site and Bridge River Rapids)	4,410
11	Fraser Basin — thermal (Hat Creek)	2,000
12	Columbia Basin (Mica Dam*)	2,610
13	Columbia Basin (Revelstoke*)	1,800
14	Kootenay Basin — thermal (East Kootenay)	1,400
15	Columbia Basin (Seven Mile Canyon* on Pend d'Oreille*; Kootenay Canal*; Murphy Creek)	1,208
16	Lower Fraser Basin (Yale, Spuzzum, Boston Bar, and Cisco sites)	2,420
17	South Coastal Basins (Elaho Site on Squamish River)	500
18	Vancouver Island (Kokish and Duncan Bay sites)	310
	TOTAL POTENTIAL CAPACITY: Hydro-electric	31,311 MW
	Thermal-electric	3,400 MW

*Potential sites that, by 1977, were harnessed or were under active development

Coal fields occur in many locations in the province, but known gas and oil fields are mainly associated with the relatively undisturbed sedimentary basins of the northeast. Historically, coal has been one of the mainstays of the mineral economy (see Map 35). Except for the recent strong market for metallurgical coal, the output has been used in thermal applications. On the basis of conversion to equivalent heat units, Figure 1 shows the historical trend in fossil fuel production and illustrates the comparative recency of petroleum and natural gas development in the province. The dramatic increase in coal output in the 1970's is the result of export sales. Coal output reached a peak of nearly 9 million tonnes in 1975.

Figure 2 compares the British Columbia production and reserves of coal, natural gas, and petroleum. In each case the inner graph circle represents cumulative annual outputs to 1975, the second circle suggests the ultimate recovery (using existing technology), and the outer circle indicates the total known amount of each resource. The graph makes clear that the provincial endowment of coal resources is vast and that it far exceeds the combined energy equivalent of petroleum and natural gas. In terms of cumulative production to 1975, however, natural gas output rivals that of coal.

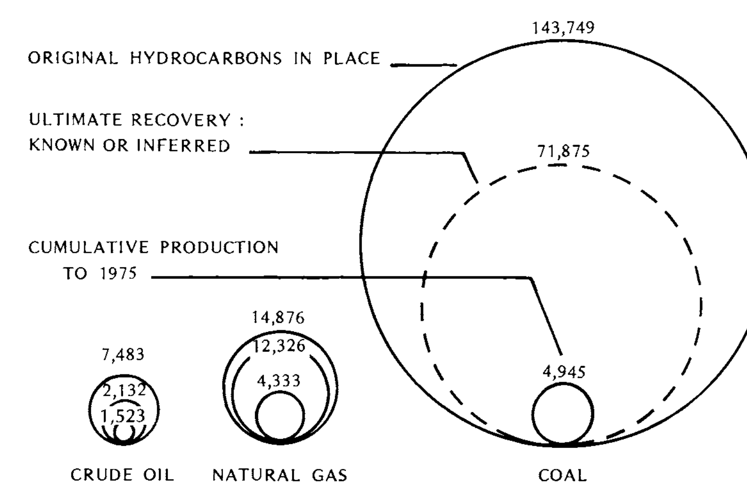
In part this comparability of output reflects the adaptability of natural gas to various thermal applications. In 1957 the Westcoast Transmission gas pipeline was built to connect the Peace River area to markets in the Lower Mainland and in the adjacent United States. The Peace River and Fort Nelson fields now supply natural gas to all major load centres in the province. While the reserves of natural gas in British Columbia appear to be sufficient to meet provincial requirements for many years, recovery may be difficult. Production declined after 1973, though increases in field prices may reverse the trend. Output in 1976 totalled approximately 855 million m^3. The 4,400 km international pipeline (Foothills Pipelines Ltd.) that will bring Alaska gas to United States markets via the Yukon, northeastern British Columbia, and Alberta represents a potential source of future supply.

Known resources of petroleum in British Columbia are modest, but they are sufficient to have been linked by pipeline with southwestern British Columbia. At Kamloops the Westcoast Petroleum line joins the Trans Mountain oil pipeline connecting Alberta fields with markets in the Lower Mainland and in the State of Washington. British Columbia's production in 1976 totalled about 2.3 million m^3, less than half its requirements.

While refined petroleum products and coal figure prominently in British Columbia's total energy mix, electrical energy continues to contribute an important share (see following text). The basic resource endowment of the province suggests that hydro-electric will continue to dominate the pattern of electricity generation for years to come.

FIGURE 2:

FOSSIL FUEL RESERVES AND CUMULATIVE PRODUCTION
(TRILLIONS OF BRITISH THERMAL UNITS)



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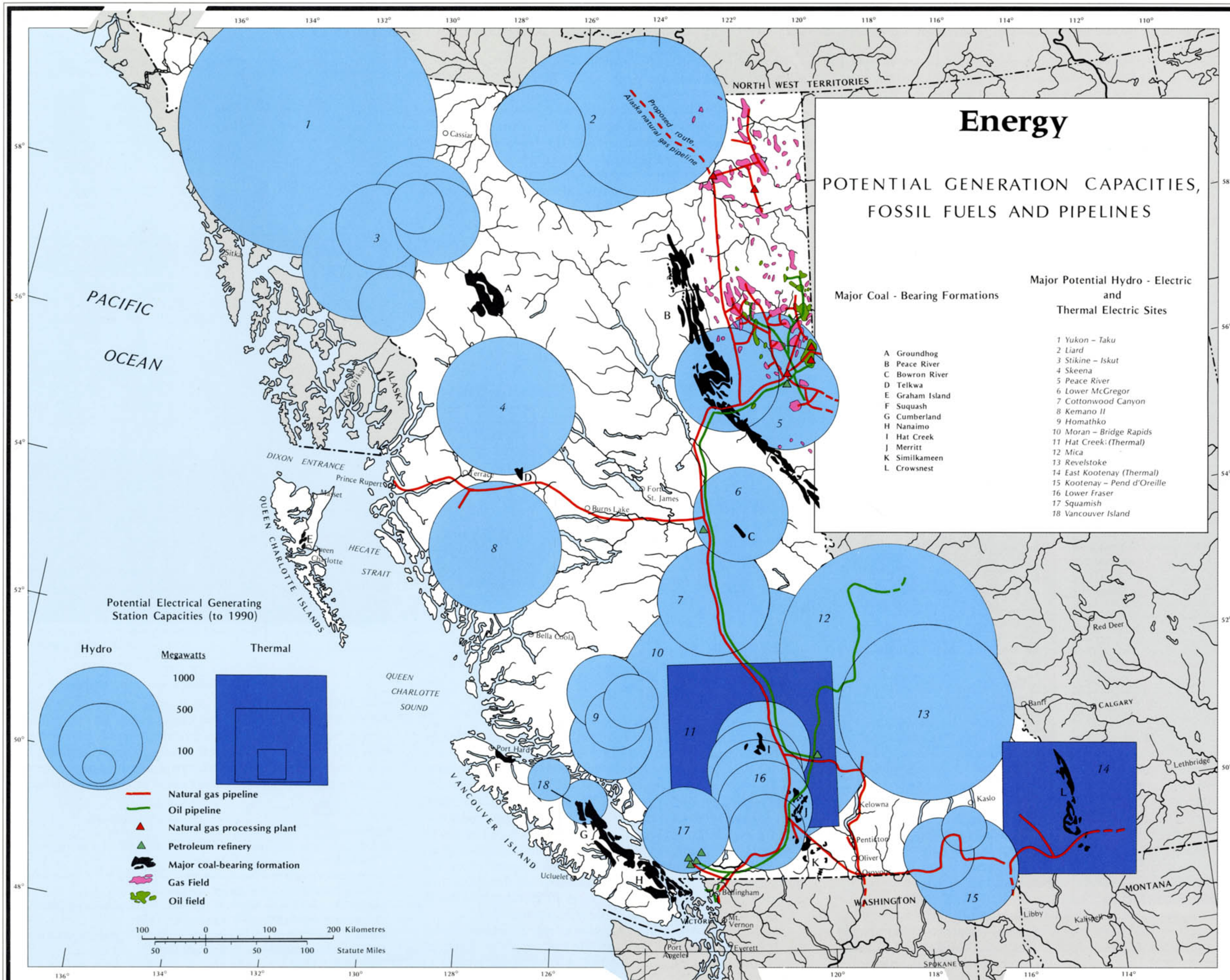

Energy
POTENTIAL GENERATION CAPACITIES, FOSSIL FUELS AND PIPELINES
Major Coal - Bearing Formations
A Groundhog
B Peace River
C Bowron River
D Telkwa
E Graham Island
F Suquash
G Cumberland
H Nanaimo
I Hat Creek
J Merritt
K Similkameen
L Crowsnest
Major Potential Hydro - Electric and Thermal Electric Sites
1 Yukon – Taku
2 Liard
3 Stikine – Iskut
4 Skeena
5 Peace River
6 Lower McGregor
7 Cottonwood Canyon
8 Kemano II
9 Homathko
10 Moran – Bridge Rapids
11 Hat Creek (Thermal)
12 Mica
13 Revelstoke
14 East Kootenay (Thermal)
15 Kootenay – Pend d'Oreille
16 Lower Fraser
17 Squamish
18 Vancouver Island
Potential Electrical Generating Station Capacities (to 1990)
Hydro
Megawatts
Thermal
1000
500
100
Natural gas pipeline
Oil pipeline
Natural gas processing plant
Petroleum refinery
Major coal-bearing formation
Gas Field
Oil field
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC
OCEAN
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
NORTH WEST TERRITORIES
ALASKA
WASHINGTON
MONTANA
Proposed route, Alaska natural gas pipeline
Cassiar
Sitka
Ketchikan
Prince Rupert
Masset
Queen Charlotte
Terrace
Burns Lake
Fort St. James
Bella Coola
Port Hardy
Ucluelet
Victoria
Port Angeles
Bellingham
Mt. Vernon
Everett
Kelowna
Penticton
Oliver
Osoyoos
Kaslo
Banff
CALGARY
Red Deer
Lethbridge
Libby
Kalispell
SPOKANE

Map 48. Energy: Electrical Energy Consumption by Electrical Service Areas, 1961 and 1971

The maps on the accompanying page are based on data compiled by the former British Columbia Energy Board and illustrate the spatial changes in component electrical energy use that took place in the period 1961–1971. Detailed figures of consumption by Electrical Service Areas are not available for later periods. The data by E.S.A. include all sources of electrical energy, public and private.

As the background colours on the maps indicate, Area 15 (Lower Mainland), which contains the economic and industrial heartland of British Columbia, accounted for over 30 per cent of the total use of electrical energy in both 1961 and 1971. Similarly, Area 6, in which the Aluminum Company of Canada smelter is located, has high use and shows no significant variation through the decade. On the other hand, Area 14, embracing not only the energy-intensive COMINCO base-metal complex at Trail, but also the urbanized southern Okanagan Valley, shows a relative decline in the period. It is important to note, however, that total use of electrical energy increased greatly during the decade, so that a constant relative position in fact represents a substantial absolute increase. The following table indicates the aggregate electrical energy consumption in the province for the two years represented by the maps and provides an up-date to 1975.

BRITISH COLUMBIA ELECTRICITY CONSUMPTION, BY END USE (Gigawatt hours*)

End Use	Total Provincial Consumption		Sales by B.C. Hydro Only**	
	1961	1971	1971	1975
Residential	2,083.3	4,855.2	4,287	6,087
Commercial	1,260.8	3,629.1	1,352	1,953
Industrial	7,800.0	12,733.7	9,473	11,661
Other***	1,484.4	5,694.2	589	524
Total	12,628.5	26,912.2	15,701	20,225

*1 Gigawatt hour = 1 million kilowatt hours

**Sales by B.C. Hydro account for about 70 per cent of the total electrical energy sales in the province. Sales by ALCAN, COMINCO, West Kootenay Power and Light, and MacMillan-Bloedel make up most of the remainder.

***"Other" includes allocations to street lighting, irrigation, and other small uses, plus losses attributable to distribution, transmission, and transformation. It also includes company use by B.C. Hydro and other electrical producers.

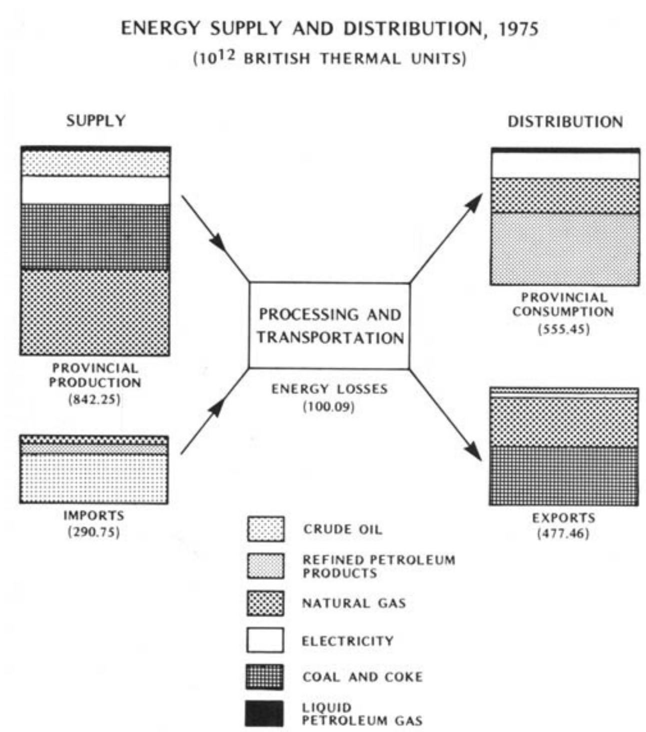
The pie-graphs on the maps show that for most of the Electrical Service Areas the largest end-use component of electrical energy is industrial. In some areas the total regional consumption is small, and even a modest-sized plant could use a major proportion. An example is in E.S.A.1, where the Cassiar Asbestos operation is the major industrial user and in fact generates all of its own energy requirement (see Map 46). In other instances, total regional use is appreciable, and a large industrial component may be the result either of a single industry that involves a heavy input of electrical energy or of aggregates of smaller units. Such is the case in Area 4 (Prince Rupert), where pulp- and paper-milling is a major economic activity, and in Area 8 (Cariboo), where sawmills and planer mills constitute much of the industrial use (see Maps 31 and 33).

Interestingly, the residential and commercial components, at least in the more populous areas, remained rather similar through the decade, which suggests that the demand in these sectors expanded at about the average rate for the province.

Among the areas of lower population, Area 9 (Upper Fraser) shows a marked shift over the decade from an emphasis on industrial to mainly commercial and residential use. Much of this change is attributable to a rapid increase in commercial and residential construction following completion of the Yellowhead Highway linking Prince George with the Upper Fraser region and Alberta in 1970.

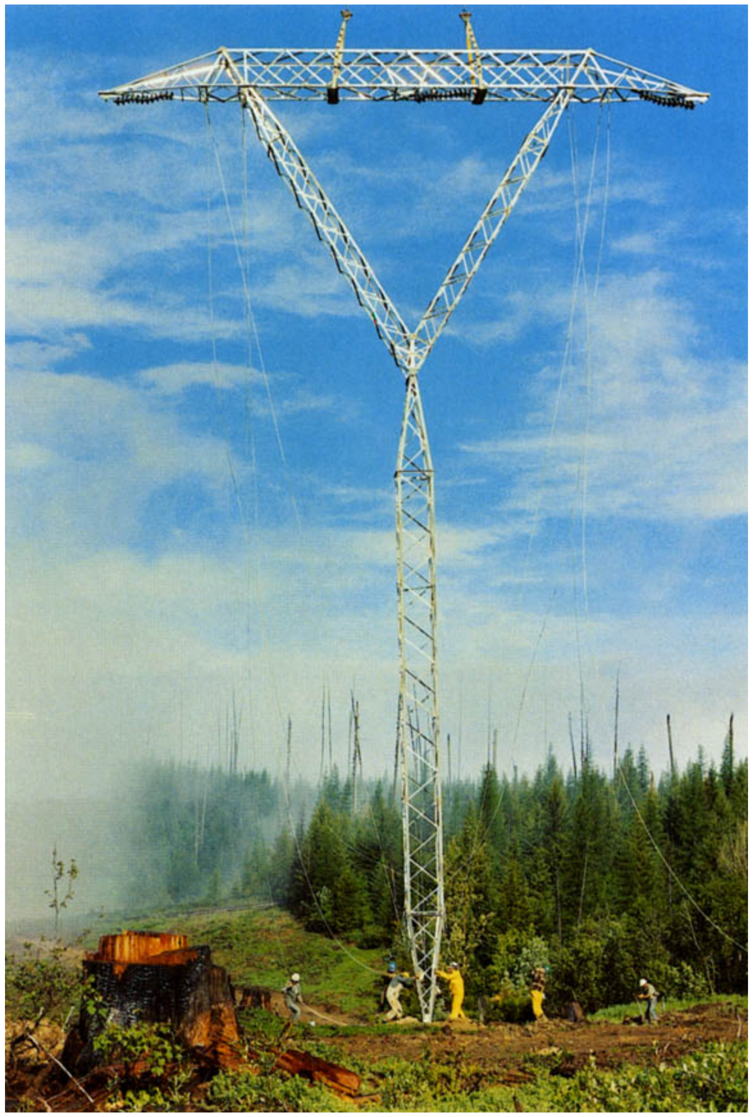
While electricity is an important energy commodity, it is but one of several. The major components of energy production and consumption are represented in the accompanying diagram. For comparison, the various forms of energy are expressed in heat-equivalents. Such representation has the disadvantage of emphasizing those energy forms that are efficiently converted into heat and whose use, therefore, is mainly in thermal applications.

The height of each block in the diagram is proportionate to the amount of that commodity produced in British Columbia,



imported, consumed in British Columbia, or exported. Clearly, provincial output in 1975 was sizeable, but it was supplemented by a considerable volume of imports, notably crude petroleum. Consumption within the province was also substantial, especially of refined petroleum products, but large amounts of natural gas and coal were exported. Although provincial production declined after 1973, appreciable amounts of gas continued to be exported to the Northwest States in fulfilment of contract commitments. As the quantities indicated in the diagram show, the amount of energy available for distribution is less than combined imports and internal production. This is attributable to losses in conversions, transportation use, and transmission.

Earlier maps in the energy section of this atlas have shown the dramatic increase in demand for and supply of electrical energy. A comparable increase has occurred with respect to



Transmission lines carry power from distant sources to areas of high consumption.

refined petroleum products. No dramatic change is anticipated in the use of internal combustion engines and, therefore, in the growing quantities of refined petroleum products consumed each year. At least for the next decade, it seems unlikely that major shifts will occur in the relative proportions of gas, electricity, and petroleum products made use of in British Columbia.

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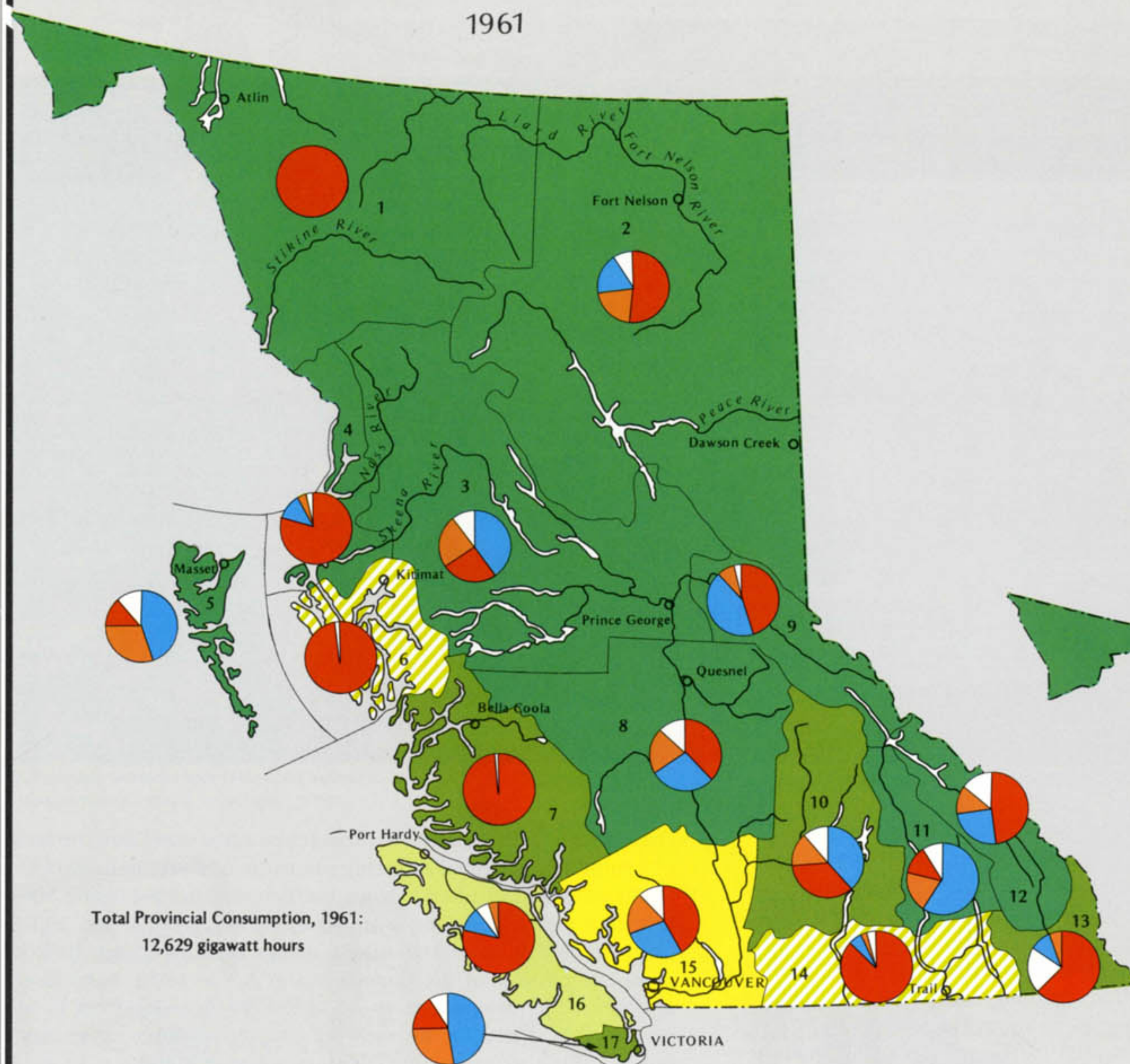
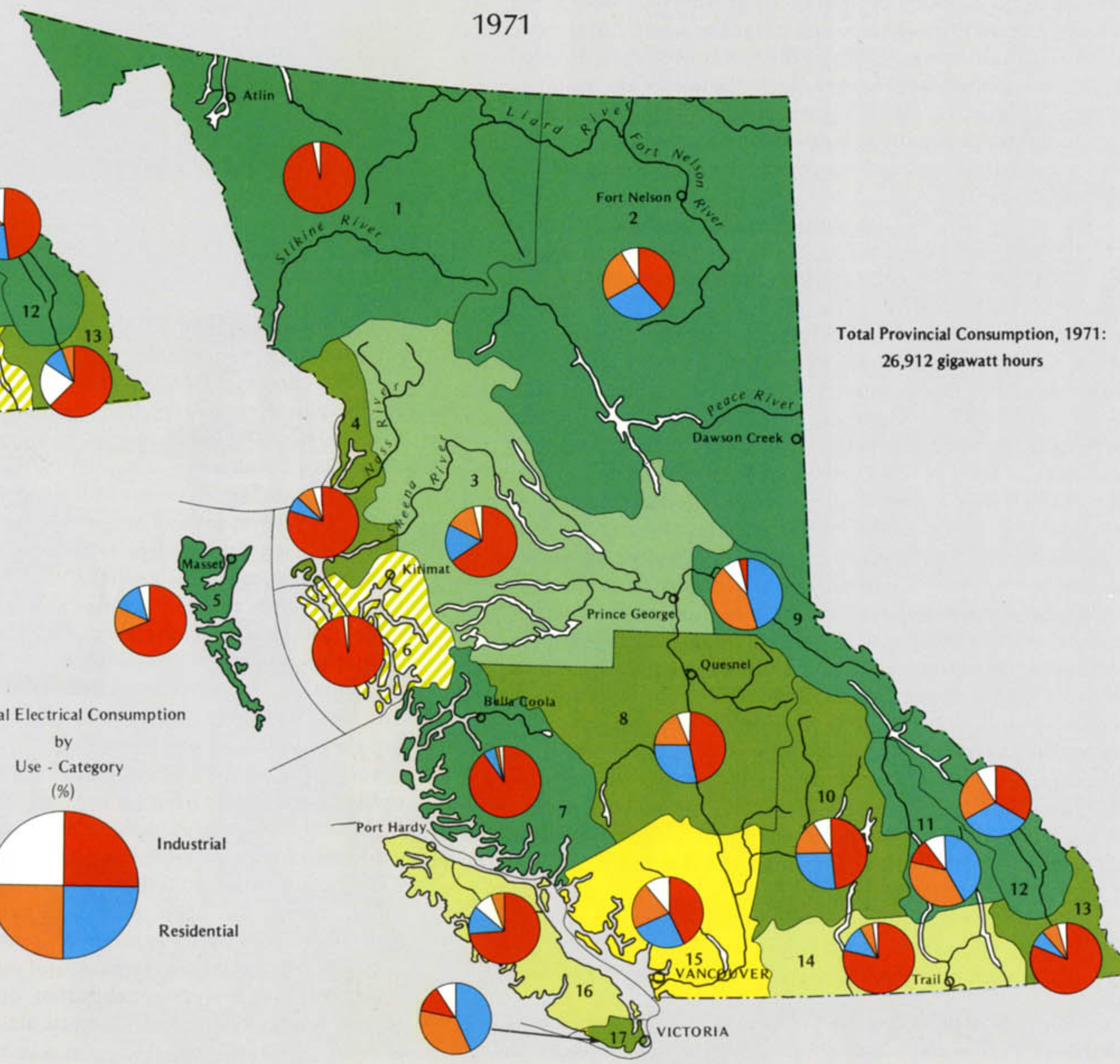
Energy

ELECTRICAL ENERGY CONSUMPTION BY ELECTRICAL SERVICE AREAS 1961—1971



Total Provincial Consumption, 1961:
12,629 gigawatt hours



Total Provincial Consumption, 1971:
26,912 gigawatt hours

Electric Service Areas
As Designated by the British Columbia Energy Board

1 Atlin
2 Peace River
3 Prince George - Bulkley
4 Prince Rupert
5 Queen Charlotte
6 Kitimat - Kemano
7 Ocean Falls
8 Cariboo
9 Upper Fraser
10 Kamloops - Vernon
11 Revelstoke
12 Upper Columbia
13 East Kootenay
14 Nelson - Princeton
15 Lower Mainland
16 Nanaimo
17 Victoria

Regional Proportion of Total Provincial Electrical Energy Load

- Less than 1%
- 1 - 4%
- 5 - 7%
- 12 - 14%
- 20 - 23%
- Greater than 30%

Regional Electrical Consumption by Use - Category (%)

Other — Industrial — Commercial — Residential

100 0 100 200 Kilometres
50 0 50 100 Statute miles

Map 49. Water Use, 1976

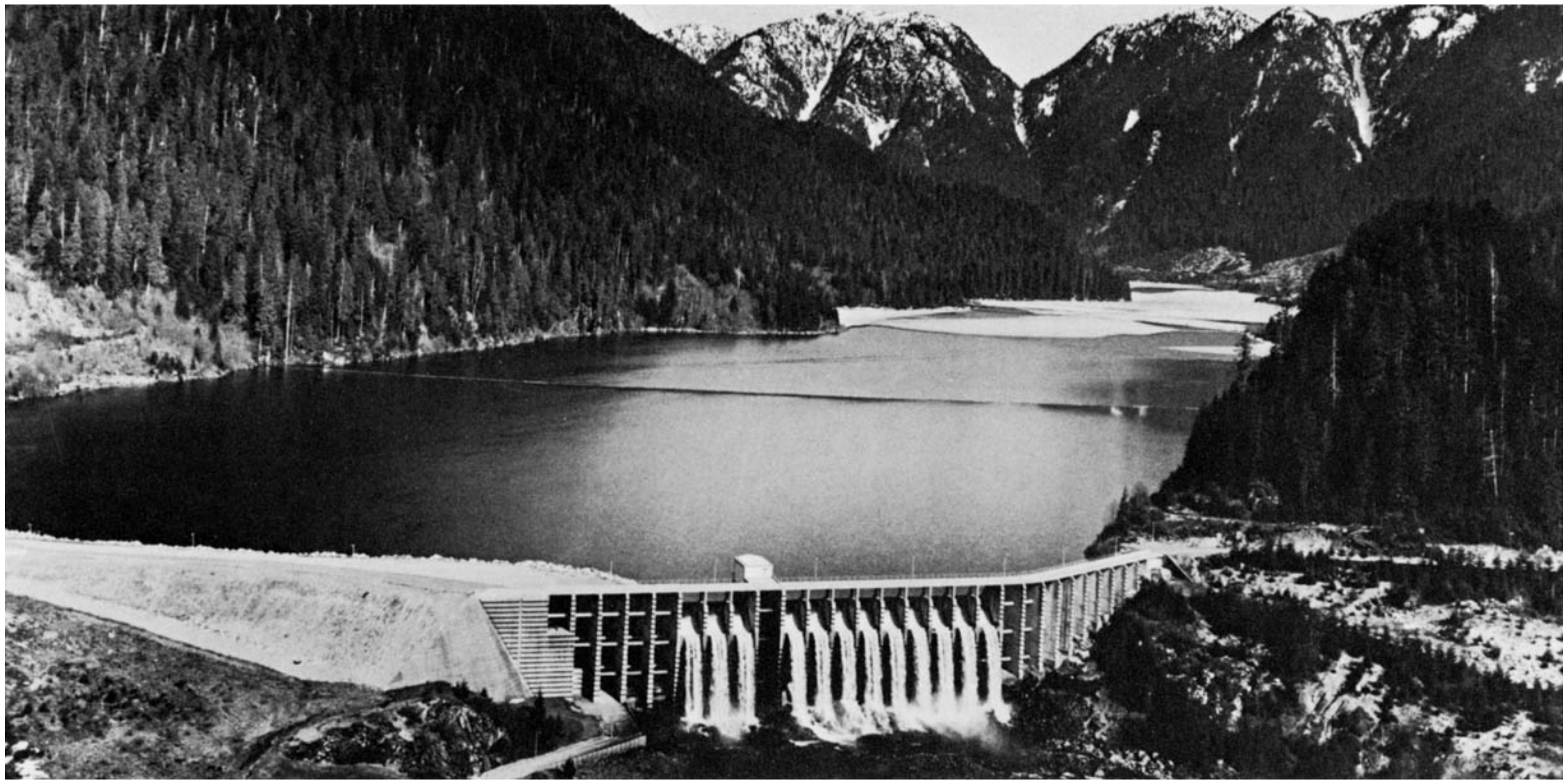
As other maps in this atlas (notably Maps 18 and 19) have shown, British Columbia has abundant water resources. An individual's perception of the extent and quality of that endowment varies according to the use to which the water is put. The avid dry-fly fisherman casting a lure on one of British Columbia's myriad upland lakes, for example, may base his assessment upon such things as water clarity and the frequency with which trout rise to his lure. An engineer viewing the same water body may perceive it somewhat differently, perhaps as a potential source of irrigation water for a new apple orchard in the adjacent lowland. One way of assessing the importance of the water resource on a province-wide scale is through an examination of the uses to which it is put.

The accompanying map illustrates those forms of water use for which quantitive data are available. It may be considered an expression of the spatial pattern of water consumption, though, in stricter terms, the amount of water actually consumed is but a small portion of the water used. Most water is discharged after having been changed in quality, to greater or lesser extent, depending upon the use to which it has been put. Some processes consume higher proportions of the water used than do others. In irrigation applications, for example, about half the water is consumed — that is, taken up by plants, evaporated, or lost to groundwater percolation. Pulp-milling, coal-washing, and some other industrial applications consume only about 5 per cent of the water used.

The intensity of background colour on the map represents the proportion of total provincial water use in each Water District. Districts 3 (Nelson), 25 (Peace River), and 17 (Revelstoke) are by far the heaviest water users, together accounting for about 80 per cent of the total. District 3 alone represents over one-third. As the pie-graphs indicate, however, virtually all of the water use in each of the three districts is for the generation of electrical power. In the Prince George area (District 24), most of the water is destined for industry, in this case mainly the washing of chemical pulp. In District 11 (Vancouver), hydro-electric generation is again the dominant form of use despite the fact that municipal systems in that area utilize large quantities of water. By comparison, however, vastly greater amounts of water are needed to drive the turbines in hydro-electric plants than to meet the domestic requirements of hundreds of thousands of people. On the other hand, water employed in power generation suffers comparatively little change in quality, except for loss of hydraulic head, whereas municipal discharge tends to be heavily contaminated. Overall, more than 97 per cent of the provincial total goes to hydro-electric applications and less than 1 per cent to industrial use. While the proportion is small, that use amounts to about 8.75 million cubic metres of water daily. Expressed as streamflow it would represent a stream discharge of 100m³/sec flowing all day, every day — about one-tenth of the mean flow of the Columbia River at Revelstoke.

Irrigation constitutes a small but significant use-component. As the map shows, however, Districts 4, 5, 6, 13, 14, 18 and 19, the areas where irrigation is greatest, are not intensive water users.

Diversion of water to municipal systems represents the smallest of the major use-sectors. It amounts in aggregate to about 4.5 million m³ per day. About 75 per cent of the provincial population is served by municipal works, by far the largest of which is Vancouver's. The Greater Vancouver Water District supplies fourteen member municipalities, which contain half the population of the province.



The Seymour Falls dam and reservoir are part of Greater Vancouver Water District storage.

The category labelled miscellaneous in the pie-graphs includes conservation uses, fluming, and mineral baths. The Hazelton District is outstanding in that regard; there appreciable amounts of water are allocated to the preservation of salmon runs. Use categories that are individually less than 10 per cent are difficult to represent and are grouped as "Other."

Because water storage capacity is closely linked with water use and with water licensing, it is shown on the map. Surface water is stored in both natural and man-made reservoirs. Imperial units are used in reference to water storage data in British Columbia, and the map information is therefore expressed in acre-feet. An acre-foot represents one acre flooded to a depth of one foot (43,560 ft.³ or 1,234 m³). Only the larger storage areas are shown in the map, Districts 23 (Fort Fraser) and 25 (Peace River) being outstanding. Each has a capacity well in excess of 30 million acre-feet (37 billion m³), and together they account for 70 per cent of the provincial total. Both districts have important associated hydro-electric developments. In Water Districts 3 and 17 not only are there substantial hydro-electric works, but also much storage has been developed as part of the international Columbia River Treaty agreement.

Since the province is so abundantly endowed with water resources, it is understandable that British Columbians should regard water as a free commodity, its cost being limited to the provision of a delivery system and to a nominal administration charge. This traditional view of water as a free good and the lack of a suitable method of assessing the value of water in its various applications has resulted in some inefficient, if not profligate, use. In recent years, however, water-use conflicts have arisen, especially in and around the major urban centres. These helped stimulate passage of the Canada Water Act in 1970. They have also lent encouragement to co-operative investigation at all levels of government not only into water-resource inventory, but also into the forecasting of future water demand.

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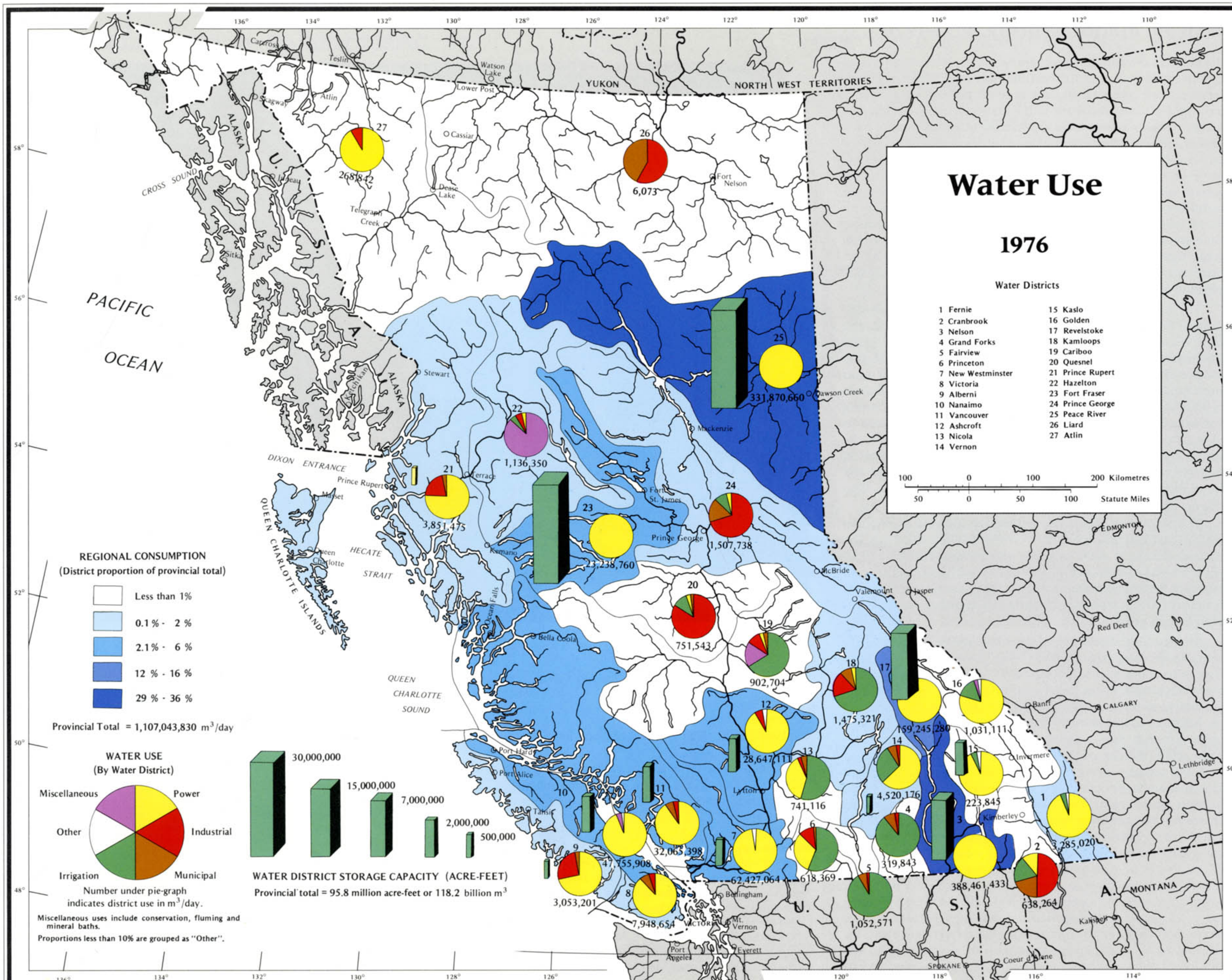

Water Use
1976
Water Districts
1 Fernie
2 Cranbrook
3 Nelson
4 Grand Forks
5 Fairview
6 Princeton
7 New Westminster
8 Victoria
9 Alberni
10 Nanaimo
11 Vancouver
12 Ashcroft
13 Nicola
14 Vernon
15 Kaslo
16 Golden
17 Revelstoke
18 Kamloops
19 Cariboo
20 Quesnel
21 Prince Rupert
22 Hazelton
23 Fort Fraser
24 Prince George
25 Peace River
26 Liard
27 Atlin
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
REGIONAL CONSUMPTION
(District proportion of provincial total)
Less than 1%
0.1% - 2 %
2.1% - 6 %
12 % - 16 %
29 % - 36 %
Provincial Total = 1,107,043,830 m³/day
WATER USE
(By Water District)
Miscellaneous
Power
Other
Industrial
Irrigation
Municipal
Number under pie-graph indicates district use in m³/day.
Miscellaneous uses include conservation, fluming and mineral baths.
Proportions less than 10% are grouped as "Other".
30,000,000
15,000,000
7,000,000
2,000,000
500,000
WATER DISTRICT STORAGE CAPACITY (ACRE-FEET)
Provincial total = 95.8 million acre-feet or 118.2 billion m³
PACIFIC OCEAN
QUEEN CHARLOTTE SOUND
HECATE STRAIT
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
CROSS SOUND
ALASKA
U.S.A.
YUKON
NORTH WEST TERRITORIES
MONTANA
27 268,842
26 6,073
25 331,870,660
22 1,136,350
21 3,851,475
24 1,507,738
23 23,238,760
20 751,543
19 902,704
18 1,475,321
17 159,245,280
16 1,031,111
12 28,647,111
13 741,116
14 4,520,176
15 223,845
1 3,285,020
11 32,063,398
10 47,755,908
9 3,053,201
8 7,948,654
7 62,427,064
6 618,369
5 1,052,571
4 319,843
3 388,461,433
2 638,264
Atlin
Teslin
Carcross
Skagway
Watson Lake
Lower Post
Cassiar
Dease Lake
Telegraph Creek
Juneau
Sitka
Ketchikan
Stewart
Fort Nelson
Dawson Creek
Mackenzie
Terrace
Prince Rupert
Masset
Queen Charlotte
Kemano
Fort St. James
Prince George
McBride
Valemount
Jasper
Bella Coola
Ocean Falls
Port Hardy
Port Alice
Tahsis
Lytton
Banff
Calgary
Edmonton
Red Deer
Invermere
Kimberley
Lethbridge
Bellingham
Mt. Vernon
Everett
Port Angeles
Victoria
Spokane
Coeur d'Alene
Kalispell

Map 50. Manufacturing, 1951–1970

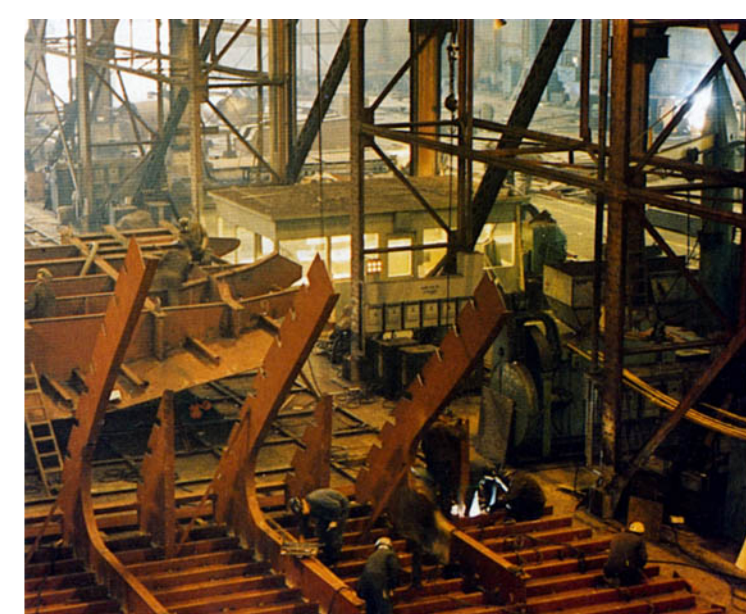
The maps on the adjacent page represent the regional patterns of manufacturing value in British Columbia over the span of two decades. Such comparisons over time are difficult because several changes have been made to the Standard Industrial Classification. In cases where large differences in relative value exist between regions, the disparities are of little consequence. Where they are only in the range of one or two percentage points, however, caution should be exercised in interpreting the maps. Despite such data problems, the value added concept is more useful in making regional comparisons of manufacturing activity than is labour force. The latter is insufficient on its own because some kinds of industry are more labour-intensive than others. Taken together, however, value added and labour force by industry provide the best available indication of the regional distribution of manufacturing activity (see Map 11).

The upper two maps show that for the key areas of southwestern British Columbia, little or no change has occurred. The lower Fraser Valley is pre-eminent, accounting for about half the provincial manufacturing value in both 1951 and 1970. Mainly because of its importance in the processing of lumber and other forest products, Vancouver Island held a prominent second place in both years. Total provincial value added by manufacturing was over $592 million in 1951 and approached $1.6 billion in 1970. The change apparent in the relative importance of the central and northwestern areas of the province is attributable to the rapid expansion of forest processing in the Prince George and Prince Rupert areas during the 1950's and 1960's (see Maps 30 to 33).

The third map shows the percentage increase in regional value of manufacturing activity over the two decades. Thus, the internal change in each region is emphasized. The growth in value in northwestern British Columbia is particularly great, and the Peace River region also shows a remarkable increase, though its share of the total provincial value of manufacturing was very small in both years.

The last map shows the regional increase in total manufacturing value compared to the average provincial increase. Because of its dominance in the overall manufacturing pattern, the lower Fraser Valley area largely determines the provincial average, which, over the period, increased 173 per cent. The pattern is not dissimilar to that shown for labour force (see Map 11). Once again, although their total manufacturing bases are comparatively small, the central and northern regions of the province show the greatest increases. By comparison, Vancouver Island grew at about 20 per cent less than the provincial average, while the West Kootenay and south coastal regions grew by substantially smaller proportions, respectively, 50 per cent (that is, 123 per cent below the provincial average) and 37 per cent (136 per cent below the provincial average). There are many reasons for these different rates of growth in manufacturing activity, but in the case of the south coast, economic conditions in the pulp and paper industry were an important factor. For the West Kootenay region, the manufacturing mainstay has long been related to base-metal smelting and refining. It is a large, but relatively stable industry, so that, despite the expansion of sawmilling and the addition of pulp- and paper-milling to the regional economy in the 1960's, the rate of industrial growth has been less than for the province as a whole.

The Haida Monarch, *a self-propelled, self-dumping log carrier built in North Vancouver, shown in the process of unloading.*



Shipbuilding has long been associated with the West Coast manufacturing industry.

A tabulation of the census value added by each of the major industrial components to the British Columbia total is given in the Historical and Statistical Summary at the end of this atlas.

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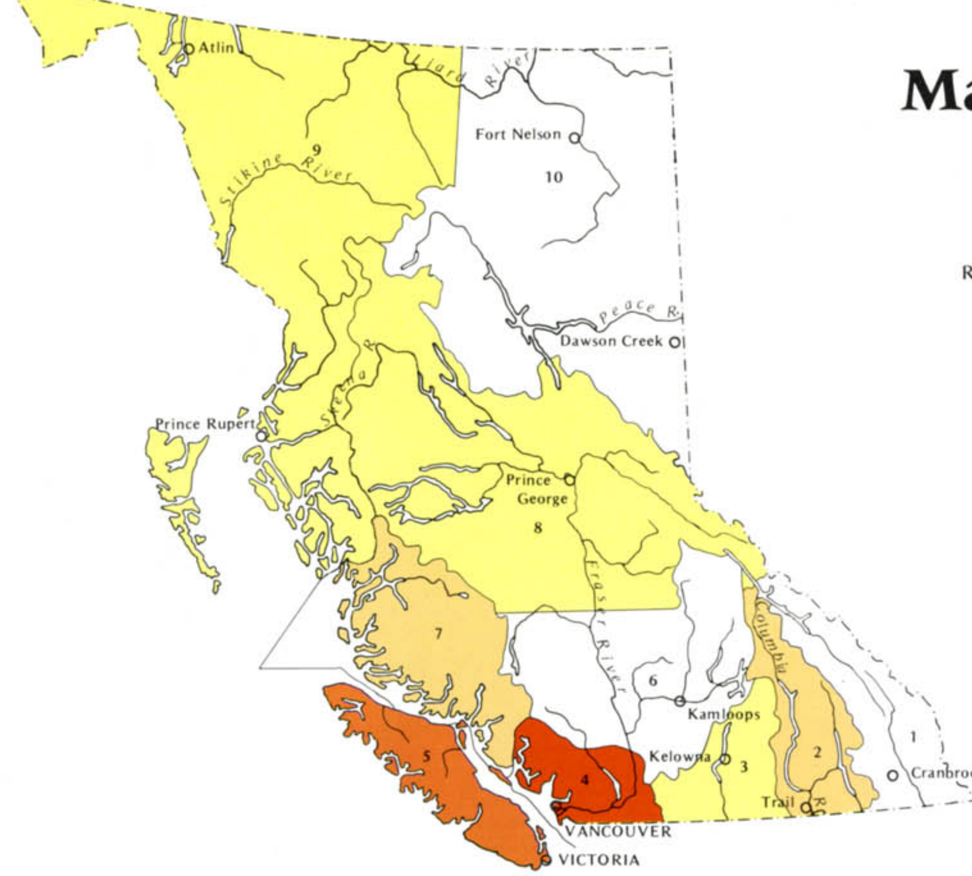
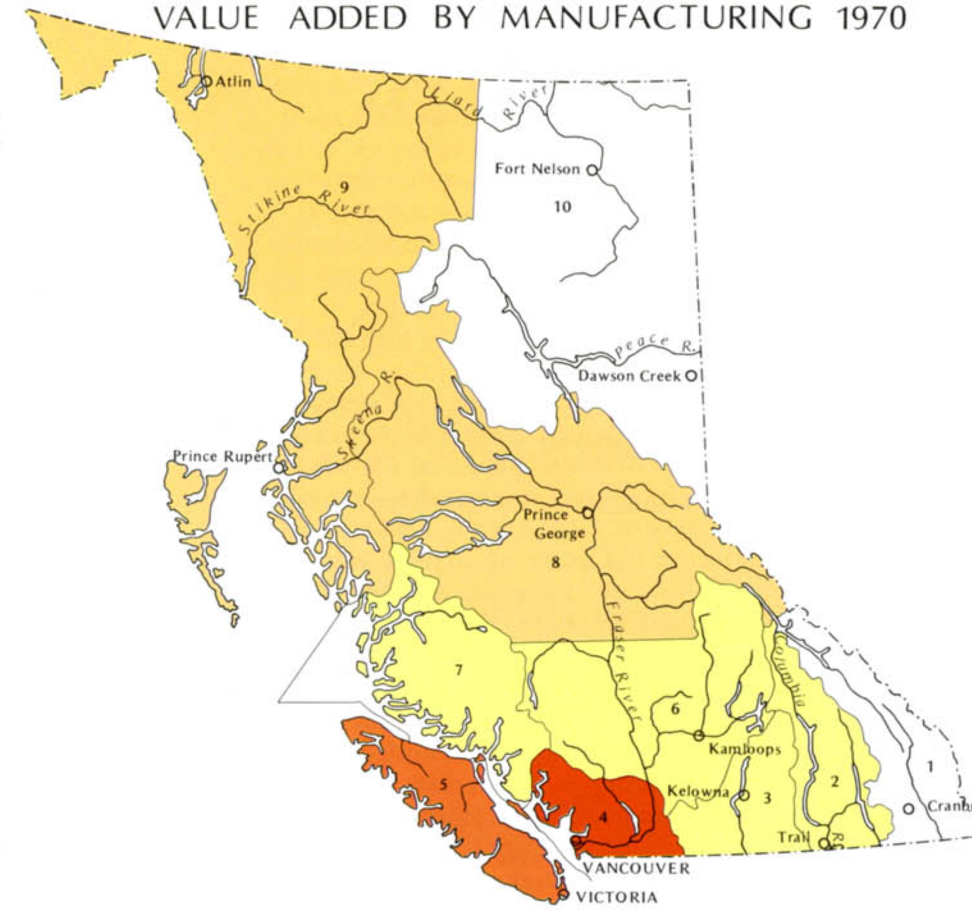
Manufacturing

1951 - 1970

VALUE ADDED BY MANUFACTURING 1951



VALUE ADDED BY MANUFACTURING 1970



Regional Percentage of Provincial Total

- 0 % - 2 %
- 2 % - 5 %
- 5 % - 10 %
- 15 % - 20 %
- 50 % - 55 %

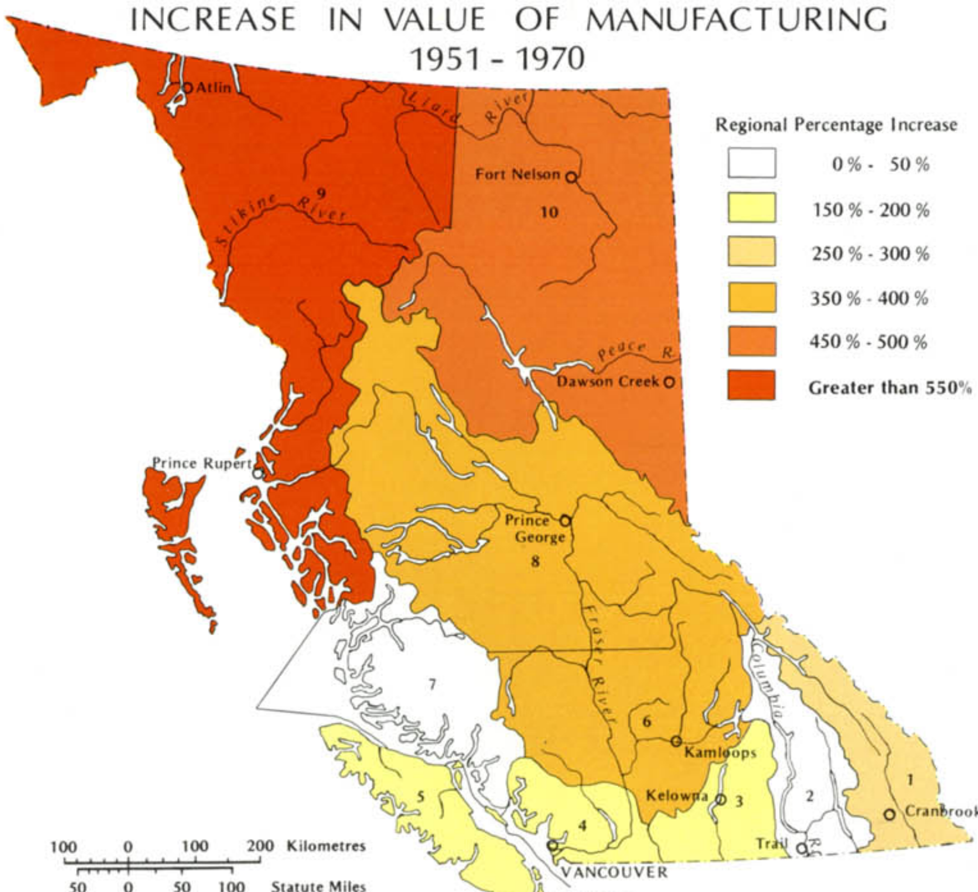
Provincial Totals

1951 - $592,449,000
1970 - $1,617,392,000

British Columbia Census Divisions

1. East Kootenay
2. West Kootenay
3. Okanagan
4. Lower Fraser Valley
5. Vancouver Island
6. South Central Interior
7. Central Coast
8. Prince George
9. Northwest
10. Northeast

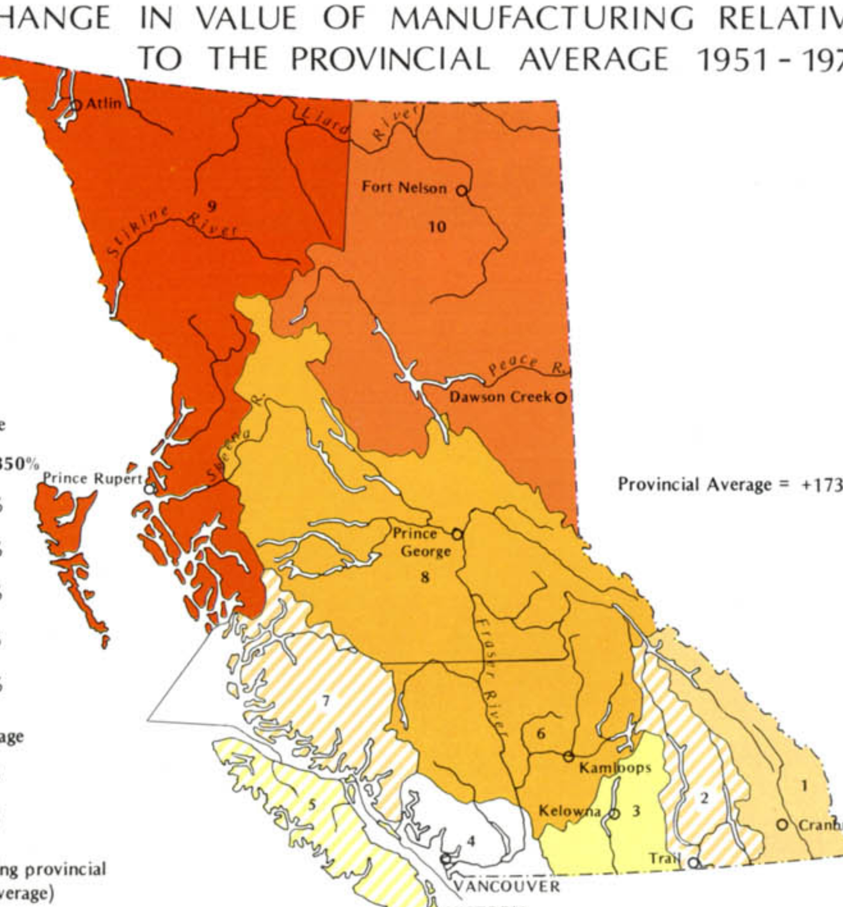
INCREASE IN VALUE OF MANUFACTURING 1951 - 1970



Regional Percentage Increase

- 0 % - 50 %
- 150 % - 200 %
- 250 % - 300 %
- 350 % - 400 %
- 450 % - 500 %
- Greater than 550%

CHANGE IN VALUE OF MANUFACTURING RELATIVE TO THE PROVINCIAL AVERAGE 1951 - 1970



Provincial Average = +173%

Above Provincial Average

- Greater than 350%
- 250 % - 350 %
- 150 % - 250 %
- 50 % - 150 %
- 1 % - 50 %
- 0 % - 1 %

Below Provincial Average

- 1 % - 50 %
- 50 % - 150 %

(percentages calculated by subtracting provincial average from census division average)

Map 51. Manufacturing, 1972

The map on the facing page is based upon Statistics Canada information that lists industries according to the Standard Industrial Classification. There an industry is defined as a group of establishments engaged in a similar kind of economic activity. The definition is broad, however, so that all pursuits related to a particular industrial group are included. Hence the clerical, administrative, and financial functions directly associated with a given goods-producing industry are regarded as part of the value added by that industry to the total provincial output.

As the intensity of background colour on the map indicates, Region 5 (Vancouver–Powell River) accounted for over half of the total value of manufacturing in the province. A similar pattern is evident in earlier years, though changes in the statistical boundaries as well as in the Standard Industrial Classification make difficult a detailed comparison (see preceding map page). Next in order of importance is Region 6 (Vancouver Island–Waddington). Here, most of the economic activity is concentrated along the east coast lowland, though considerable sawmilling and pulp- and paper-milling take place elsewhere on the Island (see Maps 31 and 33). For convenience, the boundary of the Economic Region includes part of the mainland coast, but manufacturing productivity in that area is in fact almost nonexistent. In Region 7, on the other hand, manufacturing associated with the forest industry is widespread, though it is generally oriented to the main population centres and transportation routes. While the regional population in the Central Interior is less than that of the Okanagan, the former contributes a greater value added in manufacturing.

The pie-graph symbols show the relative importance of the main types of manufacturing within each region. The graphs reveal the great importance of the forest industry in almost all parts of the province. Out of the 1972 total value added by manufacturing of $2.2 billion, about half accrued from the processing of forest products. Although the map portrays manufacturing activity only, it is clear that the Wood Industries, Furniture, and Paper groups are directly based upon the forest resource (see Map 27). Paper and Allied Industries figure prominently in Regions 6 and 7. In fact, they are also important in all other regions except the Okanagan, but because of the disclosure principle, they are obscured in the data for each Economic Region under the general term "Other Major Groups." Where less than three independent but functionally similar industrial plants occur within the same unit area, official statistics do not list them separately. Depending upon the number and regional value of these plants, the "Other Major Groups" segment of the pie-graphs may be large.

Food and beverage industries are important in Economic Regions 3, 5, and 8. In the first the main components are the processing of tree fruits and wine-grapes. In Region 5 food and beverage industries are diverse, but they include the handling and packaging of local farm products as well as of imported raw materials such as cane-sugar. In the North Coast-Stikine Region, fish freezing and canning is locally important (see Map 42).

As might be expected, the areas of greatest population show the greatest diversity of manufacturing activity. Again, the lower Fraser Valley and east coast Vancouver Island are the key areas, and together they comprise the areal focus of British Columbia's manufacturing industry.

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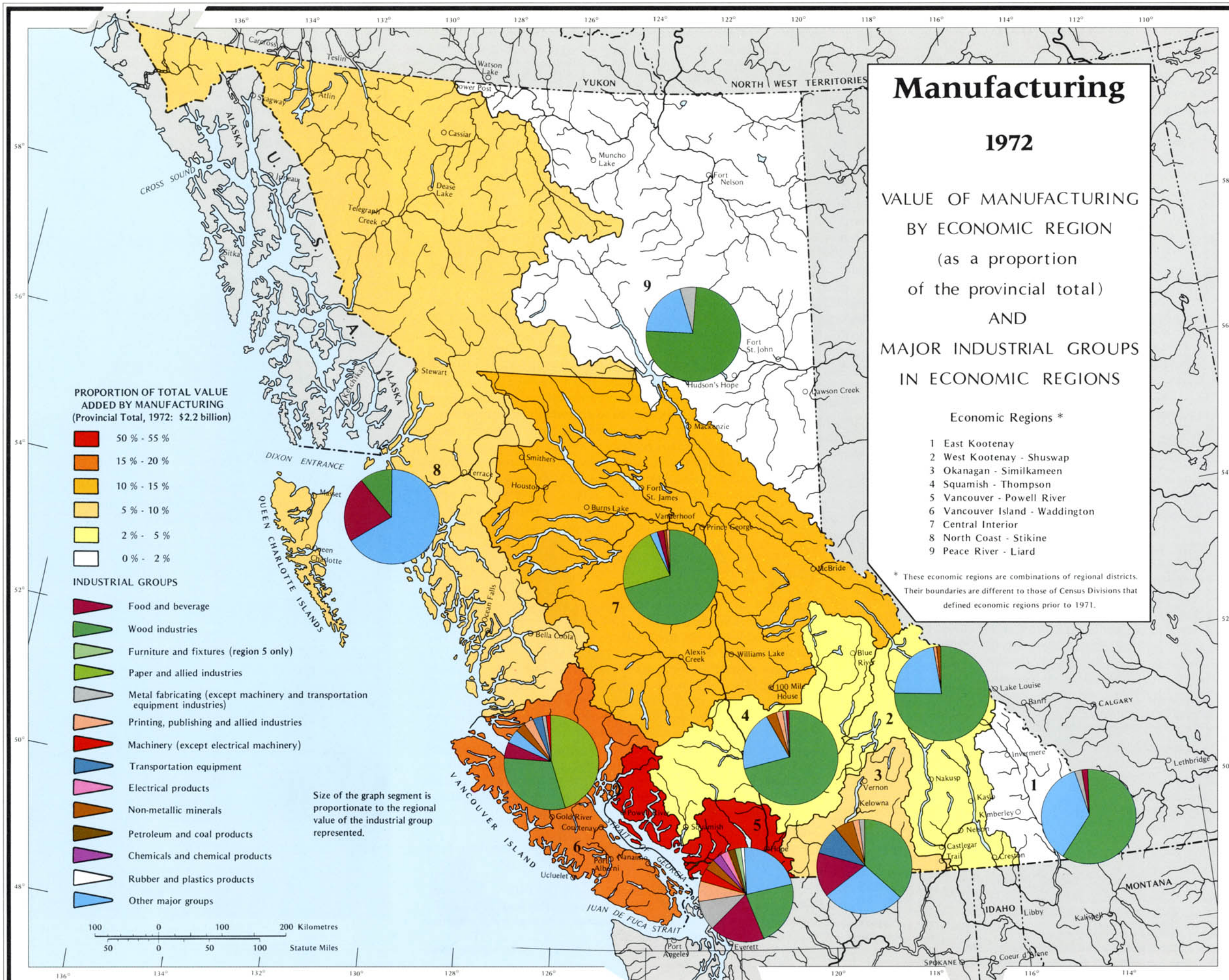
The B.C. Sugar Company refines imported raw sugar for domestic consumption.

Clayburn Industries markets construction and refractory brick internationally.


Manufacturing
1972
VALUE OF MANUFACTURING BY ECONOMIC REGION (as a proportion of the provincial total) AND MAJOR INDUSTRIAL GROUPS IN ECONOMIC REGIONS
Economic Regions *
1 East Kootenay
2 West Kootenay - Shuswap
3 Okanagan - Similkameen
4 Squamish - Thompson
5 Vancouver - Powell River
6 Vancouver Island - Waddington
7 Central Interior
8 North Coast - Stikine
9 Peace River - Liard
* These economic regions are combinations of regional districts. Their boundaries are different to those of Census Divisions that defined economic regions prior to 1971.
PROPORTION OF TOTAL VALUE ADDED BY MANUFACTURING
(Provincial Total, 1972: $2.2 billion)
50 % - 55 %
15 % - 20 %
10 % - 15 %
5 % - 10 %
2 % - 5 %
0 % - 2 %
INDUSTRIAL GROUPS
Food and beverage
Wood industries
Furniture and fixtures (region 5 only)
Paper and allied industries
Metal fabricating (except machinery and transportation equipment industries)
Printing, publishing and allied industries
Machinery (except electrical machinery)
Transportation equipment
Electrical products
Non-metallic minerals
Petroleum and coal products
Chemicals and chemical products
Rubber and plastics products
Other major groups
Size of the graph segment is proportionate to the regional value of the industrial group represented.
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
CROSS SOUND
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
IDAHO
MONTANA
CALGARY
Lethbridge
Carcross
Teslin
Watson Lake
Lower Post
Atlin
Skagway
Cassiar
Muncho Lake
Fort Nelson
Dease Lake
Juneau
Telegraph Creek
Sitka
Fort St. John
Hudson's Hope
Dawson Creek
Stewart
Mackenzie
Smithers
Terrace
Masset
Houston
Fort St. James
Burns Lake
Vanderhoof
Prince George
Queen Charlotte
McBride
Ocean Falls
Bella Coola
Alexis Creek
Williams Lake
Blue River
100 Mile House
Lake Louise
Banff
Invermere
Nakusp
Vernon
Kelowna
Kaslo
Kimberley
Nelson
Castlegar
Trail
Creston
Gold River
Courtenay
Powell River
Squamish
Hope
Nanaimo
Port Alberni
Ucluelet
Port Angeles
Everett
Libby
Kalispell
SPOKANE
Coeur d'Alene
1
2
3
4
5
6
7
8
9

Map 52. Recreation and Tourism: Provincial and National Parks and Marine Parks, 1975

British Columbia is known nationally and internationally for the extent and diversity of opportunities for outdoor recreation. From saltwater angling to big-game hunting and from family picnicking to wilderness camping, the landscape and biotic environment offers a wide range of recreational attractions. The importance of reserving suitable recreational areas for the use and enjoyment of the public has long been recognized, and over the years systems of National and Provincial parks have been created. Most of the parks are provincial, though a substantial area (450,763 ha) is contained in National Parks. These include both long-established Yoho, Kootenay, Glacier, and Mount Revelstoke parks, and the recently instituted Pacific Rim National Park on Vancouver Island. Data for the National Parks and for the larger Provincial Parks are listed in the accompanying table. Locations are shown on the map.

The provincial park system consists of well over 300 parks, embracing a total area of nearly 44,000 square kilometres. Thus, in gross terms, the combined area of Provincial and National parks in British Columbia is the equivalent of nearly 2 ha per capita. Though the total is impressive, much of the land reserved in parks is not readily accessible and should be considered more in the context of potential than of presently used recreational land (see Maps 55 and 56).

PARKS IN BRITISH COLUMBIA WITH AREA OVER 10,000 HECTARES

Name	Current Area (ha)	Date Established
A. NATIONAL PARKS		
Kootenay	140,600	1920
Glacier	135,000	1886
Yoho	131,400	1886
Mount Revelstoke	25,900	1914
Pacific Rim*	17,863	1975

*The area indicated is the estimated total land area, when fully established, of Pacific Rim's three component parks — Long Beach, Broken Islands Group, and West Coast Trail.

Name	Current Area (ha)	Date Established
B. PROVINCIAL PARKS		
Tweedsmuir	969,760	1938
Spatsizi Plateau Wilderness	667,208	1975
(Adjacent Tatlatui Park	104,600	1973)
Wells Gray	521,200	1939
Atlin	230,000	1973
(Adjacent Atlin Recreational Area*	38,000	1973)
Strathcona	219,741	1911
Mount Robson	217,283	1913
Garibaldi	193,596	1920
(Adjacent Golden Ears Park	54,950	1967)
Kwadacha Wilderness	165,600	1973
Mount Edziza	130,000	1972
(Adjacent Mt. Edziza Recreational Area*	99,600	1972)
Bowron Lake	121,662	1961
Muncho Lake	87,384	1967
Naikoon	71,800	1973
Mount Assiniboine	38,600	1922
Kokanee Glacier	25,600	1922
Cathedral	33,273**	1968
Stone Mountain	24,686	1957
Hamber	24,234	1941
Carp Lake	19,120	1973
Cape Scott	14,880	1973
Manning	7,573	1941
(Adjacent Skagit Valley Recreational Area*	32,200	1973)

*Provincial Recreational Areas have been established for the use and enjoyment of the public, but they do not have park status. Roadless tracts known as Nature Conservancies and Wilderness Conservancies have also been created, the former within existing parks, the latter outside park boundaries. Up to 1978 the only established Wilderness Conservancy was the Purcell Wilderness Conservancy, in the Kootenay country embracing 130,000 ha.

**Park area increased from 7,372 ha, September 1975.

Provincial Parks are classified according to accessibility and function. Class A parks have a high degree of legislative protection against competing land uses and are designed to preserve outstanding natural features and historic sites. Class B parks are intended to serve the same purpose, but the degree of legislative protection is less. Other forms of resource use are permitted in these parks so long as they do not seriously degrade recreational values. Class C parks have some legislative protection, but their function is primarily to meet local community needs, and they are commonly managed by municipal governments. In 1975 there were approximately 250 provincial parks in Class A, 7 in Class B, and 65 in Class C. Prominent in the Class B group are Strathcona Park on Vancouver Island, established in 1911 as the first Provincial Park in British Columbia, and Tweedsmuir Park, the largest in the province.

In addition to the areas that have been given official park status, other recreational areas have been set aside under the administration of the Forest Service. Indeed, from 1940 to 1957, all recreational management of crown land was the responsibility of the Forest Service. In 1957 the Department of Recreation and Conservation was established, and it assumed responsibility for gazetted parks. Escalating recreational use of crown forest land in the 1960's, however, led to an amendment to the Forest Act and, in 1971, to a renewal of the Forest Service role in recreational land management. There are now about one thousand developed recreational sites in the less accessible areas and several hundred kilometres of trails and canoe routes under the administration of the Forest Service. These provide rustic campsites and limited access in areas of crown land that are generally well removed from urban centres and from established facilities in the provincial park system.

British Columbia's coastline is characterized by myriad islands, sheltered coves and anchorages, and extensive fjord channels. It is a magnificent cruising area for power boats and for sailing craft. In response to a massive increase in marine-oriented recreation that began in the 1950's, special-purpose marine parks were established, the first of which was Montague Harbour Provincial Marine Park on Galiano Island. Marine parks afford attractive waterfront locations for boaters to visit in the course of cruising. They offer protected anchorage, mooring buoys, floats or docks, and waterfront facilities such as tables, fire circles, and water supply. Camping space is available for boaters who lack accommodation aboard. These parks provide recreational opportunities that are complementary to privately owned marinas, which offer many facilities including fuel, provisions, boat-storage space, and other services. As the map indicates, marine parks are located in the Strait of Georgia area, where recreational boating is most heavily concentrated.

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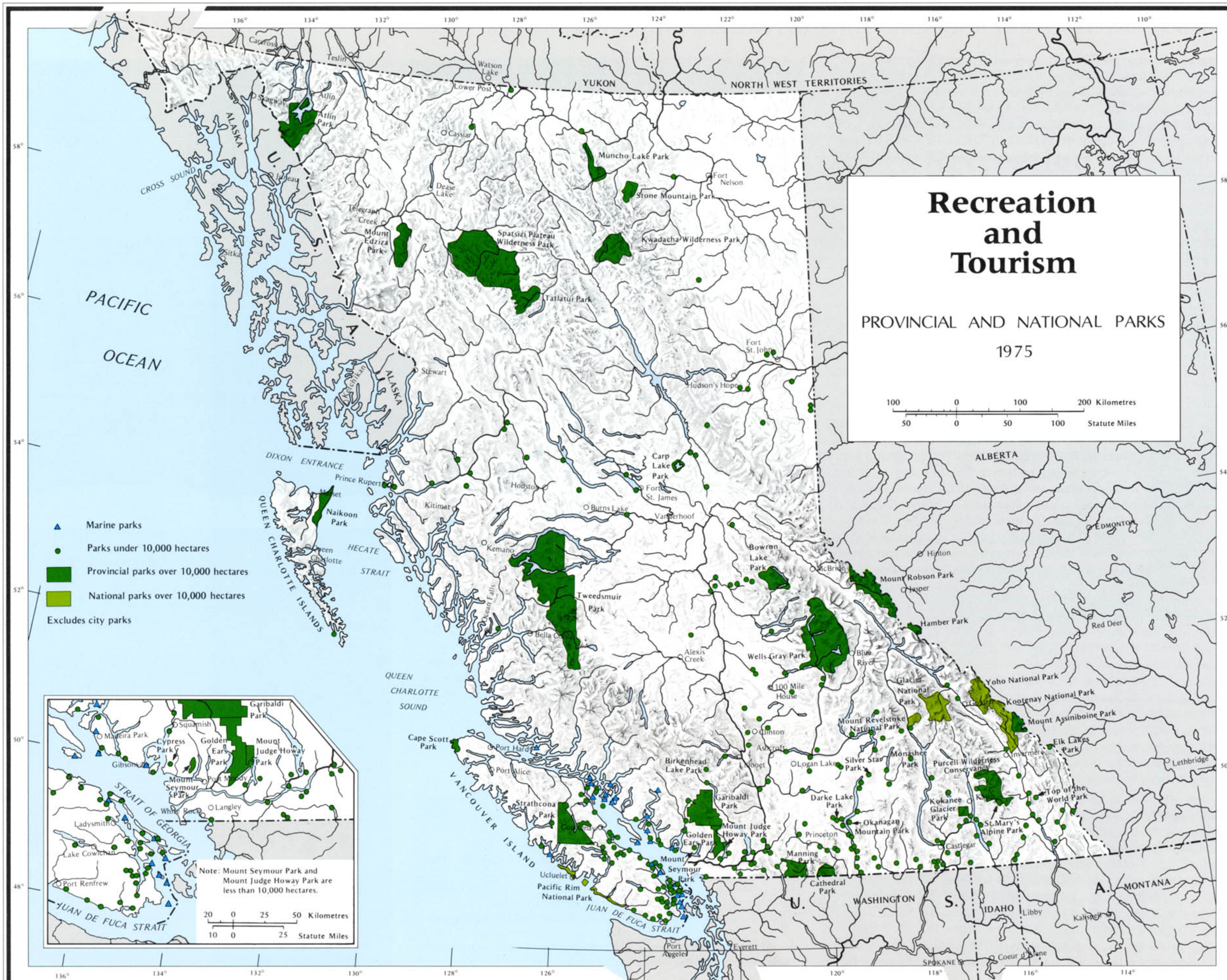
Cathedral Mountain is one of the scenic features of Yoho National Park.



Recreation and Tourism
PROVINCIAL AND NATIONAL PARKS
1975
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Marine parks
Parks under 10,000 hectares
Provincial parks over 10,000 hectares
National parks over 10,000 hectares
Excludes city parks
Note: Mount Seymour Park and Mount Judge Howay Park are less than 10,000 hectares.
20 0 25 50 Kilometres
10 0 25 Statute Miles
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
JUAN DE FUCA STRAIT
STRAIT OF GEORGIA
Atlin Park
Muncho Lake Park
Stone Mountain Park
Kwadacha Wilderness Park
Spatsizi Plateau Wilderness Park
Tatlatui Park
Mount Edziza Park
Naikoon Park
Carp Lake Park
Tweedsmuir Park
Bowron Lake Park
Mount Robson Park
Hamber Park
Wells Gray Park
Glacier National Park
Yoho National Park
Kootenay National Park
Mount Assiniboine Park
Elk Lakes Park
Mount Revelstoke National Park
Monashee Park
Purcell Wilderness Conservancy
Kokanee Glacier Park
St. Mary's Alpine Park
Top of the World Park
Silver Star Park
Darke Lake Park
Okanagan Mountain Park
Cathedral Park
Manning Park
Garibaldi Park
Golden Ears Park
Mount Judge Howay Park
Mount Seymour Park
Birkenhead Lake Park
Strathcona Park
Cape Scott Park
Pacific Rim National Park
Cypress Park

Map 53. Recreation and Tourism: Ski Areas and Boat-Launching Ramps, 1975

One means of appreciating the importance and diversity of outdoor recreation in an area is through a consideration of the kind and number of recreational facilities available. The accompanying map shows the distributions of two types of facility, each representing a distinctly different and readily identifiable form of outdoor recreation. Their availability indicates not only the recreational qualities of the local environment but also the nature of public demand. Both public and private developments are shown on the map.

Boat-launching ramps primarily serve the needs of fishermen and water-skiers. They are designed for the launching of comparatively small, trailer-borne craft, and hence they must be accessible by road. As might be expected, there is a strong concentration in the Lower Mainland and on southern Vancouver Island, where the population is greatest and where suitable boating water is at hand. Elsewhere in the province they are found mainly on southern interior lakes and reservoirs and, in the area north of Kamloops, in association with the better-known sports-fishing areas. The map shows that Prince George and other major nodes of population in the central interior and in the northeast have few launching ramps in their immediate vicinities.

The ski areas shown on the map were mainly developed as centres for downhill skiing, but the same areas are also used by increasing numbers of cross-country skiers. A combination of access and good snow conditions is essential, but they must be coupled with long, generally steep slopes to satisfy the requirements of downhill skiers. Many locations in British Columbia possess an abundance of suitable snow and terrain, but development has taken place only where it is justified by user-demand. From an examination of the climatic and terrain maps contained in this atlas, it is possible to make general inferences about the physical suitability of some areas as opposed to others. The coastal zone, for example, is characterized by relatively mild, wet winters with frequently overcast skies. In the lower elevations at least, the snow cover is likely to be of short duration, and its quality will probably be heavy for skiing. In the interior, by contrast, less abundant but drier snow is usual, and there are extensive slopes of powder snow (see Maps 12, 20, and 21). On that basis, it is not surprising to find a scattered pattern of ski areas in the interior, with relatively few in the populous southwest coastal region. Those in the interior are used by the local population, but because some of them are within five or six hours driving time from Vancouver, they are also accessible on weekend trips to winter recreationists from the Lower Mainland.

A comparison of ski areas on Vancouver's North Shore mountains with those in the Whistler Mountain area of Garibaldi Provincial Park provides a convenient illustration of the influence of elevation and local climatic gradients upon snow conditions. Ski runs at Grouse Mountain and Seymour Mountain near Vancouver have a top elevation of about 1,280 metres; those at Whistler Mountain extend from about 1,950 metres to a base elevation of 650 metres. The average ski season for Vancouver's North Shore lasts from December to mid-April, that for Whistler from November to June. Especially to the downhill enthusiast, the three-and-a-half-hour round trip by automobile from Vancouver is scant penalty to pay for the advantages of high-calibre skiing. It is understandable, then, that the Whistler Mountain area should have witnessed such remarkable growth since its initial development as a skiing area in the mid-1960's. Because the great majority of users are Lower Mainland residents, similar facilities will probably be provided elsewhere in the locality in response to the growing recreational needs of urban residents, increases in leisure time, and improved access.

Boat-launching ramps facilitate access to British Columbia's abundant fresh and saltwater recreational resources.

Skiers at Grouse Mountain enjoy a vista which stretches from the city of Vancouver to Vancouver Island.

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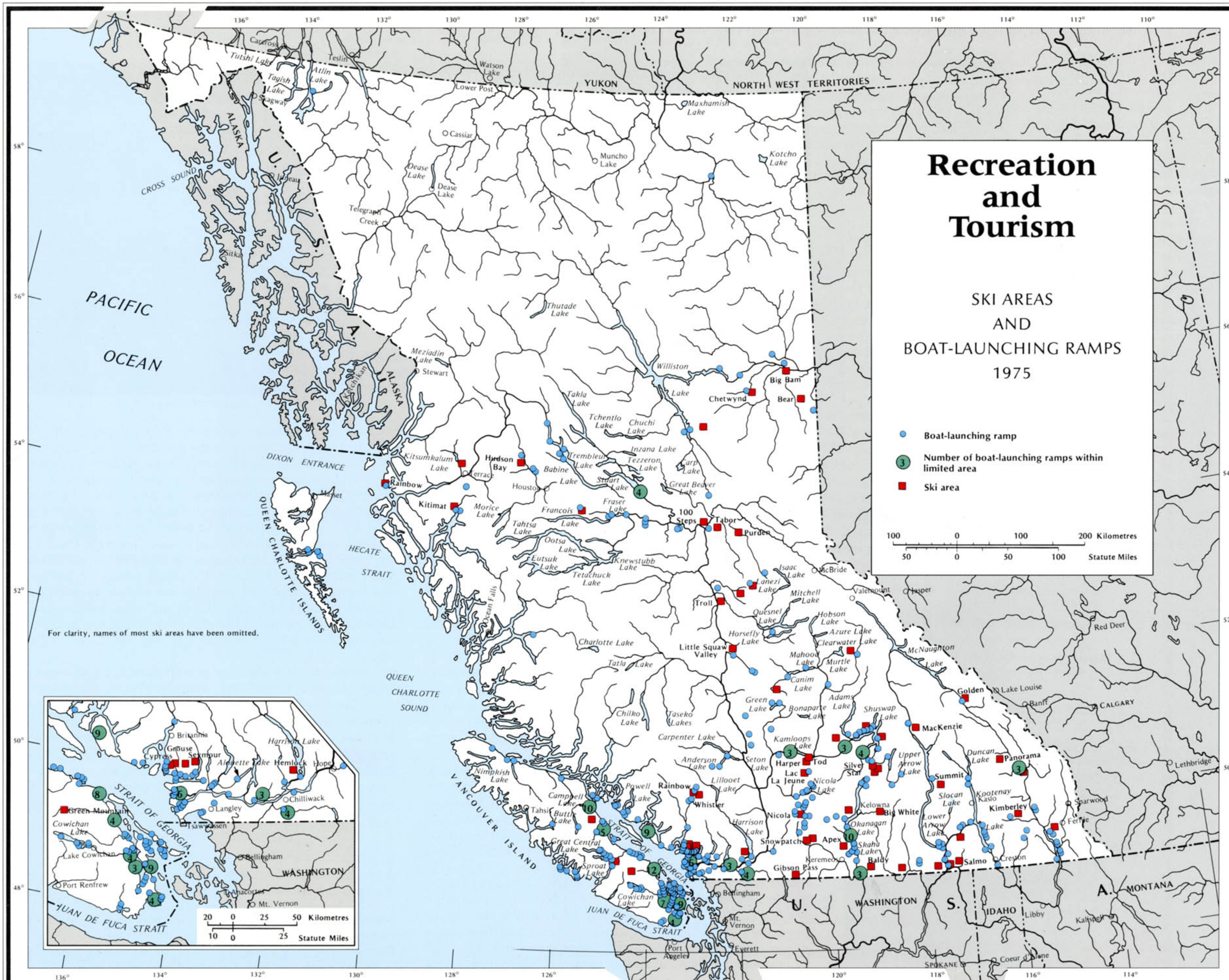
Recreation and Tourism
SKI AREAS AND BOAT-LAUNCHING RAMPS 1975
Boat-launching ramp
Number of boat-launching ramps within limited area
Ski area
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
For clarity, names of most ski areas have been omitted.
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
CALGARY
Red Deer
Lethbridge
Big Bam
Bear
Chetwynd
Rainbow
Kitimat
Hudson Bay
100 Steps
Tabor
Purden
Troll
Little Squaw Valley
Golden
MacKenzie
Panorama
Summit
Kimberley
Whistler
Harper
Tod
Silver Star
Big White
Apex
Snowpatch
Gibson Pass
Baldy
Salmo
Green Mountain
Cypress
Grouse
Seymour
Hemlock
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 54. Recreation and Tourism: Total Campground Attendance, 1975

Of the many leisure activities available in an industrialized society, outdoor camping has considerable attraction. Its appeal is generally considered to relate to the psychological needs of urban dwellers to escape the pressures of the city and to attempt to regain contact with a natural environment. Whatever the propellants may be, there is a strong and continuing demand for campsites and camping facilities appropriate to the pursuit of outdoor recreation. In response to that demand considerable capital, both public and private, has been spent on the development of campgrounds in areas of particular recreational desirability — commonly in places where there is a combination of attractive scenery, water-oriented activities, and hiking opportunities.

There were an estimated 650,000 camper nights recorded for Provincial Parks for the year 1960, about a decade after the British Columbia campsite system was initiated. A camper night is defined as one person camping overnight in one twenty-four hour period. The original statistics are expressed in party nights, and because the average party is a theoretical 3.2 people, there are 3.2 camper nights per party night. By 1970 the number had risen to over 1.5 million, and in 1975 it was approximately 1.75 million. Thus, campsite use had risen from 400 camper nights per thousand residents in 1960 to 686 in 1970 and 712 in 1975. Increases in the number of users have been accompanied by increases in the number of park reserves, campgrounds, picnic tables, and other park facilities. Between 1960 and 1970, for example, the number of campsites in Provincial Parks had been expanded by over 70 per cent. British Columbia residents have accounted for about 60 per cent of the campsite use. While that proportion has changed little, the percentage of users from the United States has increased to about 30 per cent of the total in recent years.

Provincial campsite at Murtle Lake, Wells Gray Park.

Canoeists explore Clearwater Lake in Wells Gray Park.

Complementing the campground facilities in Provincial and National parks are the large number of commercial campgrounds which have been developed. These are mainly in the Okanagan-Shuswap area and on Vancouver Island and provide sites for tents and recreational vehicles. It is estimated that the privately operated campgrounds represent one-third of the total summertime supply of commercial accommodation in the province.

The number and distribution of campers in British Columbia is shown on the accompanying map. It is based upon campground attendance in Provincial and National parks only and therefore excludes the many campers who register in privately operated campgrounds. The attendance data represent the total number of camper nights recorded at each campground during the 1975 season. In addition to the 1.75 million camper nights recorded at Provincial Parks, 50,000 persons stayed at campsites in National Parks within British Columbia. Because their camper records are more complete, only those campgrounds are included at which a camping fee is levied and at which a parks officer is in attendance. For cartographic reasons, some of the campgrounds in the more congested areas are omitted.

The distribution of total camper nights shows a general similarity to that of population (see Map 2), but there are major differences. The southern Interior Plateau, the East Kootenay country, and the southern Cariboo area, for example, show high campground attendance even though populations in those localities are relatively small. This suggests the interaction of user numbers, relative access, and recreational appeal. Because of their scenic grandeur, the diversity of outdoor activities possible, and the amenities available, Provincial and National parks in the Rocky Mountains show moderately high campground attendance. It might be higher were it not for the distance from major urban centres in British Columbia and the competing recreational opportunities of similar nature in adjacent parks in Alberta and Montana. Vancouver Island shows high campground use largely because of the number and attractiveness of its campgrounds, which are readily accessible from Victoria and, by ferry, from Vancouver and also because the camping season is relatively long. High attendance is apparent for a number of campgrounds in the Shuswap-Okanagan area. Among the reasons for this are the warm summers, freshwater swimming beaches, and the relatively short distance from the coast. Local user population in the Okanagan-Kamloops area is also substantial. Farther north, the number of campgrounds is much fewer, the regional population smaller, and summer temperatures somewhat cooler (see Map 21). In that area the campground showing greatest total attendance is at Lakelse Lake, near Kitimat, where a large campsite has been developed (see Map 15).

While the map shows that total attendance at individual campgrounds in the north is nowhere large, it is important to recognize that campground use is a function of the number of campsites available. Consequently, a small campground with a few sites, even though frequently used, will probably record a relatively small number of camper nights for the season and will be represented by a small symbol. An expression of intensity of campground use is given in the succeeding map.

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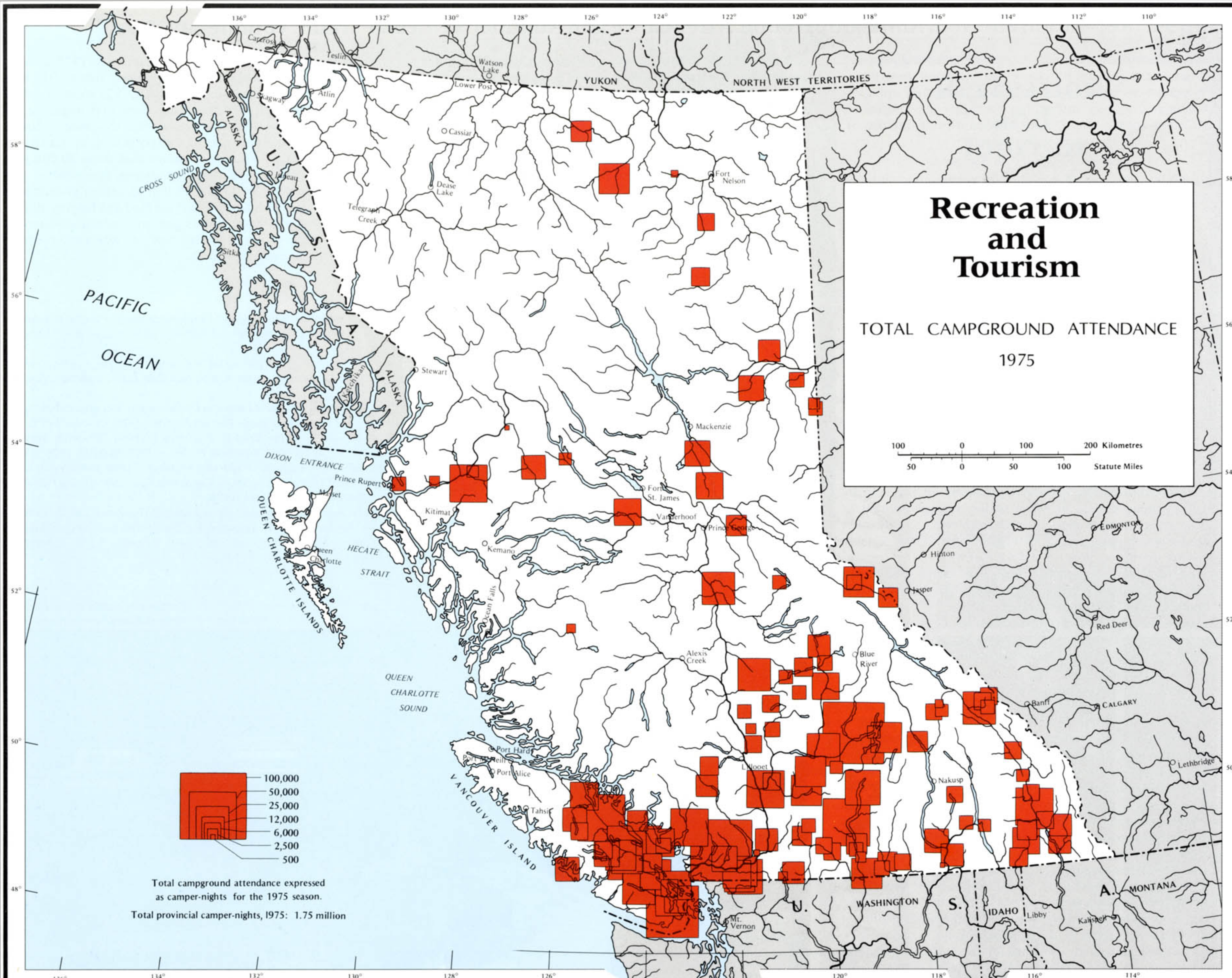

Recreation and Tourism
TOTAL CAMPGROUND ATTENDANCE
1975
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
100,000
50,000
25,000
12,000
6,000
2,500
500
Total campground attendance expressed as camper-nights for the 1975 season.
Total provincial camper-nights, 1975: 1.75 million
PACIFIC OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
CROSS SOUND
WASHINGTON
IDAHO
MONTANA
Watson Lake
Lower Post
Teslin
Atlin
Cassiar
Fort Nelson
Dease Lake
Telegraph Creek
Stewart
Prince Rupert
Kitimat
Kemano
Mackenzie
Fort St. James
Vanderhoof
Prince George
Alexis Creek
Blue River
Jasper
Hinton
Edmonton
Red Deer
Banff
Calgary
Lethbridge
Nakusp
Lillooet
Port Hardy
Port Alice
Tahsis
Mt. Vernon
Libby
Kalispell
Ocean Falls

Map 55. Recreation and Tourism: Campground Attendance and Summer Vehicular Traffic Volumes, 1975

The map opposite complements that on the preceding page. For purposes of comparison, it is convenient to know how intensively a given campground is used. A small, seemingly unimportant campground may, in fact, have a higher use-rate than a large, better-known one. One expression of user-intensity is:

$$\frac{\text{camper nights/season}}{\text{number of campsites/campground.}}$$

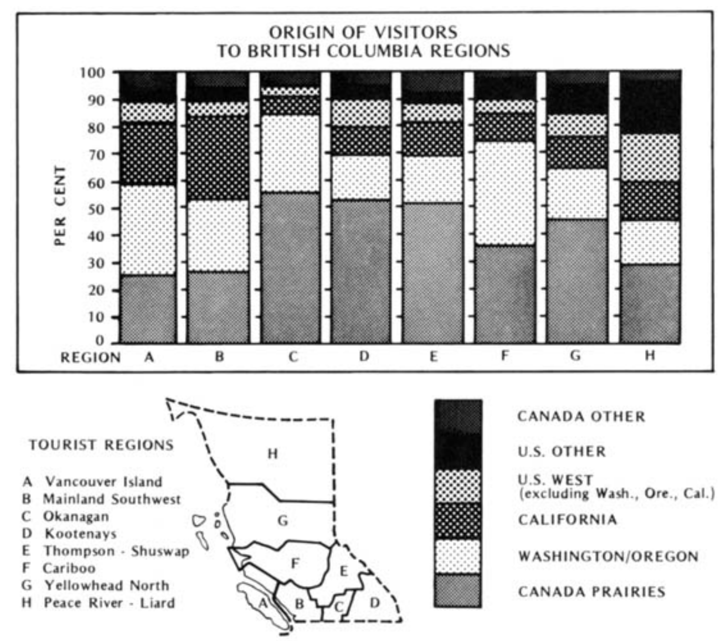
Using this measure, a small, heavily used campground with few campsites can be readily distinguished from a large campground with many sites that may accommodate a season's total of many more campers but that may not be so intensively used. Thus, some assessment of the "popularity" of a campground can be made.

The map shows only provincial campgrounds and indicates that in 1975 Topley Landing Park (on Babine Lake), Loon Lake Park, Marble Canyon Park, and Montague Harbour Marine Park experienced very heavy use. In each case the number of developed campsites is small. By comparison, Miracle Beach Park, one of the larger and better-known campgrounds on Vancouver Island recorded less than 270 camper nights per unit. It should be borne in mind, however, that an average of 270 nights per unit in itself represents a high degree of campsite use and that in peak demand periods the intensity is much higher. Further, the total number of users of the Miracle Beach campground is much greater.

An indirect indication of campground use is vehicular access and traffic volume. The latter is represented on the map by flow-lines proportionate in width to the average number of vehicles using the route. Flow-lines are simplified and only those routes for which traffic counts are available are shown. Notably absent are the flows along the Alaska Highway, in the Terrace-Nass Basin area, and on northern Vancouver Island. In instances where ferry trips are involved, line-width is based upon vehicle count only, not passenger numbers.

Beyond southwestern British Columbia, 1975 summer vehicle traffic was heaviest in the loop via the Fraser Canyon route to Cache Creek, eastward to Kamloops and Revelstoke, through the Okanagan Valley, and along the Hope-Princeton highway. Some of that traffic is accounted for by freight trucks and other service vehicles, but a large share of it is comprised of automobiles. It is not possible to determine from the vehicle counts what proportion of the summer automobile traffic is made up of campground-users. Even among those who are, not all stay at campgrounds in Provincial Parks.

In addition to campers, there are many recreationists who may be classed as tourists who stay at hotels and motels. Thus, the distribution and use-frequency of tourist accommodation could provide a good indication of the recreational attractiveness of a given area and visitor circulation within it. Especially for motels, however, occupancy rates are not available. In a general way, though, it is possible to provide some indication of the spatial pattern of tourism on the basis of visitor sampling. The accompanying diagram shows, for each of eight tourist regions in the province, the origins of non-resident visitors. For all regions, a high proportion from the Canadian prairies and from Washington, Oregon, and California is evident. People from outside Anglo-America constitute a very small proportion of the visitor population. The great majority of the estimated 7.25 million persons who visited British Columbia in 1975 travelled by automobile. Consequently, it is no surprise to find that those states and provinces closest to British Columbia accounted for most of the visitor traffic everywhere, though there are notable differences from region to region in that regard. For the province as a whole, about three-quarters of the Canadian total came from Alberta; nearly half of the United States visitors came from Washington. Within the Peace River-Liard region, however, travellers from states other than those on the west coast made up over one-third of the visitor total.



Not all of the visitors to British Columbia in 1975 came as tourists; many were on business trips. Similarly, many of the B.C. residents who made trips of over 160 km in 1975 were travelling on business. Regardless of the distinctions that might be attempted using these data, it is evident that the travel industry constitutes an important part of tertiary economic activity in British Columbia. It has been estimated that about 70,000 persons were employed in the accommodation, food service, and recreation industries in 1975 and that travellers generated a revenue of nearly $1 billion, mainly for food and lodging, during that year. As an indication of the significance of tourist-catering, about two-thirds of the generated revenue was attributable to spending by non-resident visitors.

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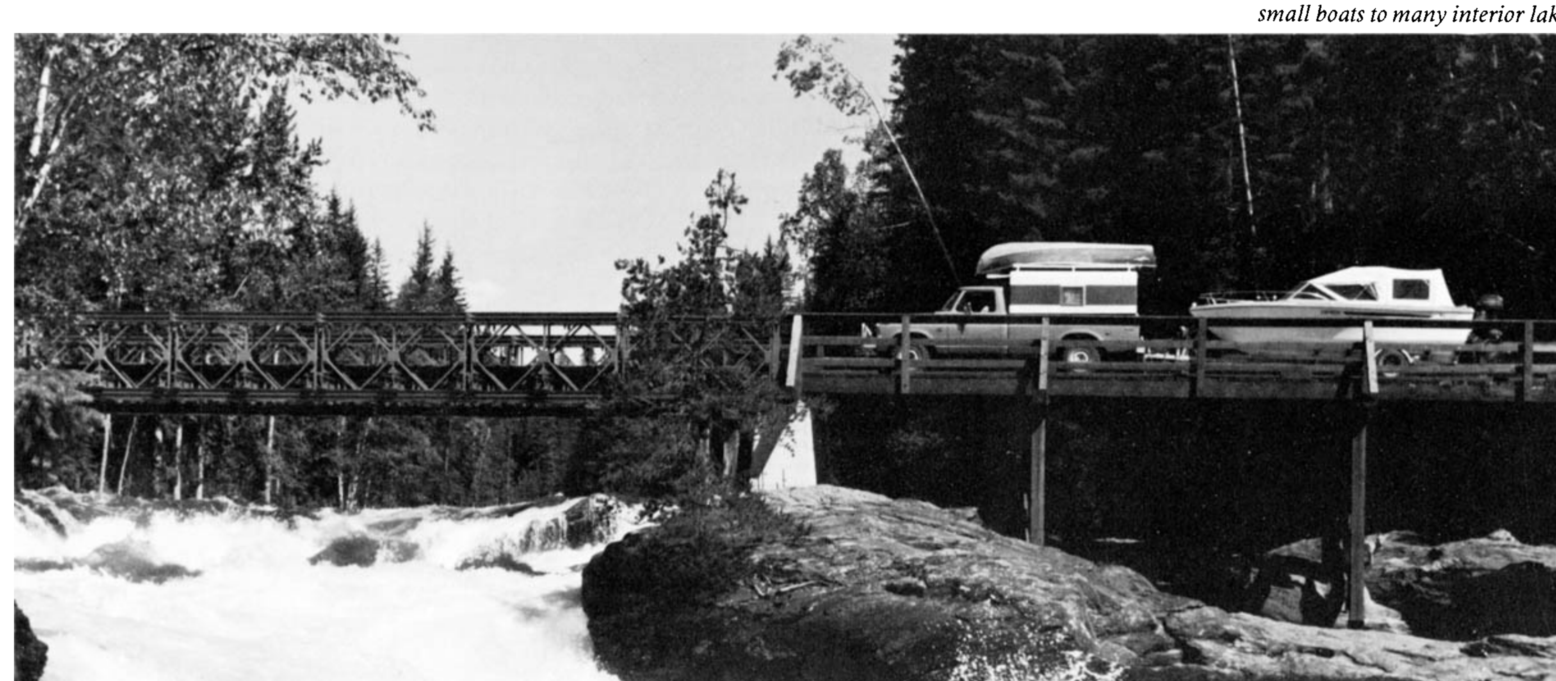
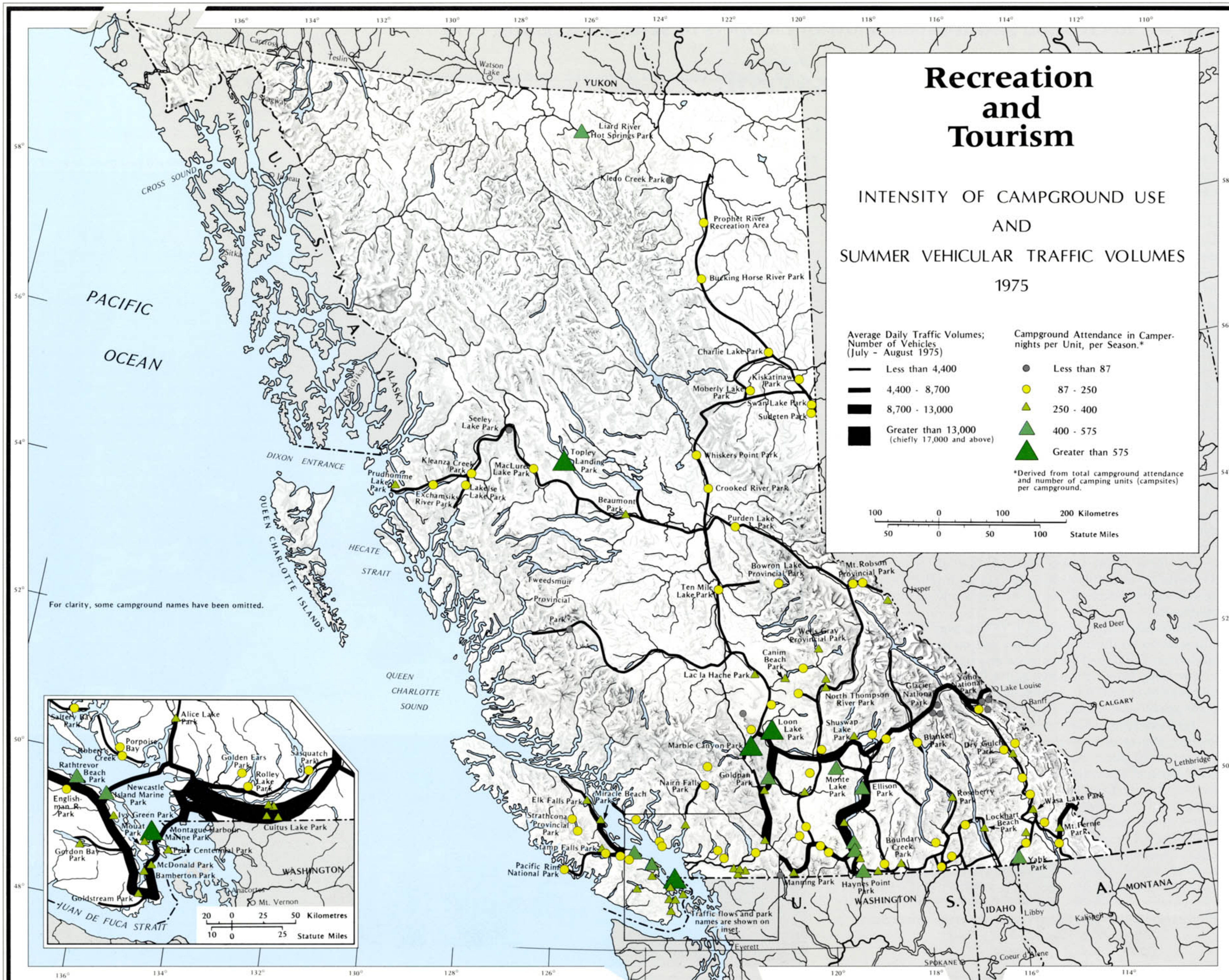
Car tops and trailers are used to carry small boats to many interior lakes.





Recreation and Tourism
INTENSITY OF CAMPGROUND USE AND SUMMER VEHICULAR TRAFFIC VOLUMES 1975
Average Daily Traffic Volumes; Number of Vehicles (July - August 1975)
Less than 4,400
4,400 - 8,700
8,700 - 13,000
Greater than 13,000 (chiefly 17,000 and above)
Campground Attendance in Camper-nights per Unit, per Season.*
Less than 87
87 - 250
250 - 400
400 - 575
Greater than 575
*Derived from total campground attendance and number of camping units (campsites) per campground.
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
For clarity, some campground names have been omitted.
Traffic flows and park names are shown on inset.
PACIFIC OCEAN
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
CROSS SOUND
YUKON
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
Liard River Hot Springs Park
Kledo Creek Park
Prophet River Recreation Area
Bucking Horse River Park
Charlie Lake Park
Kiskatinaw Park
Moberly Lake Park
Swan Lake Park
Sudeten Park
Whiskers Point Park
Crooked River Park
Purden Lake Park
Seeley Lake Park
Kleanza Creek Park
MacLure Lake Park
Topley Landing Park
Prudhomme Lake Park
Exchamsiks River Park
Lakelse Lake Park
Beaumont Park
Bowron Lake Provincial Park
Mt. Robson Provincial Park
Ten Mile Lake Park
Tweedsmuir Provincial Park
Wells Gray Provincial Park
Canim Beach Park
Lac la Hache Park
North Thompson River Park
Glacier National Park
Yoho National Park
Loon Lake Park
Marble Canyon Park
Shuswap Lake Park
Blanket Park
Dry Gulch Park
Nairn Falls Park
Goldpan Park
Monte Lake Park
Ellison Park
Rosebery Park
Wasa Lake Park
Elk Falls Park
Miracle Beach Park
Strathcona Provincial Park
Stamp Falls Park
Pacific Rim National Park
Lockhart Beach Park
Mt. Fernie Park
Boundary Creek Park
Yahk Park
Manning Park
Haynes Point Park
Teslin
Carcross
Watson Lake
Skagway
Juneau
Sitka
Ketchikan
Jasper
Red Deer
Lake Louise
Banff
CALGARY
Lethbridge
Libby
Kalispell
Coeur d'Alene
SPOKANE
Everett
Saltery Bay Park
Roberts Creek
Porpoise Bay
Alice Lake Park
Golden Ears Park
Rolley Lake Park
Sasquatch Park
Rathtrevor Beach Park
Newcastle Island Marine Park
Englishman R. Park
Ivy Green Park
Mouat Park
Montague Harbour Marine Park
Cultus Lake Park
Gordon Bay Park
Prior Centennial Park
McDonald Park
Bamberton Park
Goldstream Park
JUAN DE FUCA STRAIT
Anacortes
Mt. Vernon
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 56. Recreation and Tourism: Flow of Campers to Selected Regions, 1976

The maps on the accompanying page were prepared to suggest the dynamics of one aspect of recreation. They show the flow of campers to the three most popular camping regions of British Columbia. The maps are based upon the 1976 seasonal totals of camper nights for Provincial Parks within the respective Resource Management Regions, the boundaries of which are indicated. Data are for Provincial Parks at which a camping fee is charged and for which relatively detailed camper records are maintained.

From the first map it is evident that 40 per cent of the attendance at Vancouver Island campgrounds was composed of Island residents. The flow from the Lower Mainland was considerable, but only slightly larger than that from the United States. During the camping season direct ferry connections to the Victoria area are available from Port Angeles, Seattle, and Anacortes as well as via the British Columbia mainland, and this ease of access may encourage American visitors. Also, Victoria is widely known as a tourist-catering centre, and travellers may wish to spend some time there in conjunction with a camping trip to the Island. Further, Vancouver Island has a diversity of recreational attractions, including sea-angling, and is regarded by many as the showplace of the provincial park system. On the other hand, many campers resident in the Lower Mainland region may be dissuaded by the cost of a round trip by ferry and the length of the summer lineups, given the alternative opportunity of a visit to the Thompson-Okanagan region. Visitors to Island campgrounds from Alberta and from other Canadian provinces make up 18 per cent of the total — a higher proportion than stay at campgrounds in the Lower Mainland. In considering these relative amounts, it is well to remember that the total campground attendance at Vancouver Island parks was far greater than for those of the Lower Mainland. Details of these areal differences are not easily explained, but it seems that Vancouver Island is widely perceived as an area of outstanding recreational opportunity.

The second map shows that in 1976 Lower Mainland residents were by far the most important user-group in that region. Visitors from the United States made up a significant proportion, but few came from Vancouver Island. Even fewer came from other regions in British Columbia, though this is in part a function of smaller user-populations in those regions.

Total campground attendance in the Thompson-Okanagan Resource Management Region in 1976 was comparable to that for Vancouver Island. Again, the relative attractiveness of the area is apparent. Although the region ranks second in population after southwestern British Columbia, only 14 per cent of the campground use was attributable to local residents. Nearly one-quarter of the total use was by Albertans. In that connection, Kamloops is a convenient day's drive from Calgary via the Trans-Canada Highway. The fact that Vancouver Island residents accounted for 6 per cent of the campground use suggests the desire of people to experience both saltwater and freshwater oriented recreation. Such complementarity results from the very different physical and biotic environments of the two regions.

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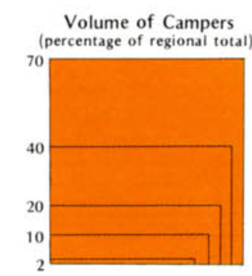
Top: Skiing in Garibaldi Park rivals the world's best.

Bottom: Chuckwagon races provide excitement at summertime rodeos in the Interior.

Recreation and Tourism

FLOW OF CAMPERS TO SELECTED REGIONS 1976

VANCOUVER ISLAND

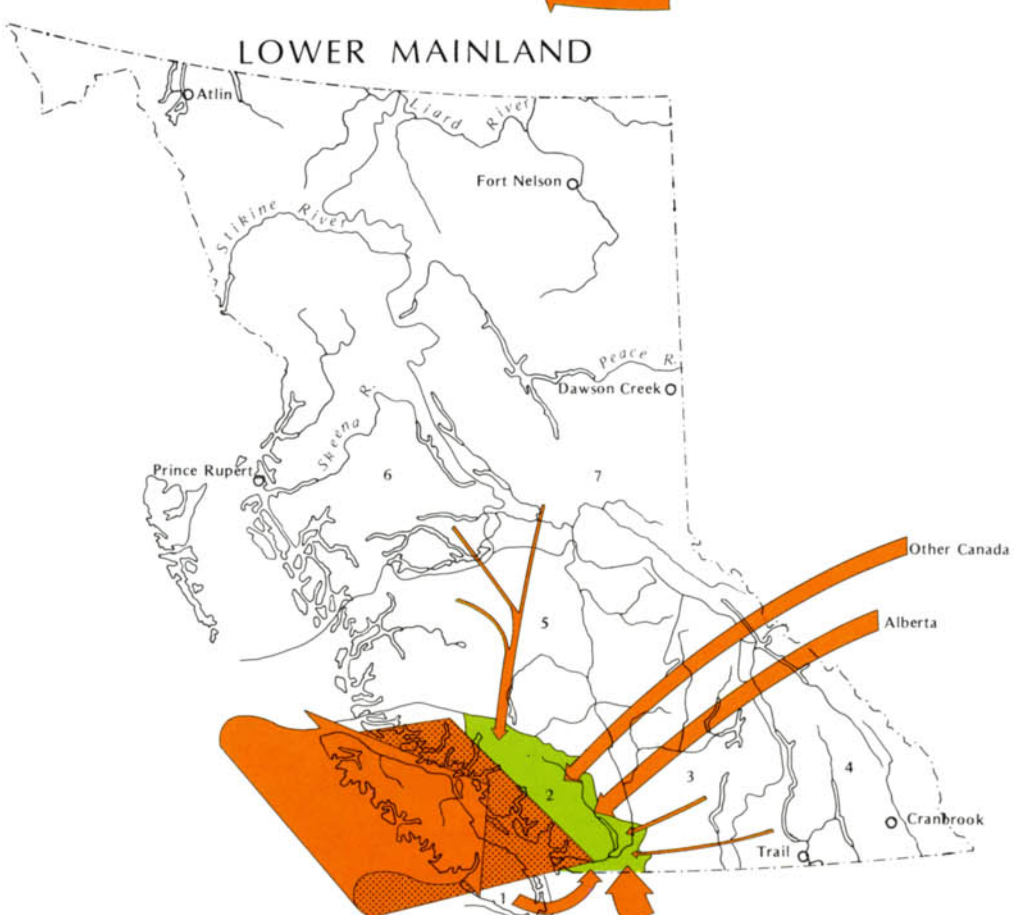


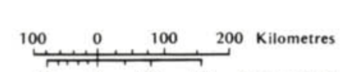
Resource Management Regions

1 Vancouver Island
2 Lower Mainland
3 Thompson - Okanagan
4 Kootenay
5 Cariboo
6 Skeena
7 Omineca - Peace

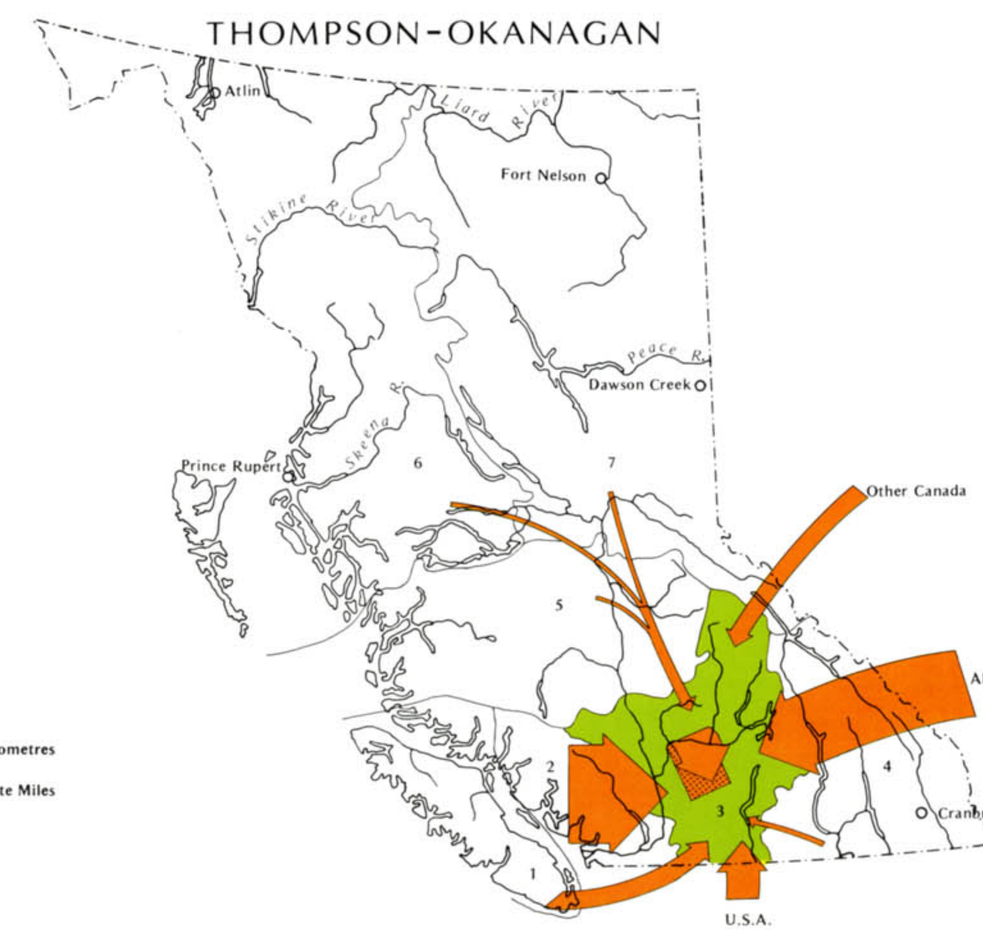
Width of arrow is proportionate to volume of flow from regions indicated.

LOWER MAINLAND





THOMPSON-OKANAGAN



Map 57. Transportation: Land and Ferry Routes and Airports, 1976

British Columbia accounts for about 17 per cent of Canada's exports and a high proportion of the products destined for export are moved to the Vancouver area or to Prince Rupert by rail. The rail network is generally similar to that of roads. The two transcontinental railways traverse much unpopulated country, and the northern extensions of the British Columbia Railway penetrate virtual wilderness. With a combined main track distance of 5,200 km in British Columbia, Canadian Pacific and Canadian National railways provide links to ice-free west coast ports that in turn facilitate connections with Pacific Rim markets. In that sense the resources and industrial products of much of Canada are tributary to Prince Rupert and particularly to Vancouver. The British Columbia Railway, with over 2,000 km of main track, has been developed largely to encourage resource industries in the interior, especially in central and northern areas where the roads are few and shipping distances are considerable. For example, Prince George is over 700 km by road from Prince Rupert and nearly 800 km from Vancouver. For haul distances of that magnitude, rail transport of bulk materials is commonly considered to be more cost-efficient than truck transport.

In addition to the main railway systems, there are five other operating railways in the province — Northern Alberta Railways, British Columbia Harbours Board, Burlington Northern, B.C. Hydro, and White Pass and Yukon. The most recent of these, the B.C. Harbours Board Railway, is an integral part of the transport system delivering coal from the East Kootenay area to Japanese markets. Rail traffic is discussed in the text for Map 59.

The physical nature of the province is such that water transport is often the most efficient means of moving passengers and freight. A variety of services is maintained, but the most extensive component is the system operated by British Columbia Ferries. It provides service to Vancouver Island and coastal communities northward to Prince Rupert, from which linking service to Alaska is available. The provincial Department of Highways also operates a ferry fleet as part of the road system. Statistics on ferry traffic are given in the text for Map 58.

Because of difficulty of access occasioned by terrain, because of the linear and nodal pattern of settlement, and because of time/distance considerations, air transport also figures prominently. Especially on the coast, many communities depend as much upon seaplanes as upon watercraft. There are about 350 landing fields and 100 seaplane bases in the province, not all of which could be conveniently shown on the map. Most of the air traffic, however, is handled at the major airports which have frequent, scheduled service. Vancouver, Victoria, and Prince George airports account for about 80 per cent of the passenger and air-freight traffic. As would be expected, Vancouver International Airport is dominant, handling about two-thirds of the 1976 total passenger traffic. For flights within the province originating or terminating at Vancouver, the main passenger traffic is with Kelowna, Nanaimo, Prince George, Kamloops, Victoria, and Prince Rupert, in that order. Approximately two-thirds of Vancouver's 1976 total of about 800,000 inbound and outbound passengers on internal flights had destinations or origins in those cities.

Several international air carriers operate services at Vancouver, but Canadian Pacific and Air Canada account for much of the total traffic. In addition to regular terminal facilities, C.P. Air has a major aircraft repair and maintenance depot at Vancouver. In 1976 appproximately 2 million outbound passengers and 30,000 tonnes of outbound mail and air freight were handled at Vancouver. Over half of British Columbia's outbound passenger traffic was to Canadian destinations — Toronto, Calgary, and Edmonton accounting for 40 per cent. Of the total outbound passenger traffic from Vancouver, 17 per cent went to destinations in the continental United States and another 12 per cent embarked on other international flights.

On the accompanying diagram the tonnages of imported materials, such as food products, automobiles, and other manufactured items, are small in comparison with high bulk, low value exports. In 1976 about 11 million tonnes of coastwise and 33 million tonnes of deepsea cargo were loaded. On a value basis, total exports of all commodities through British Columbia customs ports in 1976 was approximately $7.4 billion. Total imports were valued at $3.1 billion. Not all imports to British Columbia are consumed within the province, however, and many foreign products consumed in British Columbia enter Canada through other customs ports.

Except for Kitimat, where alumina is imported to feed the large aluminum smelter, the symbols portraying international traffic reflect export flows. With the exception of cereal grains, those exports are very largely of British Columbia origin.

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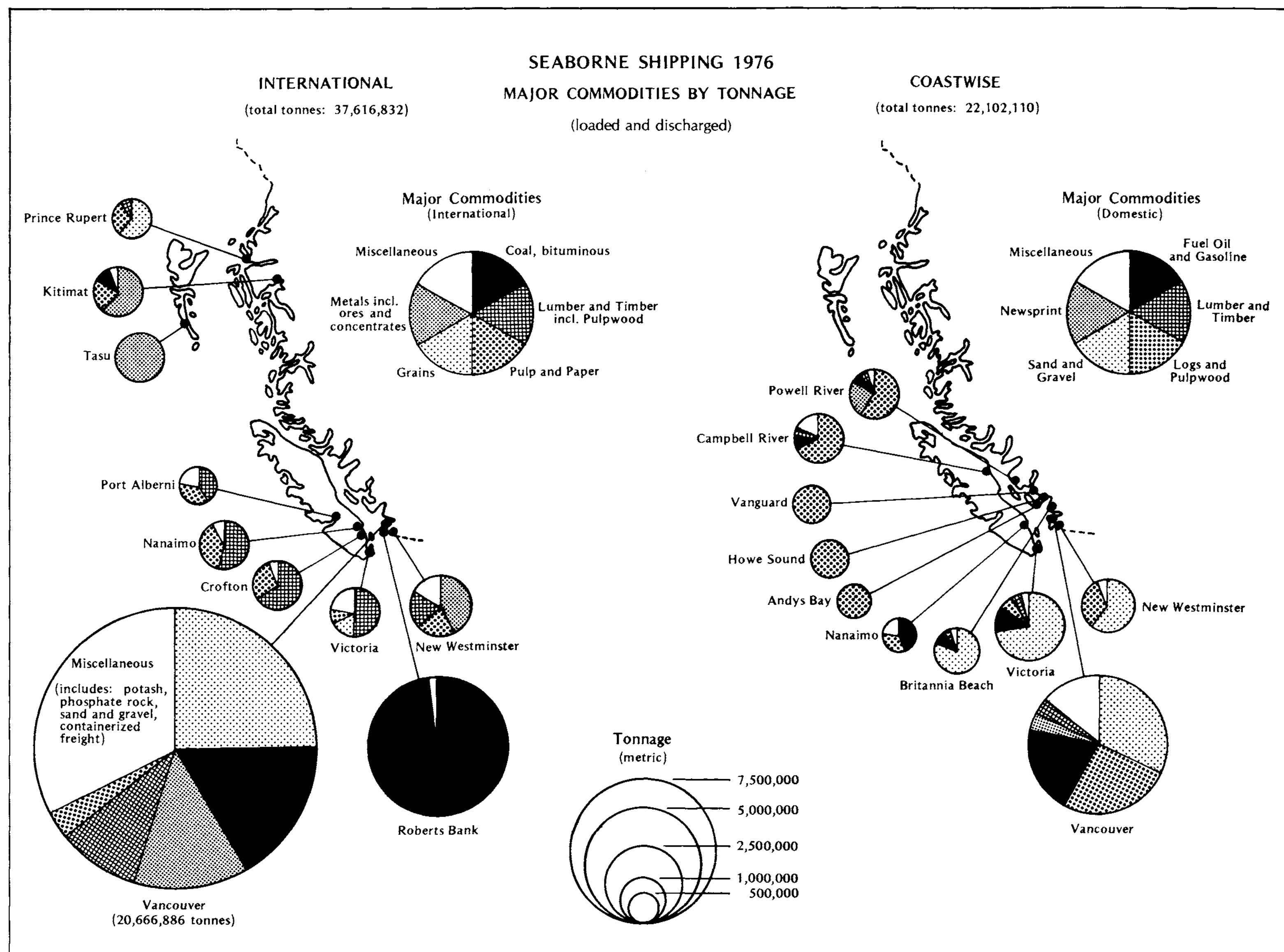

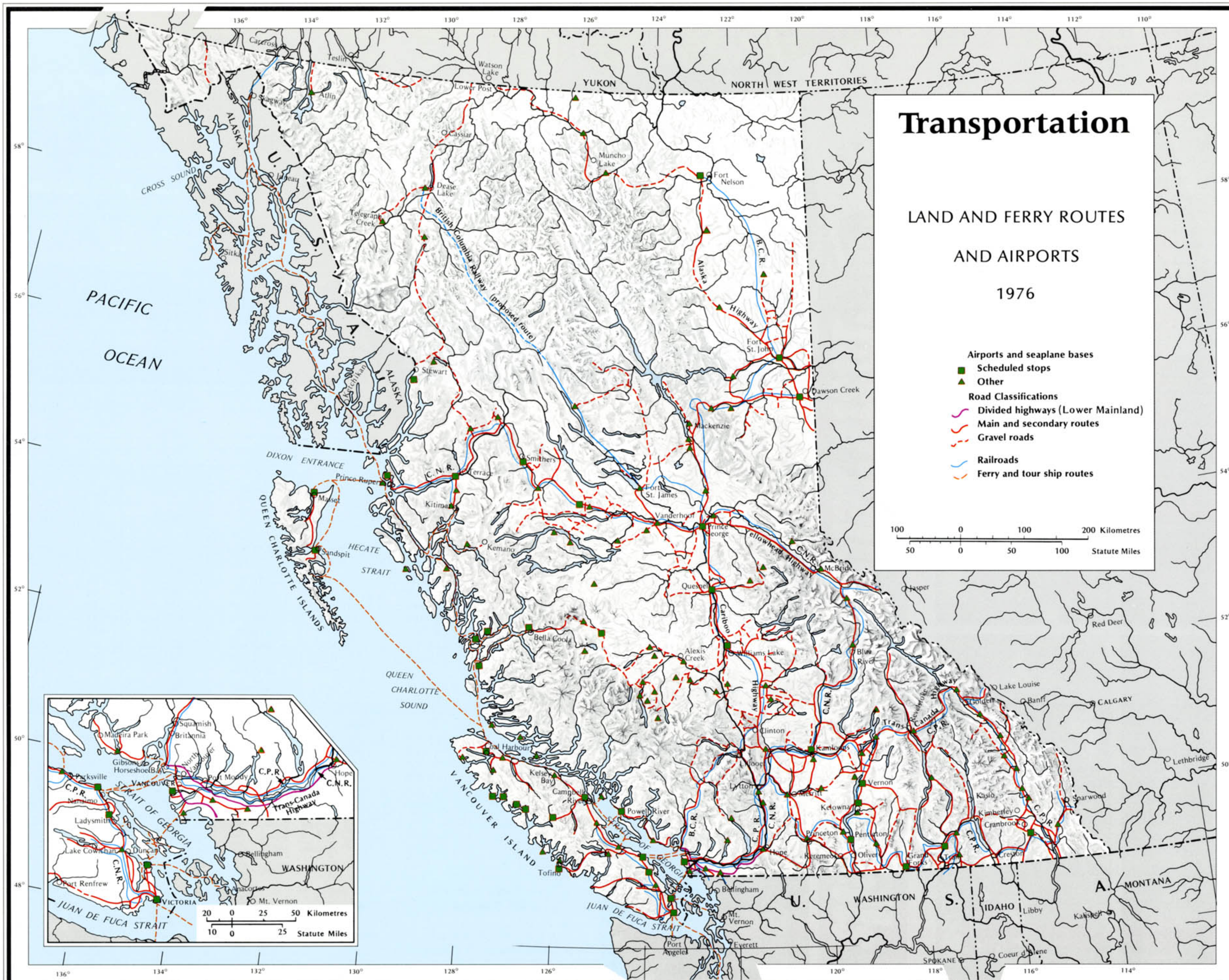
Transportation
LAND AND FERRY ROUTES
AND AIRPORTS
1976
Airports and seaplane bases
Scheduled stops
Other
Road Classifications
Divided highways (Lower Mainland)
Main and secondary routes
Gravel roads
Railroads
Ferry and tour ship routes
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALASKA
U. S. A.
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
JUAN DE FUCA STRAIT
WASHINGTON
IDAHO
MONTANA
Atlin
Teslin
Carcross
Skagway
Juneau
Sitka
Watson Lake
Lower Post
Cassiar
Dease Lake
Telegraph Creek
Muncho Lake
Fort Nelson
Alaska Highway
B.C.R.
British Columbia Railway (proposed route)
Fort St. John
Dawson Creek
Stewart
Mackenzie
Prince Rupert
C.N.R.
Terrace
Kitimat
Smithers
Masset
Sandspit
Kemano
Fort St. James
Vanderhoof
Prince George
Yellowhead Highway
McBride
Jasper
Quesnel
Cariboo
Bella Coola
Alexis Creek
Williams Lake
Blue River
Red Deer
Lake Louise
Banff
Calgary
Golden
Trans-Canada Highway
C.P.R.
Clinton
Kamloops
Lytton
Vernon
Merritt
Kelowna
Princeton
Penticton
Keremeos
Oliver
Grand Forks
Trail
Nelson
Kaslo
Kimberley
Cranbrook
Creston
Sparwood
Lethbridge
Hope
Port Hardy
Kelsey Bay
Campbell River
Powell River
Tofino
Bellingham
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell
Squamish
Britannia
Madeira Park
Gibsons
Horseshoe Bay
North Vancouver
Vancouver
Port Moody
Parksville
Nanaimo
Ladysmith
Lake Cowichan
Duncan
Port Renfrew
Victoria
Anacortes
Strait of Georgia
20 0 25 50 Kilometres
10 0 25 Statute Miles

Map 58. Transportation: Traffic Flows (Percentage Change 1966–1971)

Change in traffic flows over time is one measure of the vital circulation process of goods and of people. It reflects regional differences in economic development, whether they derive from dam construction, from expansion in a resource industry, from recreation and tourism facilities, or from some other propellant. Map 55 shows average summer road-traffic volumes in conjunction with campground attendance, and the map on the opposite page indicates changes in summer road traffic over five years.

Increases occurred throughout the system in response to overall growth in population, number of licensed vehicles, and economic activity. It is evident, though, that traffic along some routes changed considerably more than on others. Upgrading of the road surface was a major factor. A notable example is the North Thompson road between Kamloops and Yellowhead, which was improved to highway standards in 1970. Traffic there more than doubled between 1966 and 1971. On the other hand, between Williams Lake and Bella Coola there was virtually no growth. That route primarily serves the ranching communities of the Chilcotin country and the fishing and farming area of Bella Coola. Although there has been considerable log hauling over its eastern portion in recent years, the route has been essentially a dead end. The lack of a regular ferry service for passengers and vehicles between Bella Coola and other coastal points and the 1,000 km round trip over a gravel surface have tended to dissuade casual visitors. Changes now being made to coastal ferry services will improve transport connectivity to various mid-coast communities. Another route showing very low increase is that from Pine Pass to the Dawson Creek area. In fact, on some portions there was a decrease in average daily traffic as a result of the decline in construction activity after completion of the first phase of hydro development in the area. In contrast, average daily traffic on Highway 16 west of Prince George showed a substantial increase over the period, owing to developments in forestry and mining there (see Maps 30, 31, and 35).

Data upon which the map is based do not include changes in volume of ferry traffic. However, ferry links are an integral part of the road transport system, and their importance is suggested by the data in the table, which shows traffic on a selection of ferry routes.

In addition to vehicular and passenger ferry traffic within the province, links to external points are provided by the British Columbia Steamship Company, by Black Ball Transport Inc., the Washington State ferry system between Sidney and Anacortes, and by the State of Alaska between Prince Rupert and Skagway. In general, the external links are strongly oriented toward summer tourist traffic.

While the total volume of traffic moved via the ferry systems is much less than that carried by roads, the data suggest its importance and indicate the large percentage increase in traffic on the main routes between 1970 and 1975. The cross-Strait ferry traffic between Vancouver, Victoria, and Nanaimo approximates the volume moved along some of the more important land routes in the province. On that account not only can the ferries be seen as an integral part of the road system, but also the Strait of Georgia can be considered as much a regional bond as a regional barrier.

Active Pass, in the Canadian Gulf Islands, is on the busy Vancouver-Victoria ferry route.

FERRY TRAFFIC–SELECTED ROUTES, 1970 and 1975
Figures are Approximate Round Trip Totals

Route	1970 Passengers (includes vehicle drivers)	1970 Vehicles	1975 Passengers (includes vehicle drivers)	1975 Vehicles	% increase 1970–1975 Passengers	% increase 1970–1975 Vehicles
C.P. Rail						
Vancouver–Nanaimo	—	—	272,000	77,000	—	—
Department of Highways						
Albion (Lower Fraser River)	504,200	286,300	1,039,900	517,500	106	81
Castlegar (Columbia River)	759,400	361,600	939,500	455,700	24	26
Comox–Powell River	155,800	39,400	196,000	50,700	26	29
Denman Island (E. coast, Vancouver Island)	127,400	55,500	296,300	133,100	133	140
Gabriola Island (Nanaimo)	241,500	80,800	458,300	158,600	90	96
Kootenay Lake (Balfour–Kootenay Bay)	316,700	126,600	342,400	149,500	8	18
Needles–Fauquier (Lower Arrow Lakes)	176,400	77,000	324,700	109,300	84	42
Quathiaski Cove (Campbell River–Quadra Island)	289,300	100,800	492,300	205,900	70	104
Sub-total, above routes	2,570,700	1,128,000	4,089,400	1,780,300	59	58
Total All Highways Ferries	4,400,000	1,660,000	6,925,700	2,752,000	57	66
British Columbia Ferries						
Vancouver (Tsawwassen)–Victoria (Swartz Bay)	2,530,700	835,700	4,008,600	1,296,600	58	55
Vancouver (Horseshoe Bay)–Nanaimo (Departure Bay)	1,753,300	653,300	2,633,800	1,013,200	51	55
Horseshoe Bay–Langdale	852,100	345,300	1,363,300	583,100	60	69
Horseshoe Bay–Bowen Island	192,200	68,100	207,700	125,300	60	84
Swartz Bay–Fulford Harbour (Saltspring Island)	167,700	80,000	324,200	153,600	93	92
Kelsey Bay (Vancouver Island)–Prince Rupert	29,600	9,700	54,600	17,000	84	75
Kelsey Bay–Beaver Cove (Vancouver Island)	—	—	74,700	34,400	—	—
Sub-total, above routes (excluding Kelsey Bay–Beaver Cove)	5,525,600	1,992,100	8,666,900	3,223,200	68	72
Total of All B.C. Ferries	5,671,000	2,102,000	9,612,500	3,558,200	70	69

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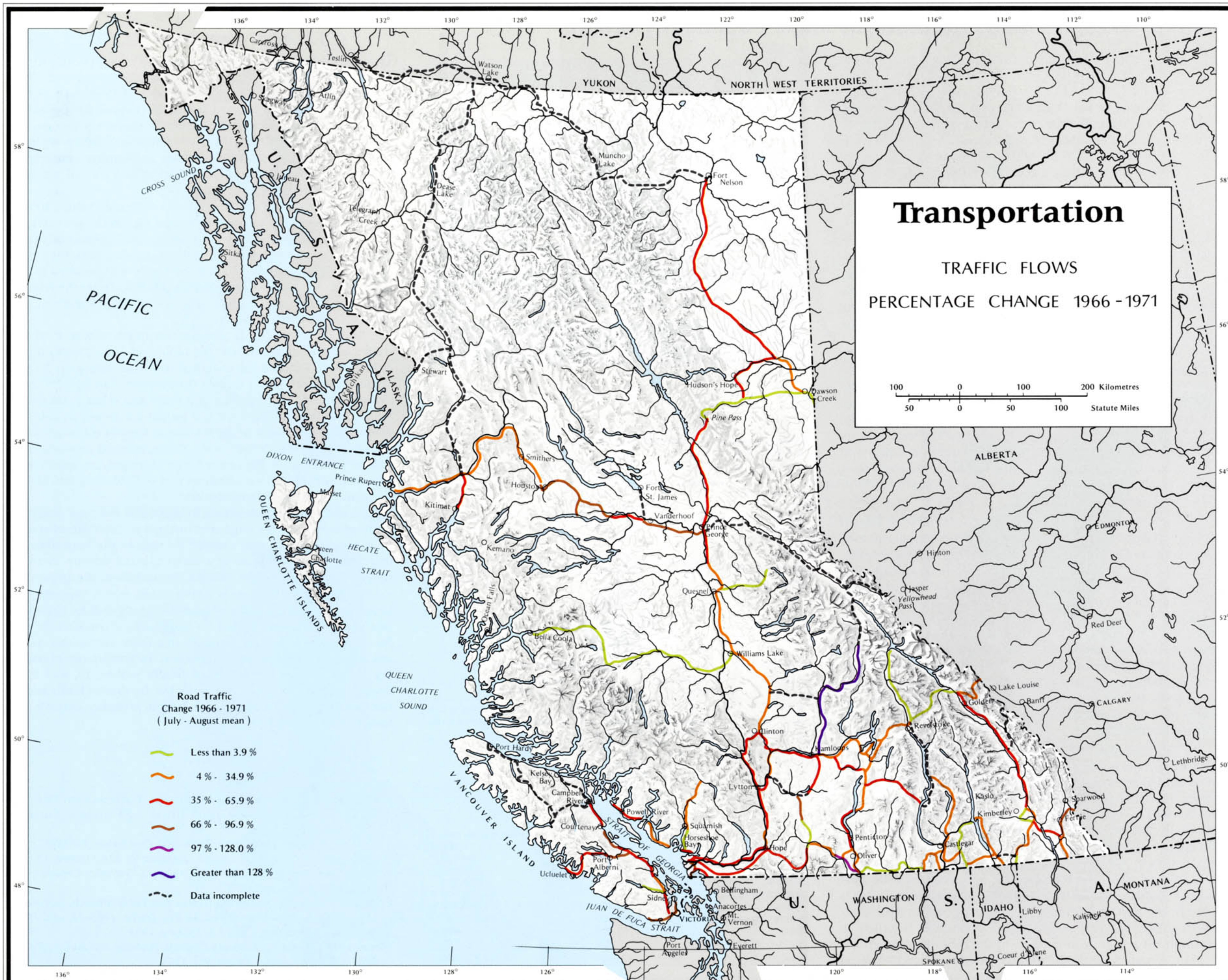
Transportation
TRAFFIC FLOWS
PERCENTAGE CHANGE 1966 - 1971
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Road Traffic
Change 1966 - 1971
(July - August mean)
Less than 3.9 %
4 % - 34.9 %
35 % - 65.9 %
66 % - 96.9 %
97 % - 128.0 %
Greater than 128 %
Data incomplete
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
Carcross
Teslin
Watson Lake
Skagway
Atlin
Juneau
Sitka
Ketchikan
Muncho Lake
Fort Nelson
Dease Lake
Telegraph Creek
Stewart
Hudson's Hope
Dawson Creek
Pine Pass
Smithers
Houston
Prince Rupert
Masset
Kitimat
Kemano
Fort St. James
Vanderhoof
Prince George
Queen Charlotte
Quesnel
Ocean Falls
Bella Coola
Williams Lake
Jasper
Yellowhead Pass
Hinton
Edmonton
Red Deer
Lake Louise
Banff
Golden
Calgary
Revelstoke
Clinton
Kamloops
Lytton
Port Hardy
Kelsey Bay
Campbell River
Powell River
Courtenay
Squamish
Horseshoe Bay
Hope
Penticton
Oliver
Castlegar
Kaslo
Kimberley
Sparwood
Fernie
Lethbridge
Port Alberni
Ucluelet
Sidney
VICTORIA
Bellingham
Anacortes
Mt. Vernon
Everett
Port Angeles
Spokane
Coeur d'Alene
Libby
Kalispell

Map 59. Transportation: Rail Flows by Major Commodity Group

This map is based on information from the Canadian Transport Commission and the British Columbia Railway. The C.T.C. rail information for C.P.R. and C.N.R. freight traffic comes from a 1 per cent sampling of way bills while that for B.C.R. is derived from actual car loadings. From these data, average freight traffic carried on British Columbia's three major rail systems was computed for the period 1972–1974. The commodity groupings are those used by Statistics Canada and the intra-provincial flows are portrayed by Economic Region. For simplicity, and because of space limitations, the six commodity groupings in the original C.T.C. data are reduced to four — "Live Animals" and "Food, Feed and Tobacco" being grouped on the first map, and "End Products — Inedible" and "Special Types of Traffic" on the last.

The intensity of background colour on each map is proportionate to rail tonnage moved. The pie-graph segments show destination of goods, with the size of the segments indicating the volumes of freight traffic moved. The colour and position of the segments indicate destination of goods. For example, map 1 shows that the Northeast Census Division led all other divisions in the shipment of "Live Animals and Food, Feed and Tobacco" in the 1972–1974 average. In fact, live animals and feed were the significant components of that group, as the agricultural orientation of the Peace River country would suggest (see maps 39, 40, and 41). The pie-graph segment indicates that the total volume was appreciable (approximately 235,000 tonnes annually) and that the major destination is Census Division 4 (Lower Fraser Valley). Small quantities move to other divisions or are transhipped within the Peace River region.

In the movement of "Crude Materials (Inedible)," Census Division 1 (East Kootenay) accounts for more annual rail tonnage than any other region. About 300,000 tonnes moved within the East Kootenay region (transhipment) and another 570,000 tonnes moved to Census Division 3 (Okanagan). The great bulk of it, however, amounting to about 8 million tonnes, was coal shipped to the Lower Fraser Valley and destined for export to Japan. It was hauled by 85,000-ton-capacity unit trains from the Fernie area to the Westshore bulk-loading facility at Roberts Bank (see Maps 35 and 47). In Census Division 8, Prince George, over 900,000 tonnes of "Crude Materials (Inedible)" were transhipped within the region. In this case the product was largely mineral, as was the substantial transhipment within Division 9 (Northwest).

"Fabricated Materials (Inedible)" consist mainly of lumber and forest products. Map 3 shows that Census Divisions 6, 8, and 10 accounted for much of the traffic and that the Prince George region was particularly important. Here the annual tonnage moved within the region was greater than that shipped elsewhere. The Prince George Division, however, is served by two major rail lines which have a number of transfer or break-in-bulk points. Although they figure prominently in the movement of rail freight, these centres are not necessarily the final destinations of the commodities moved. Regional consumption is in fact small: most of the product moves to the coast at Vancouver or Prince Rupert, and much of the remainder is railed to transhipment points or to markets in the continental interior.

The tonnage of "End Products (Inedible)" and "Special Types of Traffic" moved by rail was small in comparison to the other commodity groups. The Lower Fraser Valley recorded the largest volumes, with about 50 per cent of the total 254,000 tonnes moved. The appreciable flow from Division 8 to Division 4 does not represent export of finished products. In this case the flow is of "Special Types of Traffic," composed mainly of piggyback operations. Mostly the products are lumber and related forest products, loaded on truck trailers and moved via B.C. Railway to Vancouver.

Unit trains carry coal from Sparwood, in the Kootenays, 1,125 kilometres to the deepwater port at Roberts Bank for transfer to bulk-carriers bound for Japan.

ANNUAL AVERAGES INTERPROVINCIAL RAIL AND TRUCK TRAFFIC AND INTERNATIONAL RAIL TRAFFIC

A. Interprovincial Rail Traffic, 1973–1975 Annual Average (Tonnes)

	Loadings from British Columbia to:	**Unloadings** to British Columbia from:
Atlantic provinces	80,300	17,700
Quebec	366,500	208,700
Ontario	616,000	631,000
Manitoba	211,400	351,500
Saskatchewan	174,200	6,204,300
Alberta	1,962,700	11,049,200
British Columbia (internal)	12,043,500	12,043,500
Total	15,454,600	30,505,900

B. International Rail Traffic, 1973–1975 Annual Average (Tonnes)

Delivered to U.S. Rail from British Columbia*	**Received** from U.S. Rail
4,469,700	2,258,900

*Deliveries to U.S. Rail include all traffic delivered across the B.C. border to U.S. points regardless of origin. Receipts from U.S. Rail include all commodity traffic regardless of final destination.

C. Interprovincial Trucking (Freight), 1974 (Tonnes)

	Origin British Columbia to:	**Destination** British Columbia from:
Atlantic provinces	5,100	3,700
Quebec	24,700	68,800
Ontario	68,900	239,200
Manitoba	60,600	58,900
Saskatchewan	95,100	41,100
Alberta	820,700	1,040,900
British Columbia (internal)	10,804,500	10,804,500
Yukon	89,200	14,000
Northwest Territories	5,000	700
Total	11,973,800	12,271,800

The maps show internal rail flows only and exclude freight traffic carried on the minor rail systems within the province. In 1975 total loadings in British Columbia, including external flows, had risen to approximately 30 million tonnes; unloadings were over 40 million tonnes. Most of the traffic was handled in the Lower Mainland. The accompanying table illustrates the relative strengths of the rail-freight linkages and, for comparison, includes data for truck transport.

Internal flows clearly account for much of the total rail traffic. It is also evident from the table that domestic rail traffic considerably exceeds international and that deliveries to the United States are about double the receipts. The bulk of these exports consists of shipments of lumber and other forest products. Unloadings of domestic rail freight are nearly double the loadings because much of the interior of Canada is hinterland to British Columbia's ice-free ports. Grain, mineral products, and animal products are the major kinds of freight, an appreciable part of which moves via elevators and bulk-loading facilities in Vancouver to international markets.

Available data on trucking indicate that the total domestic tonnage moved is very large, and internal British Columbia traffic is about equal to that shipped by rail. As the haul distance increases, however, there is a more marked decline in truck freight than in rail freight volume. Nevertheless, the amount of truck freight from Ontario is considerable, which suggests Ontario's function as a supplier of manufactured goods for Canadian markets. Unfortunately, data for international truck traffic and for internal flows are not available in a form comparable to the rail tabulation. By inference, however, the importance of trucking in the overall movement of freight within, to, and from British Columbia is great. Especially for the shorter hauls and in the Lower Mainland area, truck freight probably exceeds rail tonnages by a considerable margin.

References

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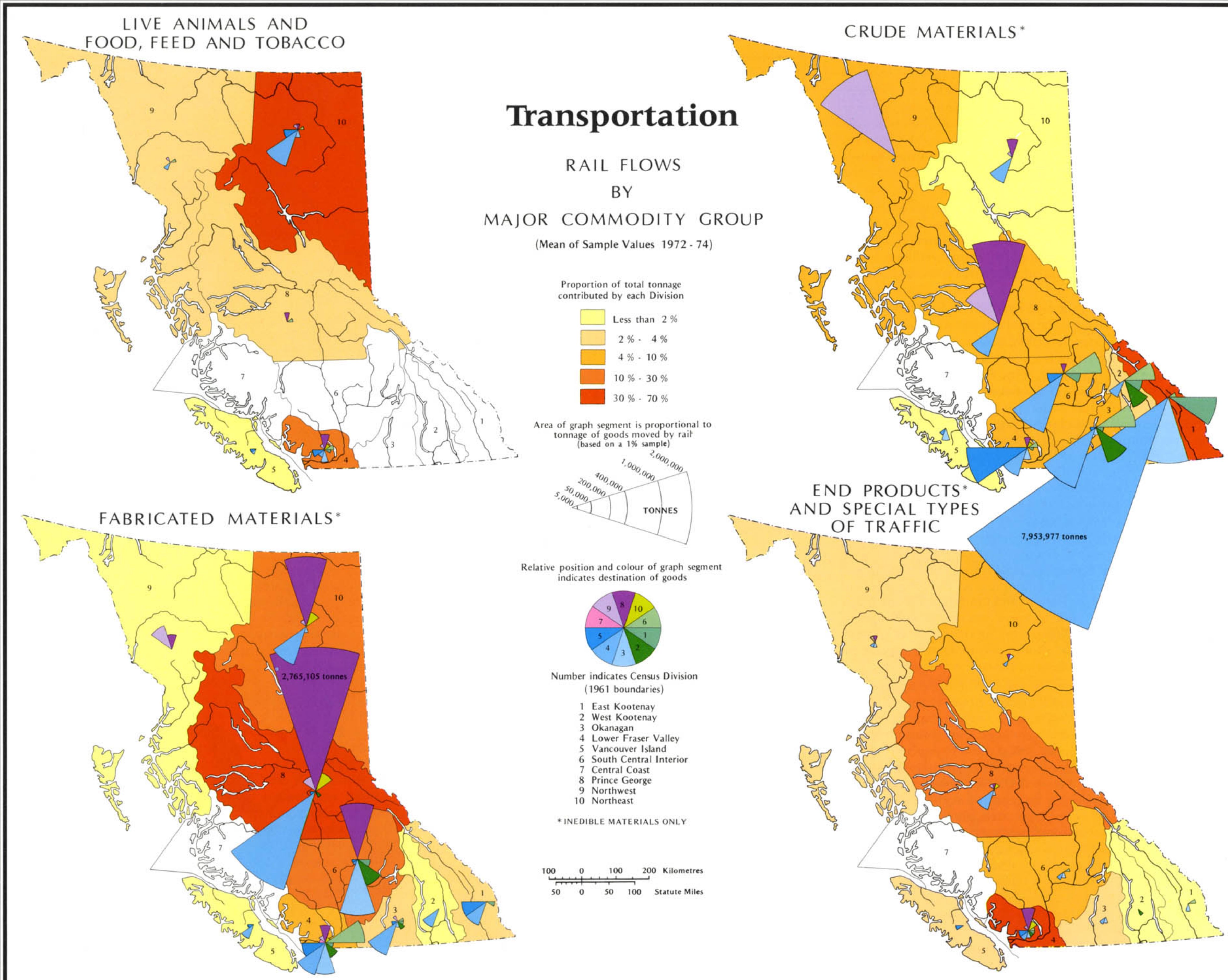
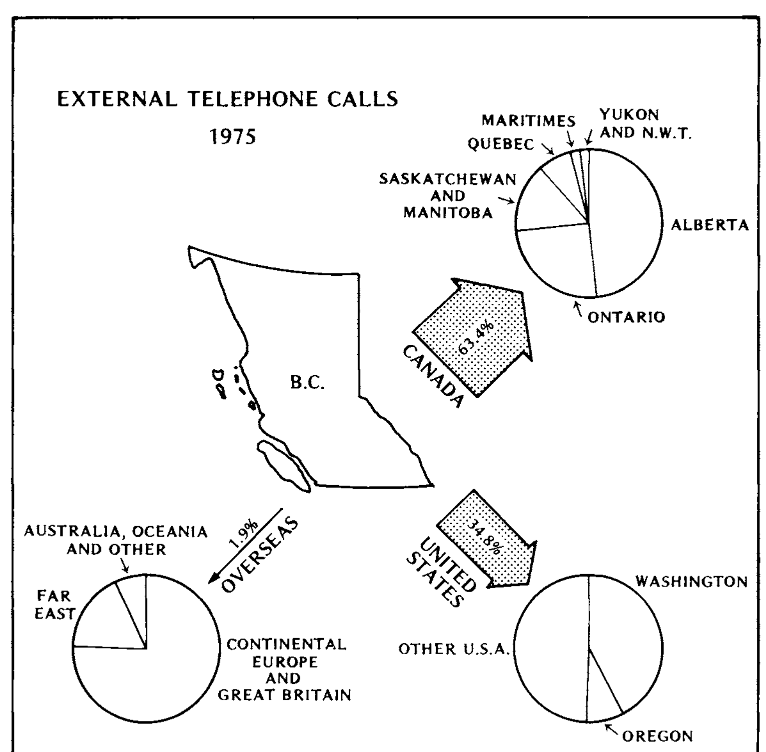

LIVE ANIMALS AND FOOD, FEED AND TOBACCO
CRUDE MATERIALS*
Transportation
RAIL FLOWS
BY
MAJOR COMMODITY GROUP
(Mean of Sample Values 1972 - 74)
Proportion of total tonnage contributed by each Division
Less than 2 %
2 % - 4 %
4 % - 10 %
10 % - 30 %
30 % - 70 %
Area of graph segment is proportional to tonnage of goods moved by rail
(based on a 1% sample)
2,000,000
1,000,000
400,000
200,000
50,000
5,000
TONNES
Relative position and colour of graph segment indicates destination of goods
Number indicates Census Division
(1961 boundaries)
1 East Kootenay
2 West Kootenay
3 Okanagan
4 Lower Fraser Valley
5 Vancouver Island
6 South Central Interior
7 Central Coast
8 Prince George
9 Northwest
10 Northeast
* INEDIBLE MATERIALS ONLY
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
FABRICATED MATERIALS*
2,765,105 tonnes
END PRODUCTS* AND SPECIAL TYPES OF TRAFFIC
7,953,977 tonnes

Map 60. Communication: Regional Linkages Based on Telephone Calls, 1975

Isolated relay stations transfer microwave signals across Canada.



Communication, whether by radio, telex, telephone, or some other form, is basic to the exchange of information between points and thus to the functioning of an industrialized society. The volume and direction of such communication can therefore provide insights into the relative importance of different centres within an area. They can also be useful in assessing the degree of association between regions. The map on the accompanying page expresses, in diagrammatic form, regional linkages based upon telephone communication.

The data upon which the map is based represent a sample of completed toll calls originating from British Columbia stations. In the ten-day sample period there were approximately 255,000 completed toll calls of which about two-thirds were to places in British Columbia and nearly one-quarter to other places in Canada.

The size of the circle for each selected community shown on the map is proportionate to the total number of calls originating from it. For clarity of representation, different colours are used to distinguish calls originating from each given centre. Except for lower volume traffic, the width of the flow lines is proportionate to the volume of telephone traffic between respective centres. A hierarchy of urban places in the province is immediately apparent from the circle symbols. Not surprisingly, Vancouver, Victoria, Nanaimo, and New Westminster are dominant, but Campbell River shows a disproportionately high volume of originating traffic considering its rather modest population (approximately twelve thousand in 1976). A possible explanation is that Campbell River is not only the major regional centre for northern Vancouver Island but also an important coastal base for scheduled and non-scheduled commercial seaplane services. Prince Rupert, by contrast, accounted for only 1 per cent of the total originating calls. Among interior centres, Prince George and Kamloops are dominant, each accounting for about 7 per cent of the total traffic. Kelowna, Nelson, and Cranbrook are the major centres for telephone traffic in the southern and southeastern parts of the province. Each is an important centre of regional administration. The linkages from them to Alberta suggest regional interaction, especially with Calgary.

Flow lines represent traffic from each of the selected centres to the five most frequently called places. About 17 per cent of the calls from Prince George, for example, were to Vancouver; less than 3 per cent were placed to Kamloops. Only about 1,700 calls originated from Prince Rupert, and of these 30 per cent were to Vancouver. One of the more interesting regional links revealed in the map data is that between Dawson Creek and Alberta. Although Prince George may be regarded as the dominant regional centre for the Peace River area, about as many long-distance calls were placed from Dawson Creek to Edmonton as to Prince George, and Edmonton and Calgary together account for over 12 per cent of the outgoing calls from Dawson Creek. This may be a measure of Edmonton's sphere of influence as a major western Canadian city, but it probably also reflects the traditional orientation of the Peace River country. Until comparatively recent times, transport connections from Dawson Creek were far more effective to the southeast than to the southwest.

The rather convoluted pattern in southwestern British Columbia represented in the inset suggests the strong ties between Victoria and Vancouver. About one-third of the toll calls originating in Victoria were placed to stations in Vancouver; less than 9 per cent went to Nanaimo. The external linkages from Vancouver are suggested by the fact that while 10 per cent of the originating calls were channelled to Victoria, over 5 per cent were to Toronto and 4 per cent to Calgary.

The accompanying text illustration represents the frequency of all telephone calls originating in British Columbia to points outside the province. Over 60 per cent of the external calls were to other Canadian provinces, and most of the rest were to points in the United States. Less than 2 per cent were placed to overseas destinations. Of the Canadian calls, about half went to Alberta stations and another one-quarter to Ontario. Of those to the United States over 40 per cent were to Washington and another 8 per cent to Oregon. Britain and continental Europe took three-quarters of the overseas calls, much of the remainder being placed to stations in the Far East.

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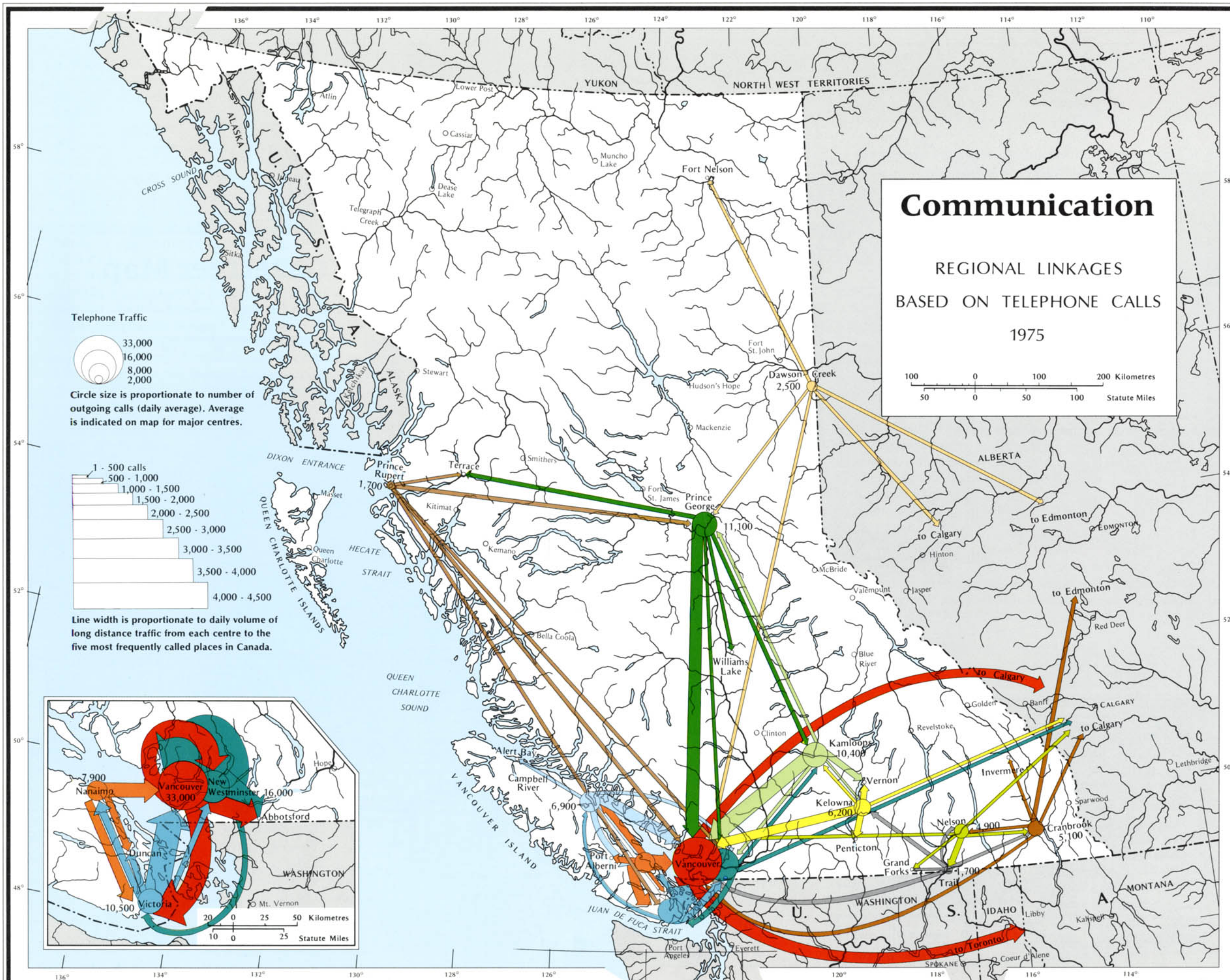
Communication
REGIONAL LINKAGES
BASED ON TELEPHONE CALLS
1975
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
Telephone Traffic
33,000
16,000
8,000
2,000
Circle size is proportionate to number of outgoing calls (daily average). Average is indicated on map for major centres.
1 - 500 calls
500 - 1,000
1,000 - 1,500
1,500 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 3,500
3,500 - 4,000
4,000 - 4,500
Line width is proportionate to daily volume of long distance traffic from each centre to the five most frequently called places in Canada.
YUKON
NORTH WEST TERRITORIES
ALBERTA
ALASKA
U. S. A.
WASHINGTON
IDAHO
MONTANA
CROSS SOUND
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
JUAN DE FUCA STRAIT
Atlin
Lower Post
Cassiar
Muncho Lake
Dease Lake
Telegraph Creek
Fort Nelson
Juneau
Sitka
Stewart
Fort St. John
Hudson's Hope
Dawson Creek
2,500
Mackenzie
Smithers
Terrace
Prince Rupert
1,700
Masset
Kitimat
Fort St. James
Prince George
11,100
Kemano
Queen Charlotte
McBride
Valemount
Jasper
Hinton
to Calgary
to Edmonton
EDMONTON
Red Deer
Bella Coola
Williams Lake
Blue River
Golden
Banff
CALGARY
Revelstoke
Clinton
Kamloops
10,400
Vernon
Kelowna
6,200
Penticton
Invermere
Lethbridge
Sparwood
Cranbrook
5,100
Nelson
1,900
Grand Forks
Trail
1,700
Alert Bay
Campbell River
6,900
Port Alberni
Vancouver
Port Angeles
Everett
Spokane
Coeur d'Alene
Libby
Kalispell
to Toronto
Nanaimo
7,900
Vancouver
33,000
New Westminster
16,000
Abbotsford
Hope
Duncan
Victoria
10,500
Mt. Vernon
20 0 25 50 Kilometres
10 0 25 Statute Miles

Gazetteer Map
WITH N.T.S. GRID
100 0 100 200 Kilometres
50 0 50 100 Statute Miles
PACIFIC
OCEAN
YUKON
NORTH WEST TERRITORIES
ALBERTA
WASHINGTON
IDAHO
MONTANA
U. S. A.
ALASKA
CASSIAR
OMINECA
PEACE
CARIBOO
OKANAGAN
KOOTENAY
BOUNDARY
QUEEN CHARLOTTE ISLANDS
DIXON ENTRANCE
HECATE STRAIT
QUEEN CHARLOTTE SOUND
STRAIT OF GEORGIA
JUAN DE FUCA STRAIT
BARKLEY SOUND
CROSS SOUND
VANCOUVER ISLAND
Graham Island
Moresby Island
Prince of Wales Island
Baranof Island
Bowie Seamount
Prince Rupert
Prince George
Fort St. John
Fort Nelson
Dawson Creek
Grande Prairie
Kamloops
Vernon
Kelowna
Penticton
Nelson
Cranbrook
Revelstoke
Quesnel
Williams Lake
Nanaimo
VICTORIA
VANCOUVER
EDMONTON
CALGARY
Lethbridge
SPOKANE
Juneau
Sitka
Ketchikan
Stewart
Kitimat
Terrace
Smithers
Hazelton
Banff
Jasper
Hinton
Red Deer
Seattle
Bellingham
Port Angeles
Mt. Robson
Mt. Waddington
Mt. Sir Alexander
Mt. Columbia
Mt. Assiniboine
Kicking Horse Pass
Yellowhead Pass
Crowsnest Pass
Pine Pass
Peace River
Fraser R.
Columbia
Thompson River
Liard River
Skeena River
Nass R.
Stikine River
Chilcotin
Smoky River
Athabasca
Lake Athabasca
Lesser Slave Lake
Kootenay Lake
Okanagan Lake
Williston Lake
Babine Lake
Takla Lake
Nechako Reservoir
ROCKY MOUNTAINS
COAST MOUNTAINS
COASTAL TROUGH
INTERIOR PLATEAU
GREAT PLAINS

Map 61. Gazetteer

Following is a selected list of names of places, features, and areas in British Columbia. Because of the large number of places and features in this list and the limited space on the accompanying Gazetteer Map, only those places or features that appear on the base maps or that are referred to in the text of this atlas are named on the map. Location of each item in the list is designated by the grid rectangle(s) into which it falls. Grid rectangles are shown (in red) on the Gazetteer Map and represent an adaptation of the National Topographic system of map-sheet numbering for Canada. Kamloops, for example, is designated 92–I, which means that it is located in the area enclosed by the small rectangle labelled I within large rectangle 92.

Names of administrative units such as Regional Districts, Provincial Parks, and Economic Regions are not shown on the Gazetteer Map. Those names and their associated boundaries are shown on the relevant maps in the body of the atlas. Locations of listings in this Gazetteer are given by grid rectangle only. If access to National Topographic Series (N.T.S.) maps is available, however, it is readily possible to locate the feature with greater precision, using the listed designation as the guide to the N.T.S. map number. Detail in the Bowron Lake area of central British Columbia, for example, can be found on sheet 93–H in the National Topographic Series.

Places or features in areas immediately adjacent to British Columbia that are relevant to this atlas are designated according to the nearest grid rectangle shown on the Gazetteer Map. For places in the United States, the name of the state in which they are found is indicated. For example, the entry for Libby, Montana is listed as: "Libby, MT — Pl 82–G." In this case, the grid rectangle nearest the location of Libby, Montana is 82–G. While this provides a general locational orientation, the designation 82–G is of no help in choosing the appropriate United States topographic sheets because their numbering system is quite different to that of the N.T.S.

Strict objectivity in the selection of items for a limited gazetteer is difficult to maintain. In this case the selection is based primarily on criteria of physical dimensions of a feature such as a lake or stream, or relative regional significance, or on assumed importance based upon frequency of enquiry received concerning location of a given place, feature, or area. For a complete listing of place names approved by the Canadian Permanent Committee on Geographical Names, see: Canada, Department of Energy, Mines and Resources, *Gazetteer of Canada (British Columbia)*, Ottawa, 1966, and *Cumulative Supplement* to 31 December 1976.

ABBREVIATIONS

A = area; region; locality
AB = Alberta
AK = Alaska
DM = District Municipality; incorporated area
E = east
Hdrog = hydrographic feature: arm; bank, shoal, or other undersea terrain feature; bay; cape; channel; cove; entrance; estuary; gulf; inlet; passage; reach; rock; sound; strait
Hdrol = hydrologic feature: arm (of freshwater); creek; dam; falls; lake; reservoir; river; spring
ID = Idaho
Ldfm = landform feature: canyon; glacier; icefield; island; mountain; pass; peak; peninsula; plateau; point; trench; trough; valley
Lo = lower
MT = Montana
Mt. = Mount
Mtn. = mountain
Nat Pk = National Park
N = north
NWT = Northwest Territories
Pl = place: city; community; landing; Post Office; railway station; resort; town; village
Prov Pk = Provincial Park
RD = Regional District
S = south
Up = upper
W = west
WA = Washington
YT = Yukon Territory

Elevations of mountains and passes and heights of waterfalls, where given, are shown in parentheses and are expressed in metres.

Abbotsford — DM and Pl 92–G
Abyssal Plain — Hdrog 102–I, O; 103–C
Adams Lake — Hdrol 82–M, L
Adams River — Hdrol 82–M; 83–D
Admiralty Island, AK — Ldfm 104–L, F
Aennofield — Pl 92–I
Afton Mines — Pl 92–I
Agassiz — Pl 92–H
Ahbau Lake — Hdrol 93–G
Ahousat — Pl 92–E
Ainsworth Hot Springs — Hdrol and Pl 82–F
Aiyansh — Pl 103–P
Akamina Pass — (1,779) Ldfm 82–G
Akie River — Hdrol 94–F
Alaska — A 103–K, J, O; 104–B, C, F, K, L, M, I, P, O
Alaska Panhandle — A 103–O, 104–B, C, F, K, L, M; 114–I, O, P
Alberni — Pl 92–F
Alberni–Clayoquot — RD 92–E, F, G
Alberni Inlet — Hdrog 92–F
Albion — Pl 92–G
Aldergrove — Pl 92–G
Alert Bay — Pl 92–L
Alexandria — Pl 93–B
Alexis Creek — Pl 93–B
Alice Arm — Pl 103–P
Alice Lake — Hdrol 92–L
Alice Lake — Hdrol 92–G
Alkali Lake — Pl 92–O
Allison Pass — (1,352) Ldfm 92–H
Alouette Lake — Hdrol 92–G
Alouette Mtn. — (1,348) Ldfm 92–G
Alsek River — Hdrol 114–O, P
Alta Lake — Pl 92–J
Anacortes, WA — Pl 92–B
Anahim Lake — Pl 93–C
Anderson Lake — Hdrol 92–J
Andesite Peak — (2,379) Ldfm 103–I
Anglemont — Pl 82–L
Annacis Island — Ldfm 92–G
Anyox (former mine) — Pl 103–P
Apex Mtn. — (2,246) Ldfm 82–E
Area C — Hdrog 92–C
Argenta — Pl 82–K
Argonaut Mtn. — (2,974) Ldfm 82–M
Aristazabal Island — Ldfm 103–A
Arlington — Pl 92–B
Armstrong — Pl 82–L
Arrandale — Pl 103–J
Arras — Pl 93–P
Arrow Lakes, Lo and Up — Hdrol 82–L, K, E, F
Ashcroft — Pl 92–I
Ashnola River — Hdrol 82–E; 92–H
Aspen Grove — Pl 92–H
Assiniboine Pass — (2,180) Ldfm 82–J
Athabasca Pass — (1,748) Ldfm 83–D
Athabasca River, AB — Hdrol 83–D, E
Athalmer — Pl 82–K
Athlone Island — Ldfm 103–A
Atlin — Pl 104–N
Atlin — Prov Pk 104–M, N, K, L
Atlin Lake — Hdrol 104–N
Atna Peak — (2,755) Ldfm 103–H
Atnarko River — Hdrol 93–C
August Jacob's Creek Hot Spring — Hdrol 92–G
Avalanche Pass — (1,583) Ldfm 83–E
Avola — Pl 82–M
Azouzetta Lake — Hdrol 93–O
Azure Lake — Hdrol 93–A; 83–D
Azure Mtn. — (2,495) Ldfm 93–A

Babine — Pl 93–M
Babine Lake — Hdrol 93–M, L, K
Bainbridge Cove — Hdrog 93–D
Baldonnel — Pl 94–A
Baldy Hughes — Pl 93–G
Baldy Mtn. — (1,782) Ldfm 93–N
Balfour — Pl 82–F
Bamberton — Pl 92–B
Bamfield — Pl 92–C
Banff, AB — Nat Pk 83–C; 82–N, O, J
Banff, AB — Pl 82–O
Banks Island — Ldfm 103–G, H
Baranof Island, AK — Ldfm 104–C, F
Barkerville — Pl 93–H
Barkley Sound — Hdrog 92–C
Barnston Island — Ldfm 92–G
Barrière — Pl 92–P
Bear Lake — Hdrol 94–D
Bear River Pass — (657) Ldfm 94–D
Beatton River — Hdrol 94–A, H
Beaumont — Pl 92–B
Beaver Cove — Pl 92–L
Beaver Creek — Hdrol 93–B, A
Beaver River — Hdrol 94–N
Beaverdell — Pl 82–E
Bedwell Sound — Hdrog 92–F
Bell-Irving River — Hdrol 104–A
Bella Bella — Pl 103–A
Bella Coola — Pl 93–D
Bella Coola River — Hdrol 93–D
Bellingham, WA — Pl 92–B
Bennett Lake — Hdrol 104–M
Bentinck Arm, N and S — Hdrog 93–D
Big Bar Creek — Pl 92–O, P
Big Creek — Hdrol and Pl 92–O
Big Lake Ranch — Pl 93–A
Big Timothy Mtn. — (2,151) Ldfm 93–A
Big White Mtn. — (2,317) Ldfm 82–E
Birch Island — Pl 82–M
Birkenhead Lake — Hdrol and Prov Pk 92–J
Bishop Cove — Hdrog 103–H
Black Creek — Pl 92–F
Black Mtn. — (1,217) Ldfm 92–G
Black Tusk — Ldfm 92–G
Blackpool — Pl 92–P
Blaeberry River — Hdrol 82–N
Blaine, WA — Pl 92–B
Blairmore, AB — Pl 82–G
Blind Bay — Pl 82–L
Blind Channel — Pl 92–K
Bloedel — Pl 92–K
Blubber Bay — Pl 92–F
Blue River — Pl 83–D
Boat Encampment (flooded) — Pl 83–D
Bonanza Lake — Hdrol 92–L
Bonanza Pass — (1,535) Ldfm 82–E
Bonaparte Lake — Hdrol 92–P
Bonaparte River — Hdrol 92–I, P
Bones Bay — Hdrog 92–L
Bonners Ferry, WA — Pl 82–F
Boston Bar — Pl 92–H
Boswell — Pl 82–F
Bouchie Lake — Pl 93–G
Boundary Bay — Hdrog 92–G
Boundary Country — A 82–E, F
Boundary Creek — Hdrol 82–E
Boundary Falls — Pl 82–E
Bowen Island — Ldfm and Pl 92–G
Bowie Seamount — (–30) Hdrog 103–F
Bowron Lake — Hdrol and Prov Pk 93–H
Bowron River — Hdrol 93–I, G, H
Bowser — Pl 92–F
Bowser Lake — Hdrol 104–A
Boya Lake — Prov Pk 104–P
Brackendale — Pl 92–G
Bramham Island — Ldfm 92–M
Brandywine Falls — (66) Hdrol 92–J
Brentwood Bay — Hdrog and Pl 92–B
Bridal Veil Falls — Hdrol 92–H
Bridesville — Pl 82–E
Bridge Lake — Hdrol and Pl 92–P
Bridge River — Pl 92–J, I
Brilliant — Pl 82–F
Brim River — Hdrol 103–H
Brisco — Pl 82–K
Britannia Beach — Pl 92–G
Broughton Island — Ldfm 92–L
Browning Entrance — Hdrog 103–G
Brynildsen Creek — Hdrol 94–D
Buckinghorse River — Hdrol 93–G
Buckley Bay — Hdrog and Pl 92–F
Buffalo Creek — Pl 92–P
Buffalo Lake, AB — Hdrol 83–C
Buick — Pl 94–A
Bulkley Nechako — RD 104–A; 94–D, C; 103–P; 93–M, N, O; 103–I; 93–L, K, J; 103–H; 93–E, F, G
Bulkley River — Hdrol 93–M, L
Bull River — Hdrol and Pl 82–G, F
Bullmoose Mtn. — (2,020) Ldfm 93–P
Buntzen — Pl 92–G
Buntzen Lake — Hdrol 92–G
Burke Channel — Hdrog 92–M
Burlington, WA — Pl 92–B
Burnaby — DM 92–G
Burnaby Island — Ldfm 103–B
Burns Lake — Pl 93–K
Burquitlam — Pl 92–G
Burrard Inlet — Hdrog 92–G
Burton — Pl 82–F
Bute Inlet — Hdrog 92–K
Butedale — Pl 103–H
Buttle Lake — Hdrol 104–O

Caamaño Sound — Hdrog 103–A
Cache Creek — Pl 92–I
Cadboro Bay — Hdrog and Pl 92–B
Cairn Needle — (2,292) Ldfm 92–H
Calgary, AB — Pl 82–O
Calvert Island — Ldfm 102–P; 92–M
Camano Island, WA — Ldfm 92–B
Cameron Lake — Hdrol 92–F
Campania Island — Ldfm 103–H
Campbell Island — Ldfm and Pl 103–A
Campbell Lake — Hdrol 92–K, F
Campbell River — DM 92–K
Canal Flats — Pl 82–J
Canim Lake — Hdrol and Pl 92–P
Canoe — Pl 82–L
Cape Caution — Hdrog 92–M
Cape Cook — Hdrog 92–L
Cape Flattery, WA — Hdrog 92–C
Cape George — Hdrog 103–G
Cape Lazo — Hdrog 92–F
Cape Muzon, AK — Hdrog 103–K
Cape St. James — Hdrog 102–O
Cape Scott — Hdrog and Prov Pk 102–I
Capilano Lake — Hdrol 92–G
Capilano River — Hdrol 92–G
Capital — RD 92–G, C, B
Carcross, YT — Pl 104–M
Cariboo — A 92–O, P; 93–A, B, G, H
Cariboo — RD 93–F, G, H, D, C, B, A; 83–D; 92–N, O, P, K, J
Cariboo Lake — Hdrol 93–A
Cariboo Mtn. — (1,933) Ldfm 93–A
Cariboo River — Hdrol 93–A, H
Carp Lake — Hdrol and Prov Pk 93–J
Carpenter Lake — Hdrol 92–J
Cascade — Pl 82–E
Cassiar — Pl 104–P
Cassiar Mtns. — Ldfm 104–O, I; 94–E
Cassidy — Pl 92–G
Castlegar — Pl 82–F
Cathedral — Prov Pk 92–H
Cathedral Lakes — Hdrol 92–H
Cawston — Pl 82–E
Caycuse — Pl 92–C
Cayoosh Creek — Hdrol 92–I, J
Cecil Lake — Pl 94–A
Cedar — Pl 92–G
Cedarvale — Pl 103–P
Celista — Pl 82–L
Central Coast — RD 93–E; 103–A; 93–D, C; 102–P; 92–M, N
Central Fraser Valley — RD 92–G
Central Kootenay — RD 82–N, L, K, E, F
Central Okanagan — RD 82–L, E
Central Saanich — DM 92–B
Centre Peak — (1,990) Ldfm 93–M
Chaatl Island — Ldfm 103–F
Champion Lakes — Prov Pk 82–F
Chapman Camp — Pl 82–G
Charlie Lake — Hdrol and Pl 94–A
Charlotte Lake — Hdrol 93–K
Chase — Pl 82–L
Chasm — Pl 92–P
Chatham, AK — Pl 104–F
Chatham Sound — Hdrog 103–J
Chatham Strait, AK — Hdrog 104–F, C
Cheakamus — Pl 92–G
Cheakamus River — Hdrol 92–G, J
Cheam Peak — (2,107) Ldfm 92–H
Chemainus — Pl 92–B
Cheslatta Lake — Hdrol 93–F
Chetwynd — Pl 93–P
Chewelah, WA — Pl 82–F
Chichagof Island, AK — Ldfm 114–I; 104–L
Chief Lake — Hdrol 93–J
Chilako River — Hdrol 93–F, G
Chilanko Forks — Pl 93–C

Seymour Arm (Shuswap Lake) —
Hdrol 82–M
Seymour Inlet — Hdrog 92–M
Seymour River — Hdrol 82–M
Shalalth — Pl 92–J
Shannon Falls — (30) Hdrol 92–G
Sharp Point — Ldfm 92–E
Shawatlan Lake — Hdrol 103–J
Shawatlan River — Hdrol 103–J
Shawnigan Lake — Pl 92–B
Shelagyote Peak — (2,466) Ldfm 93–M
Shelley — Pl 93–J
Sheppard Peak — (2,515) Ldfm 104–F
Sheridan Lake — Hdrol 92–P
Sheslay River — Hdrol 104–K, J
Shoreacres — Pl 82–F
Shuswap Lake — Hdrol 82–M, L
Shuswap River — Hdrol 82–L
Sicamous — Pl 82–L
Sidney — Pl 92–B
Sidney Island — Ldfm 92–B
Sifton Pass — (998) Ldfm 94–E
Sikanni Chief — Pl 94–G
Sikanni Chief River — Hdrol 94–G, H, I
Silver Star — Prov Pk 82–L
Silver Star Mtn. — (1,890) Ldfm 82–L
Silverthrone Mtn. — (2,896) Ldfm 92–M
Silverton — Pl 82–F
Similkameen River — Hdrol 92–H; 82–E
Simon Peak — (3,322) Ldfm 83–D
Simoom Sound — Hdrog and Pl 92–L
Simpson Pass — (2,107) Ldfm 82–O
Simpson Peak — (2,173) Ldfm 104–O
Sinclair Pass — (1,486) Ldfm 82–J
Sirdar — Pl 82–F
Sitka, AK — Pl 104–F
Skagit River — Hdrol 92–H
Skagway, AK — Pl 104–M
Skaha Lake — Hdrol 82–E
Skeena Crossing — Pl 93–M
Skeena-Queen Charlotte — RD 103–K, J, I, F, G, H, B, C; 102–O
Skeena River — Hdrol 103–I, P; 93–M
Skidegate — Pl 103–F
Skidegate Inlet — Hdrog 103–F, G
Skihist Mtn. — (2,944) Ldfm 92–I
Skookumchuck — Pl 82–G
Slocan — Pl 82–F
Slocan Lake — Hdrol 82–K, F
Slocan River — Hdrol 82–F
Sloko Lake — Hdrol 104–N
Sloko River — Hdrol 104–N
Sloquet Creek — Hdrol 92–G
Smith Inlet — Hdrog 92–M
Smith Island — Ldfm 103–J
Smith River — Pl 94–M
Smith Sound — Hdrog 92–M
Smithers — Pl 93–L
Smoky River, AB — Hdrol 83–E; 93–I
Snaking River — Hdrol 93–O
Snow Peak — (1,935) Ldfm 104–J
Soda Creek — Pl 93–B
Sointula — Pl 92–L
Somerville Island — Ldfm 103–J
Sonora Island — Ldfm 92–K
Sooke — Pl 92–B
Sooke Lake — Hdrol 92–B
Sorrento — Pl 82–L
South Slocan — Pl 82–F
South Thompson River — Hdrol 82–L; 92–I
South Wellington — Pl 92–G
Southbank — Pl 93–K
Southgate River — Hdrol 92–K, N
Spahats Creek Falls — (61) Hdrol 92–P
Spallumcheen — DM 82–L
Sparwood — DM 82–G
Spatsizi Plateau — A 104–H; 94–E, D
Spatsizi River — Hdrol 104–H
Spectre Peak — (2,026) Ldfm 94–F
Spences Bridge — Pl 92–I
Spillimacheen — Pl 82–K
Spillimacheen River — Hdrol 82–K, M, N
Spius Creek — Hdrol 92–I, H
Spokane, WA — Pl 82–F
Sproat Lake — Hdrol 92–F
Spuzzum — Pl 92–H
Squamish — DM 92–G
Squamish-Lillooet — RD 92–O, J, I, G
Squamish River — Hdrol 92–G, J

Squilax — Pl 82–L
Squirrel Cove — Hdrog and Pl 92–K
St. Mary River 82–G, F
St. Mary's Alpine Park — Prov Pk 82–F
Stave Falls Dam — Hdrol 92–G
Stave Lake — Hdrol 92–G
Stave River — Hdrol 92–G
Stein Mtn. — (2,774) Ldfm 92–I
Stein River — Hdrol 92–I, J
Stephens Island — Ldfm 103–J
Steveston — Pl 92–G
Stewardson Inlet — Pl 92–E
Stewart — DM 103–P
Stikine — RD 114–O, P, I; 104–M, N, O, P; 94–M, L; 104–L, K, J, I; 94–L; 104–H; 94–E; 104–A; 94–D, C
Stikine River — Hdrol 104–B, G, J, K
Stone Mtn. — Prov Pk 94–K
Strait of Georgia — Hdrog 92–K, F, G, B
Strathcona — Prov Pk 92–F
Strathnaver — Pl 93–G
Stuart Island — Ldfm and Pl 92–K
Stuart Lake — Hdrol 93–K
Stump Lake — Hdrol 92–I
Sturgeon Lake, AB — Hdrol 93–P
Sugar Lake — Hdrol 82–L
Sukunka River — Hdrol 93–P
Sullivan Bay — Pl 92–L
Sullivan Mine — Pl 82–F
Sumas — DM 92–G
Sumas Mtn. — (907) Ldfm 92–G
Summerland — DM 82–E
Summit Lake — Hdrol and Pl 93–J
Summit Pass — (1,267) Ldfm 94–K
Sunday Summit — Ldfm 92–H
Sunset Beach — Pl 92–G
Sunset Prairie — Pl 93–P
Sunshine Coast — RD 92–K, J, F, G
Superb Mtn. — (2,469) Ldfm 92–K
Surge Narrows — Pl 92–K
Surrey — DM and Pl 92–G
Sustut River — Hdrol 94–D
Swannell River — Hdrol 94–C
Swanson Bay — Hdrog 103–H
Swartz Bay — Pl 92–B
Swindle Island — Ldfm 103–A
Sylvan Lake, AB — Pl 83–C

Ta Ta Creek — Pl 82–G
Tabor Lake — Hdrol 93–G
Tachick Lake — Hdrol 93–F
Tachie River — Hdrol 93–K
Tadanac — DM 82–F
Tagish Lake — Hdrol 104–M
Tahltan River — Hdrol 104–J, G
Tahsis — Pl 92–E
Tahsis Inlet — Hdrog 92–E
Tahtsa Lake — Hdrol 93–E
Takakkaw Falls — (366) Hdrol 82–N
Takla Lake — Hdrol 93–M, N
Takla Landing — Pl 93–N
Taku River — Hdrol 104–K
Takysie Lake — Hdrog and Pl 93–F
Talchako River — Hdrol 93–D
Taltapin Lake — Hdrol 93–K
Taltapin Mtn. — (1,614) Ldfm 93–K
Talunkwan Island — Ldfm 103–B
Tanu — Pl 103–B
Tanzilla River — Hdrol 104–J, I
Tappen — Pl 82–L
Taseko Lakes — Hdrol 92–O
Taseko River — Hdrol 92–O, L
Tashme — Pl 92–H
Tasu Sound — Hdrog 103–C
Tatla Lake — Hdrol and Pl 92–N; 93–C
Tatlatui — Prov Pk 94–E, D
Tatlatui Lake — Hdrol 94–D
Tatlayoko Lake — Hdrol and Pl 92–N
Tatshenshini River — Hdrol 114–P
Tautri Lake — Hdrol 93–B
Taweh Hot Springs — Hdrol 104–G
Taylor — Pl 94–A
Tchesinkut Lake — Pl 93–K
Tchentlo Lake — Hdrol 93–N
Telegraph Cove — Pl 92–L
Telegraph Creek — Pl 104–G
Telkwa — Pl 93–L
Teresa Island — Ldfm 104–N
Terrace — DM 103–I
Tesla Lake — Hdrol 93–E

Teslin — Pl 104–N
Teslin Lake — Hdrol 104–N
Teslin River — Hdrol 104–N, O
Tetachuck Lake — Hdrol 93–E, F
Tête Jaune Cache — Pl 83–D
Texada Island — Ldfm 92–F
Tezzeron Lake — Hdrol 93–K
Thetis Island — Ldfm 92–B
Thomas Peak — (1,995) Ldfm 94–E
Thompson Pass — (1,985) Ldfm 83–C; 82–N
Thompson-Nicola — RD 93–A; 83–D; 92–O, P; 82–M; 92–J, I; 82–L; 92–H; 82–E
Thompson River — Hdrol 92–I
Thompson Sound — Pl 92–L
Thormanby Islands — Ldfm 92–G, F
Thrums — Pl 82–F
Thunder Mtn. — (2,681) Ldfm 93–D
Thurlow Islands — Ldfm 92–K
Thutade Lake — Hdrol 94–D, E
Timothy Lake — Hdrol 92–P
Tintagel — Pl 93–K
Tlell — Pl 103–G
Toad Hot Springs — Hdrol 94–K
Toad River — Hdrol 94–N, K
Toba Inlet — Hdrog 92–K
Toba River — Hdrol 92–K, J
Tofino — Pl 92–F
Tomslake — Pl 93–P
Toodoggone River — Hdrol 94–E
Top of The World — Prov Pk 82–G
Topley — Pl 93–L
Topley Landing — Pl 93–L
Tornado Mtn. — (3,099) Ldfm 82–G
Torpy River — Hdrol 93–I, H
Trail — Pl 82–E
Tranquille — Pl 92–I
Tranquille River — Hdrol 92–I
Trembleur Lake — Hdrol 93–K
Troitsa Lake — Hdrol 93–E
Trutch — Pl 94–G
Tsawwassen — Pl 92–G
Tsimpsean Peninsula — Ldfm 103–J
Tsitsutl Peak — (2,478) Ldfm 93–C
Tsusiat Lake — Hdrol 92–C
Tuchodi Lakes — Hdrol 94–K
Tuchodi River — Hdrol 94–J, K
Tudyah Lake — Hdrol 93–O
Tulameen River — Hdrol 92–H
Tumtum Lake — Hdrol 82–M
Tupper — Pl 93–P
Turner Valley, AB — Pl 82–J
Tuya Lake — Hdrol 104–O
Tuya River — Hdrol 104–O, J
Tweedsmuir — Prov Pk 93–E, F, C; 92–N; 93–D
Tzoonie River — Hdrol 92–G

Ucluelet — Pl 92–C
Union Bay — Hdrog and Pl 92–F
Union Seamount — (-238) Hdrog 92–E
Unuk River — Hdrol 104–B
Upper Campbell Lake — Hdrol 92–F
Upper Fraser — Pl 93–I
Upper Hat Creek — Pl 92–I
Usk — Pl 103–I

Valdes Island — Ldfm 92–G
Valemount — Pl 83–D
Valleyview, AB — Pl 93–P
Vananda — Pl 92–F
Vancouver — Pl 92–G
Vancouver Island — Ldfm 102–I; 92–L, K, F, G, B, C, E
Vanderhoof — Pl 93–K
Vargas Island — Ldfm 92–E, F
Vaseux Lake — Hdrol 82–E
Vavenby — Pl 82–M
Vedder Crossing — Pl 92–H
Vedder Peak — (922) Ldfm 92–G
Vermilion Pass — (1,640) Ldfm 82–N
Vernon — Pl 82–L
Vernon Lake — Hdrol 92–L
Victoria — Pl 92–B
Victoria Peak — (2,163) Ldfm 92–L

Waddington Canyon — Ldfm 92–N
Wahleach (Jones) Lake — Hdrol 92–H
Wales Island — Ldfm 103–J

Walhachin — Pl 92–I
Waneta — Pl 82–F
Wapiti Pass — (1,353) Ldfm 93–I
Wapta Falls — Hdrol 82–N
Wardner — Pl 82–G
Ware — Pl 94–F
Warfield — Pl 82–F
Wasa — Pl 82–G
Watson Island — Pl 103–J
Watson Lake, YT — Pl 104–P
Wedge Mtn. — (2,891) Ldfm 92–J
Wells — Pl 93–H
Wells Gray — Prov Pk 93–A; 83–D, M; 92–P
West Arm (Kootenay Lake) — Hdrol 82–F
West Kettle River — Hdrol 82–E
West Kootenay — A 82–K, L, E, F
West Road River — Hdrol 93–F, G
West Thurlow Island — Ldfm 92–K
West Vancouver — DM 92–G
Westbank — Pl 82–E
Westbridge — Pl 82–E
Westham Island — Ldfm 92–G
Westholme — Pl 92–B
Westwold — Pl 82–L
Wetaskiwin, AB — Pl 83–C
Whaletown — Pl 92–K
Whatshan Lake — Hdrol 82–E, L
Whidbey Island, WA — Ldfm 92–B
Whistler Mtn. — (2,149) Ldfm 92–J
White Falls — Hdrol 83–E
White Pass — (888) Ldfm 104–M
White Rock — Pl 92–G
Whitecourt, AB — Pl 93–I
Whitefish, WA — Pl 82–G
Whitesail Lake — Hdrol 93–E
Whonnock — Pl 92–G
Williams Lake — Pl 93–B
Williston Lake — Hdrol 94–C, B; 93–N, O
Willmore Wilderness, AB — Prov Pk 83–E
Willow River — Hdrol 93–J, G, H
Willow River — Pl 93–J
Wilson Creek — Pl 92–G
Windermere — Pl 82–J
Windermere Lake — Hdrol 82–K, J
Winfield — Pl 82–L
Winlaw — Pl 82–F
Winter Harbour — Pl 102–I
Wonowon — Pl 94–A
Wood Lake — Hdrol 82–L
Wood River — Hdrol 83–D
Woodfibre — Pl 92–G
Woodpecker — Pl 93–G
Woss Lake — Hdrol 92–L
Wrangell, AK — Pl 104–C
Wycliffe — Pl 82–G
Wynndel — Pl 82–F

Yahk — Pl 82–G
Yakoun Lake — Hdrol 103–F
Yakoun River — Hdrol 103–F
Yalakom River — Hdrol 92–O, J
Yale — Pl 92–H
Yarrow — Pl 92–G
Yellowhead Pass — (1,131) Ldfm 83–D
Yeo Island — Ldfm 103–A
Ymir — Pl 82–F
Yoho — Nat Pk 82–N
Youbou — Pl 92–C
Yukon River — Hdrol 104–N, M

Zakwaski Mtn. — (2,043) Ldfm 92–I
Zama Lake, AB — Hdrol 94–I
Zeballos — Pl 92–E
Zeballos Inlet — Hdrog 92–E
Zymoetz River — 103–I; 93–L

Historical and Statistical Summary

Selected Historical Events

1740–41 Bering and Chirikof sight Alaskan coast sailing from Kamchatka
1774–75 Pérez, Hezéta, and Quadra establish general trend of the coast from California to Alaska
1778 Cook visits Nootka Sound
1785 Maritime fur-trading begins with the arrival at Nootka of the *Sea Otter* commanded by James Hanna
1790 Nootka Incident
1790–92 Last Spanish explorations of the Northwest Coast under the commands of Quimper, Narváez, Galiano, and Valdes
1792–94 Vancouver surveys the coastline from the Columbia River to Cross Sound
1793 Mackenzie reaches the coast overland from Canada via Peace River gap
1805–08 Fraser establishes fur-trading posts in central B.C. and descends the Fraser River
1807–12 Thompson explores and maps much of the Columbia drainage system
1812 Lewis and Clark reach the Lower Columbia River
1813 North West Company acquires assets of the Pacific Fur Company and takes over Fort Astoria
1821 North West Company and Hudson's Bay Company amalgamate
1840–45 American immigration to the Lower Columbia country (via Oregon Trail)
1843 Fort Victoria built to replace Fort Vancouver (Washington) as western headquarters of the Hudson's Bay Company
1846 Oregon Treaty establishes 49th parallel as land border between American and British territory west of the Rocky Mountains
1848 Fort Hope established
1849 California gold rush
Vancouver Island made a crown colony
1852 Hudson's Bay Company begins mining coal at Nanaimo, the only known coastal field north of Chile
1854–56 Esquimalt serves as supply base for Pacific Squadron during the Crimean War
1857 Gold discovered on the North Thompson
1858 Fraser River gold rush
British Columbia mainland established as a separate colony
Detachment of Royal Engineers arrives to undertake surveys and to build public works
1859 New Westminster selected as capital of British Columbia
1859–60 Gold-seekers move north on the Fraser and into the Cariboo
1860 Dewdney Trail begun from Hope to Similkameen
1862 Cariboo Road begun from Yale
1865 Buildings erected at Esquimalt, which had been selected to replace Valparaiso as headquarters of the Royal Navy's Pacific Squadron
1866 Union of the colonies of British Columbia and Vancouver Island
1867 Confederation of Nova Scotia, New Brunswick, Canada East, and Canada West
United States purchases Alaska from Russia
1868 Victoria chosen as capital of the united colonies
1871 British Columbia enters Confederation
Marine portion of international boundary established (through Haro and Juan de Fuca Straits)
1874–76 Salmon canning industry established in British Columbia
1880 C.P.R. construction begins
1885 C.P.R. mainline completed to Port Moody
1886 Vancouver selected as terminus of C.P.R., incorporated as a city, and destroyed by fire
Yoho and Glacier established as first National Parks in British Columbia
Esquimalt and Nanaimo Railway completed to Nanaimo
1894 First mechanical conversion pulp mill opens in Port Alberni area
1896 Lode mining boom begins in the West Kootenay–Boundary area
1898 Gold rushes to Klondike and Atlin
Fire destroys business section of New Westminster
1906 Smelting plant at Trail and mines at Moyie and Rossland merge to form Consolidated Mining and Smelting Company
1907 Anti-Oriental riots in Vancouver
1910 Sullivan Mine starts production
1911 Powell River mill under construction
Strathcona Park established as first Provincial Park in British Columbia
1914 Outbreak of World War I
Grand Trunk Pacific (now C.N.R.) completed from Yellowhead to Prince Rupert
Completion of Canadian Northern (now C.N.R.) line from Yellowhead Pass to Vancouver
Construction begins on the Pacific Great Eastern Railway (now B.C.R.)
1915 Kettle Valley Railway (C.P.R.) completed from Penticton to Vancouver
1920–29 Agricultural settlement increases in Lower Fraser Valley and Okanagan; development of road system for automobile traffic
1921 Pacific Great Eastern Railway completed from Squamish to Quesnel
1929 Onset of the Great Depression
1935 Protest march of unemployed in Vancouver
1939 Outbreak of World War II
1942 Construction of the Alaska Highway begins
1945 Work begun on John Hart development and generating station, Vancouver Island
1948 Bridge River hydro-electric complex begun
1949 Hope to Princeton Highway opened
1953 Trans Mountain crude oil pipeline completed from Edmonton to Vancouver
1954 Kitimat aluminum smelter brought into production
Kemano generating site begins to deliver power
1956 Sloan Commission report recommends major changes in forest land tenure
1957 Westcoast Transmission gas pipeline completed from Peace River to the Lower Mainland
1961 B.C. Government takes over Black Ball Steamship Company and B.C. Ferry Authority established
1962 Rogers Pass route (Trans-Canada Highway) opened
1964 Columbia River Treaty between the United States and Canada initiated; joint development of hydro-electric power on the Columbia River
1968 Peace River development begins to deliver power
1970 Canada Water Act established
Yellowhead Highway completed
Roberts Bank deepsea port facilities established
1973 Provincial Land Commission established to reserve agricultural land
1976 Mica Dam begins to deliver power
1977 200-mile fishing limit declared by Canada

Provincial Areas and Dimensions

(Areas are approximate, based upon estimates from various sources)

Total area, including freshwater bodies: 948,600 square kilometres = 94,860,045 hectares = 100 per cent (366,255 square miles = 234,403,200 acres) = 9.5 per cent of the area of Canada.

Forest land: 52 million hectares = 55 per cent (128.7 million acres), about half of which is classed as supporting mature timber.

Arable and grazing land: 4.7 million hectares = 5 per cent (11.6 million acres). Area in farms 2.5 million ha (6.1 million acres).

Freshwater surfaces: 2 million hectares = 2 per cent (5 million acres).

Other (mainly alpine scrub and barren, icefields, urban areas): 36.2 million hectares = 38 per cent (89.4 million acres).

Length of land borders (approximate):
1,545 km (960 mi.) with Alberta
893 km (555 mi.) with Alaska
845 km (525 mi.) with Yukon Territory
423 km (263 mi.) with Washington
217 km (135 mi.) with North West Territories
145 km (90 mi.) with Montana
72 km (45 mi.) with Idaho

Most easterly point: Akamina Pass area, southeastern B.C. (114°03′12″W)

Most westerly point: Boundary Peak, in an unnamed snowfield in northwestern B.C. (139°03′40″W)

Most southerly point: Rosedale Rock, off S. Vancouver Island (48°17′34″N)

Most northerly point: Beaver River area — officially 60°N (60°00′09″N)

Longest distance North to South: approx. 1,300 km (808 mi.) (along meridian 123°33'W)
Shortest distance North to South: approx. 24 km (15 mi.) (along meridian 135°30'W)
Longest distance East to West: approx. 1,062 km (660 mi.) (along 60th parallel)
Shortest distance East to West: approx. 625 km (388 mi.) (along 56th parallel)
Longest distance, point to point, N.W. to S.E.: approx. 2,005 km (1,246 mi.)
Point farthest from the sea: N.E. corner, 747 km (464 mi.)
Highest elevation: Fairweather Mountain, 4,663 m (15,300') (only partially within B.C.) Mount Waddington, 4,016 m (13,177') (entirely within B.C.)
Longest River: Fraser River, approx. 1,370 km (850 mi.), its drainage area is the largest in B.C., approx. 230,000 km² (89,000 sq. mi.)
Highest waterfall: Della Falls (Vancouver Island), 440 m (1,443'), actually a cascade
Highest major lake: Chilko Lake, 1,171 m (3,842')
Largest natural lake: Atlin Lake, 562 km² (217 sq. mi.) (B.C. portion only); Babine Lake, 497 km² (192 sq. mi.), including islands (entirely within B.C.)
Largest man-made lake: Williston Reservoir, 1,750 km² (675 sq. mi.)
Largest valley: Rocky Mountain Trench, approx. 1,450 km (900 mi.)
Highest city elevation: Kimberley, 1,115 m (3,660')
Largest coastal island: Vancouver Island, 32,137 km² (12,408 sq. mi.)
Number of coastal islands: approx. 6,500 (excluding islets)
Length of mainland coast: approx. 12,150 km (7,550 mi.); including shores of islands approx. 27,200 km (16,900 mi.)
Longest inlet (fjord channel): Gardner Canal, approx. 114 km (71 mi.)
Deepest recorded sounding, coastal area: 764 m (2,508'), in Finlayson Channel

Highest measured waterfalls and cascades:

Della Falls	440 m (Vancouver Island)
Takakkaw Falls	366 m (Yoho National Park)
Hunlen Falls	approx. 259 m (Tweedsmuir Provincial Park)
Helmcken Falls	137 m (Wells Gray Provincial Park)
Kinuseo Falls	69 m (N. of Monkman Pass)
Rainbow Falls	67 m (Wells Gray Provincial Park)
Christina Falls	67 m (Graham R., Peace River area)
Brandywine Falls	66 m (N. of Squamish)
Spahats Creek Falls	61 m (Spahats Cr. near Wells Gray Provincial Park)
Falls of the Pool	46 m (Mount Robson Provincial Park)
Emperor Falls	44 m (Mount Robson Provincial Park)
Elk Falls	27 m (Campbell River, Vancouver Island)

Highest Mountains:

Fairweather Mountain (B.C.-Alaska boundary)	4,663 m
Mt. Quincy Adams (B.C.-Alaska boundary)	4,133 m
Mt. Waddington (N.E. of Knight Inlet)	4,016 m
Mt. Robson (W. of Yellowhead Pass)	3,954 m
Mt. Root (B.C.-Alaska boundary)	3,920 m
Mt. Tiedemann (near Mt. Waddington)	3,828 m
Mt. Columbia (B.C.-Alberta boundary)	3,747 m
Mt. Assiniboine (B.C.-Alberta boundary)	3,618 m
Monarch Mountain (E. of Rivers Inlet)	3,533 m
Mt. Sir Wilfrid Laurier (N. of Wells Gray Provincial Park)	3,505 m

Largest Islands:

Vancouver	32,137 km²
Graham (QCI)	6,436 km²
Moresby (QCI)	2,787 km²
Princess Royal	2,274 km²
Pitt	1,373 km²
Banks	855 km²
King	824 km²
Porcher	531 km²
Nootka	526 km²
Aristazabel	425 km²

Largest Lakes:

Williston (reservoir)	1,750 km²
Nechako (reservoir)	847 km²
Atlin (B.C. portion)	562 km²
Arrow, Upper and Lower (reservoirs)	518 km²
Babine	497 km²
McNaughton (reservoir)	445 km²
Kootenay	427 km²
Stuart	360 km²
Okanagan	352 km²
Shuswap	319 km²

Major fjords:

	approx. length	max. depth
Gardner Canal	114 km	503 m
Knight Inlet	113 km	549 m
Portland Canal	100 km	389 m
Dean Channel	97 km	555 m
Burke Channel	90 km	555 m
Jervis Inlet	77 km	732 m
Douglas Channel	72 km	457 m
Observatory Inlet	66 km	533 m
Bute Inlet	66 km	664 m
Alberni Inlet	60 km	366 m
Seymour Inlet	58 km	625 m
Neroutsos Inlet	52 km	247 m

Major Passes:	elevation
Vermilion (Rocky Mountains)	1,639 m
Kicking Horse (Rocky Mountains)	1,622 m (rail) 1,647 m (road)
Heckman (Coast Mountains)	1,524 m
Sinclair (Rocky Mountains)	1,486 m
Chilkat (Coast Mountains)	1,372 m
Crowsnest (Rocky Mountains)	1,357 m (rail) 1,396 m (road)
Allison (northern Cascades)	1,352 m
Rogers (Columbia Mountains)	1,323 m (rail) 1,382 m (road)
Monashee (Columbia Mountains)	1,199 m
Yellowhead (Rocky Mountains)	1,131 m (rail) 1,146 m (road)
Monkman (Rocky Mountains)	1,082 m
Chilkoot (Coast Mountains)	1,067 m
Sifton (Rocky Mountain Trench)	998 m
White (Coast Mountains)	888 m
Pine (Rocky Mountains)	869 m (rail) 912 m (road)
Eagle (Columbia Mountains)	561 m

IMPERIAL/METRIC CONVERSION TABLE

	Imperial Units	**Approximate Conversion Factor***	**Metric Equivalent**
a) **Linear**	inches	2.540	centimetres (cm)
	feet	.3048	metres (m)
	yards	.9144	metres (m)
	miles	1.609	kilometres (km)
b) **Area**	square feet	.0929	square metres (m²)
	acres	.4047	hectares (ha)
	square miles	2.590	square kilometres (km²)
c) **Volume**	quarts	1.1359	litres (ℓ)
	gallons	4.5436	litres (ℓ)
	gallons	.0045	cubic metres (m³)
	acre-feet	1,233.5	cubic metres (m³)
d) **Lumber**	board feet (f.b.m.)	.0024	cubic metres (m³)
	M B.F. (excluding saw kerf)	2.3598	cubic metres (m³)
Plywood	millions of square feet (⅜" basis)	92.9	thousands of square metres (9.5 mm basis)
e) **Mass**	pounds	.4536	kilograms (kg)
	tons (2,000 lb.)	.907	tonnes (MT or t)
f) **Energy**	horsepower	.746	kilowatts (kW)
g) **Temperature**	degrees Fahrenheit (°F)	$\frac{5}{9}$ (F-32)	degrees Celsius (°C)

* To convert Imperial to metric units, multiply by conversion factor.
To convert metric to Imperial, divide by conversion factor.

Other Conversions

litres x .001 = cubic metres (m³)
hectares x 100 = square kilometres (km²)
acres x 43,560 = square feet
cubic feet x 6.2321 = Imperial gallons
Imperial gallons x 1.2003 = U.S. gallons

ROAD DISTANCE CHART

Key: 378 KILOMETRES / 235 MILES

	Atlin	Calgary	Campbell River	Cranbrook	Dawson Creek	Edmonton	Fernie	Fort Nelson	Golden	Hope	Kamloops	Kelowna	Merritt	Nanaimo	Nelson	Penticton	Prince George	Prince Rupert	Quesnel	Revelstoke	Seattle	Smithers	Trail	Vancouver
Calgary	2353 / 1462																							
Campbell River	2837 / 1763	1233 / 766																						
Cranbrook	2778 / 1726	407 / 253	1048 / 651																					
Dawson Creek	1482 / 921	871 / 541	1381 / 858	1289 / 801																				
Edmonton	2054 / 1276	299 / 186	1416 / 880	707 / 439	571 / 355																			
Fernie	2713 / 1686	325 / 202	1147 / 713	100 / 62	1371 / 852	624 / 388																		
Fort Nelson	999 / 621	1353 / 841	1838 / 1142	1746 / 1085	483 / 300	1054 / 655	1828 / 1136																	
Golden	2551 / 1585	267 / 166	966 / 600	249 / 155	1094 / 680	566 / 352	330 / 205	1551 / 964																
Hope	2507 / 1558	903 / 561	330 / 205	718 / 446	1051 / 653	1086 / 675	818 / 508	1508 / 937	636 / 395															
Kamloops	2393 / 1487	631 / 392	602 / 374	613 / 381	937 / 582	814 / 506	694 / 431	1394 / 866	364 / 226	272 / 169														
Kelowna	2569 / 1596	615 / 382	639 / 397	594 / 369	1112 / 691	914 / 568	692 / 430	1569 / 975	348 / 216	309 / 192	175 / 109													
Merritt	2427 / 1508	724 / 450	541 / 336	673 / 418	970 / 603	908 / 564	771 / 479	1427 / 889	457 / 284	211 / 131	93 / 58	266 / 165												
Nanaimo	2686 / 1669	1081 / 672	154 / 96	896 / 557	1230 / 764	1265 / 786	996 / 619	1687 / 1048	814 / 506	179 / 111	451 / 280	489 / 304	389 / 242											
Nelson	2894 / 1798	641 / 398	842 / 523	233 / 145	1437 / 893	940 / 584	332 / 206	1894 / 1177	483 / 300	512 / 318	560 / 348	388 / 241	467 / 290	690 / 429										
Penticton	2630 / 1634	678 / 421	578 / 359	531 / 330	1173 / 729	977 / 607	629 / 391	1630 / 1013	410 / 255	248 / 154	238 / 148	63 / 39	203 / 126	426 / 265	325 / 202									
Prince George	1868 / 1161	787 / 489	969 / 602	877 / 545	412 / 256	742 / 461	959 / 596	869 / 540	682 / 424	639 / 397	525 / 326	700 / 435	558 / 347	818 / 508	1025 / 637	761 / 473								
Prince Rupert	2663 / 1655	1519 / 944	1699 / 1056	1608 / 999	1143 / 710	1473 / 915	1708 / 1061	1664 / 1034	1413 / 878	1371 / 852	1255 / 780	1429 / 888	1289 / 801	1548 / 962	1756 / 1091	1492 / 927	731 / 454							
Quesnel	1989 / 1236	908 / 564	848 / 527	1015 / 631	533 / 331	863 / 536	1098 / 682	990 / 615	768 / 477	518 / 322	404 / 251	579 / 360	438 / 272	697 / 433	904 / 562	642 / 399	117 / 73	851 / 529						
Revelstoke	2609 / 1621	415 / 258	818 / 508	398 / 247	1152 / 716	715 / 444	478 / 297	1609 / 1000	148 / 92	488 / 303	216 / 134	200 / 124	309 / 192	666 / 414	249 / 155	262 / 163	740 / 460	1471 / 914	620 / 385					
Seattle	2792 / 1735	1159 / 720	409 / 254	752 / 467	1336 / 830	1371 / 852	851 / 529	1793 / 1114	1001 / 622	285 / 177	657 / 408	533 / 331	496 / 308	257 / 160	678 / 421	470 / 292	924 / 574	1654 / 1028	803 / 499	772 / 480				
Smithers	2303 / 1431	1157 / 719	1339 / 832	1247 / 775	782 / 486	1112 / 691	1347 / 837	1304 / 810	1053 / 654	1009 / 627	895 / 556	1069 / 664	929 / 577	1188 / 738	1395 / 867	1131 / 703	370 / 230	360 / 224	491 / 305	1110 / 690	1294 / 804			
Trail	2865 / 1780	642 / 399	813 / 505	235 / 146	1408 / 875	938 / 583	333 / 207	1865 / 1159	484 / 301	483 / 300	546 / 339	370 / 230	438 / 272	661 / 411	69 / 43	307 / 191	996 / 619	1727 / 1023	875 / 544	568 / 353	668 / 415	1366 / 849		
Vancouver	2660 / 1653	1056 / 656	177 / 110	871 / 541	1194 / 742	1239 / 770	970 / 603	1661 / 1032	789 / 490	153 / 95	425 / 264	463 / 288	364 / 226	26 / 16	665 / 413	401 / 249	792 / 492	1522 / 946	671 / 417	641 / 398	232 / 144	1162 / 722	636 / 395	
Victoria	2696 / 1675	1091 / 678	266 / 165	906 / 563	1239 / 770	1275 / 792	1006 / 625	1696 / 1054	824 / 512	188 / 117	460 / 286	499 / 310	399 / 248	111 / 69	700 / 435	436 / 271	827 / 514	1558 / 968	707 / 439	676 / 420	251 / 156	1197 / 744	671 / 417	68 / 42

ECONOMIC REGIONS AND REGIONAL DISTRICTS

"Old" economic regions (prior to 1971)	"New" economic regions (1971–)
1. East Kootenay	1. East Kootenay
2. West Kootenay	2. West Kootenay–Shuswap
3. Okanagan	3. Okanagan–Similkameen
4. Lower Fraser Valley	4. Squamish–Thompson
5. Vancouver Island	5. Vancouver–Powell River
6. South Central Interior	6. Vancouver Island–Waddington
7. Central Coast	7. Central Interior
8. Prince George	8. North Coast–Stikine
9. Northwest	9. Peace River–Liard
10. Northeast	

The "new" economic regions are aggregations of Regional Districts. As shown on several of the maps in this atlas, there are 29 Regional Districts in British Columbia. Their boundaries are identical to those of Census Divisions, though the official names (federal) applied to the Census Divisions vary slightly from those used by the Ministry of Municipal Affairs in British Columbia.

As used in this atlas, the terms "Regional District" and "Census Division" are synonymous.

BRITISH COLUMBIA EMPLOYMENT BY INDUSTRY
(Canada Census data; figures are rounded)

Industry	1911	1931	1951	1971
Agriculture (farmers)	24,400	43,600	28,400	23,100
Forestry (lumbermen; chiefly loggers)	11,800[3]	12,900	19,200	27,700
Fishing & trapping (fishermen and trappers)	4,600	9,400	5,300	3,800[5]
Mining, quarrying & drilling (miners)	15,500[4]	10,300	7,600	14,700
Manufacturing & mechanical[1]	21,300	35,000	74,500	146,900
Construction	18,600	19,000	29,900	63,900
(labourers)[2]	40,700	41,800	30,900	—
Transportation & communication	15,800	30,300	51,400	86,600
Trade, finance, insurance and real estate	18,000	30,900	52,000	189,000
Community, business and personal service	33,500	72,800	139,000	225,600
Public administration & defence	—	—	—	57,100
Miscellaneous industry	—	100	6,200	71,700
Total, all industries	206,100	306,200	444,400	910,100

1. Includes stationary engineering and occupations associated with electric power production.
2. Includes labourers in all industries except agricultural, logging, fishing or mining operations.
3. Includes pulp mill employees.
4. Includes mine and smelter employees.
5. There are major discrepancies between these data and the number of personal (commercial) fishing licenses issued. In 1973, for example, a total of over 11,700 fishing licenses were issued, suggesting that the number of persons gainfully employed in fishing is much higher than those designated by the census as "fishermen."

BRITISH COLUMBIA,VALUE ADDED, BY INDUSTRY
(Canada Census data; figures are rounded; $,000)

Industry[1]	1911	1931	1951[4]	1971
Agriculture	11,500[2]	37,300	64,800	134,800
Forestry (chiefly logging)	21,200	58,300	162,300	357,500
Fisheries	9,200	15,000	30,200	58,600
Trapping	200[3]	600	800	700
Mining	21,300	42,700	115,500	316,900
Electric power generation	—	14,200	41,300	219,100
Manufacturing	65,200	184,000	556,200	1,912,600
Construction	—	29,700	268,600	1,099,300
Total	—	381,800	1,239,600	4,099,400

1. Industrial categories for census value added differ from those for employment.
2. Field crops only.
3. 1910 value.
4. 1952 data are incorporated (Statistics Canada catalogue 61 - 202.)

CLIMATIC DATA FOR SELECTED STATIONS IN BRITISH COLUMBIA*

Station		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1/a
Agassiz (Canada Dept. of Agriculture)	elev. 15m													
Temperature (°C)	Maximum	16.7	21.7	25.0	32.2	34.4	36.7	38.3	39.4	35.6	28.3	21.1	17.2	39.4
	Mean	1.1	4.4	6.1	9.4	13.3	15.6	17.8	17.8	15.6	11.1	6.1	3.3	10.0
	Minimum	−25.0	−24.4	−14.4	−3.9	−1.1	1.7	3.3	1.7	−1.1	−6.7	−14.4	−21.1	−25.0
Precipitation (cm)	Max./24 hrs.	9.4	11.6	8.6	9.2	5.1	6.4	4.8	5.9	8.0	9.8	10.0	9.3	11.6
	Mean total	21.5	17.1	14.5	11.6	8.0	7.6	4.8	6.0	10.5	19.3	20.4	23.5	164.8
	Mean snow	34.3	14.2	8.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	21.8	84.6
Sunshine (hours)	Mean total	43	68	95	115	167	159	229	198	147	90	50	33	1,394
Dease Lake	elev. 816m													
Temperature (°C)	Maximum	8.9	11.7	12.8	18.9	31.7	33.9	31.7	31.1	28.9	20.6	14.4	7.2	33.9
	Mean	−19.4	−13.3	−7.2	0.0	6.7	10.6	12.8	11.7	7.2	1.1	−8.3	−15.6	1.1
	Minimum	−51.1	−48.3	−42.8	−31.7	−11.1	−5.6	−2.2	−6.1	−15.0	−23.3	−38.9	−46.1	−51.1
Precipitation (cm)	Max./24 hrs.	1.2	0.3	1.1	0.8	2.0	2.8	4.0	4.6	2.3	2.1	0.9	0.6	4.6
	Mean total	2.8	2.6	2.1	1.2	2.1	3.8	5.4	5.4	4.4	3.4	3.2	3.0	39.4
	Mean snow	29.5	29.2	22.9	11.7	4.6	0.8	1.3	T	0.8	18.8	34.3	33.0	186.7
Sunshine (hours)	Mean total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Estevan Point	elev. 7m													
Temperature (°C)	Maximum	17.2	17.2	17.8	20.0	22.8	26.7	28.9	26.1	25.0	21.1	17.8	14.4	28.9
	Mean	4.4	5.6	5.6	7.8	10.0	12.2	13.9	13.9	12.8	10.0	7.2	5.6	8.9
	Minimum	−13.9	−10.6	−7.8	−3.3	0.0	2.8	4.4	5.0	−1.1	−4.4	−8.3	−11.7	−13.9
Precipitation (cm)	Max./24 hrs.	21.9	12.4	12.0	9.1	7.4	8.9	7.1	7.2	12.1	13.2	19.1	14.6	21.9
	Mean total	38.5	31.8	29.2	23.3	12.0	9.7	8.8	9.0	17.2	37.6	42.1	43.6	302.8
	Mean snow	15.0	5.3	3.6	1.0	T	0.0	0.0	0.0	0.0	T	2.5	6.9	34.3
Sunshine (hours)	Mean total	58	83	132	159	217	217	241	190	166	108	69	50	1,690
Fort Nelson (airport)	elev. 382m													
Temperature (°C)	Maximum	7.2	15.0	17.8	24.4	31.7	33.9	36.7	33.9	32.8	25.6	18.3	9.4	36.7
	Mean	−23.3	−17.2	−8.9	1.1	9.4	14.4	16.7	15.0	8.9	1.1	−12.2	−20.6	−1.1
	Minimum	−51.7	−48.3	−39.4	−34.4	−15.0	−1.1	1.1	−1.7	−11.1	−27.7	−41.1	−47.8	−51.7
Precipitation (cm)	Max./24 hrs.	0.2	0.5	0.4	2.0	3.5	5.2	4.7	8.1	2.8	1.9	0.5	0.1	8.1
	Mean total	2.6	2.4	2.5	2.2	3.8	6.4	7.5	5.6	3.9	2.6	2.7	2.6	44.6
	Mean snow	30.2	26.2	27.4	19.3	5.8	T	0.0	T	5.3	19.1	29.5	28.7	191.5
Sunshine (hours)	Mean total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fort St. John (airport)	elev. 695m													
Temperature (°C)	Maximum	10.6	12.8	13.9	21.7	30.0	31.7	33.3	33.3	30.0	25.6	18.3	8.9	33.3
	Mean	−17.2	−11.7	−6.7	2.8	10.0	13.9	16.1	14.4	10.0	4.4	−6.7	−13.3	1.1
	Minimum	−47.2	−42.2	−36.7	−28.9	−10.6	−0.6	2.8	−1.1	−10.0	−20.6	−36.1	−40.6	−47.2
Precipitation (cm)	Max./24 hrs.	0.8	0.2	0.7	2.0	2.6	8.0	5.7	4.9	2.5	1.5	1.3	0.3	8.0
	Mean total	3.3	2.8	2.7	2.3	3.3	6.2	6.3	5.4	3.3	3.0	3.2	3.3	45.0
	Mean snow	35.0	29.0	28.2	17.5	7.9	0.5	0.0	1.5	3.3	18.0	30.5	34.8	206.2
Sunshine (hours)	Mean total	73	106	159	214	280	274	300	270	174	137	81	60	2,128
Germansen Landing	elev. 747m													
Temperature (°C)	Maximum	11.7	11.7	15.6	20.0	27.8	32.2	30.6	32.2	27.8	19.4	11.7	8.3	32.2
	Mean	−17.2	−9.4	−5.0	1.7	7.2	11.7	13.9	12.8	8.3	1.7	−6.7	−13.3	0.6
	Minimum	−47.2	−44.4	−40.0	−26.7	−12.8	−3.3	−2.2	−3.9	−7.8	−30.6	−36.1	−45.6	−47.2
Precipitation (cm)	Max./24 hrs.	0.6	1.2	0.7	5.4	1.8	3.5	3.4	3.8	2.2	1.5	1.8	1.7	5.4
	Mean total	5.6	3.5	2.9	3.7	2.8	5.0	4.7	4.8	3.5	4.5	5.3	6.0	52.5
	Mean snow	54.6	32.8	26.7	18.0	2.5	0.0	0.0	0.0	1.0	18.0	46.7	56.6	257.0
Sunshine (hours	Mean total	35	79	140	191	259	289	267	228	128	89	33	15	1,753
Kamloops (airport)	elev. 346m													
Temperature (°C)	Maximum	13.3	16.7	22.2	28.9	36.1	38.9	39.4	38.3	33.9	28.3	17.2	16.1	39.4
	Mean	−6.1	−1.1	3.3	9.4	14.4	17.8	21.1	20.0	15.0	8.3	1.7	−2.8	8.3
	Minimum	−37.2	−28.3	−26.1	−8.3	−5.6	1.1	3.3	2.8	−2.8	−13.3	−23.3	−36.1	−37.2
Precipitation (cm)	Max./24 hrs.	7.1	5.5	4.6	5.9	3.0	2.7	2.4	3.4	4.7	9.2	8.4	6.9	9.2
	Mean total	16.2	11.1	10.1	6.4	3.7	3.9	2.3	2.6	4.4	10.6	15.4	18.1	104.8
	Mean snow	35.1	10.7	13.0	T	T	0.0	0.0	0.0	0.0	0.0	3.6	25.1	8.7
Sunshine (hours)	Mean total	56	97	148	197	255	253	314	276	196	125	67	48	2,032

Station		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1/a
Nanaimo (airport)	elev. 30m													
Temperature (°C)	Maximum	15.6	18.3	19.4	23.3	30.6	34.4	36.1	36.7	31.7	25.6	19.4	14.4	36.7
	Mean	1.7	3.3	5.0	7.8	11.7	15.0	17.2	16.7	13.9	9.4	5.0	2.8	8.9
	Minimum	−17.8	−16.7	−12.2	−5.0	−4.4	0.6	2.8	3.9	−1.1	−6.7	−16.1	−20.0	−20.0
Precipitation (cm)	Max./24 hrs.	1.2	1.8	1.8	1.9	2.1	3.9	2.8	5.0	3.3	3.9	1.8	1.3	5.0
	Mean total	5.9	4.3	3.1	2.9	4.2	5.8	5.8	7.3	5.6	6.1	5.5	5.4	62.1
	Mean snow	59.4	37.3	24.9	10.2	2.0	T	0.0	0.0	1.0	10.2	39.4	49.0	233.4
Sunshine (hours)	Mean total	53	91	127	165	235	223	289	251	189	118	60	45	1,846
Prince George (airport)	elev. 676m													
Temperature (°C)	Maximum	12.8	12.8	17.8	23.3	30.0	33.9	34.4	33.3	28.9	25.0	16.1	11.7	34.4
	Mean	−11.7	−6.1	−2.2	3.9	9.4	12.8	15.0	13.9	10.0	4.4	−2.8	−7.8	3.3
	Minimum	−50.0	−45.0	−37.8	−25.6	−8.3	−2.8	−1.7	−3.9	−12.2	−25.6	−41.7	−45.6	−50.0
Precipitation (cm)	Max./24 hrs.	1.2	1.8	1.8	1.9	2.1	3.9	2.8	5.0	3.3	3.9	1.8	1.3	5.0
	Mean total	5.9	4.3	3.1	2.9	4.2	5.8	5.8	7.3	5.6	6.1	5.5	5.4	62.1
	Mean snow	59.4	37.3	24.9	10.2	2.0	T	0.0	0.0	1.0	10.2	39.4	49.0	233.4
Sunshine (hours)	Mean total	54	89	139	187	255	256	279	245	158	104	60	39	1,865
Prince Rupert (airport)	elev. 88m (approx.)													
Temperature (°C)	Maximum	17.8	18.9	20.0	23.3	29.4	32.2	30.6	30.0	27.2	21.7	20.0	17.2	32.2
	Mean	0.0	2.8	3.3	5.6	8.3	11.1	12.8	13.3	11.7	8.3	4.4	1.1	6.7
	Minimum	−21.1	−17.2	−15.0	−6.7	−1.1	1.7	0.6	3.9	−1.1	−5.6	−11.7	−15.0	−21.1
Precipitation (cm)	Max./24 hrs.	12.5	7.8	10.4	7.1	6.6	4.8	6.7	7.1	9.5	14.1	13.8	12.5	14.1
	Mean total	21.4	20.9	18.0	18.4	12.3	10.7	12.1	14.7	24.2	35.9	26.9	25.9	241.5
	Mean snow	34.3	19.3	19.1	3.3	T	0.0	0.0	0.0	0.0	0.3	5.1	31.8	113.0
Sunshine (hours)	Mean total	42	59	86	118	159	120	120	119	95	54	40	24	1,036
Salmon Arm	elev. 506m													
Temperature (°C)	Maximum	11.1	15.6	20.6	30.0	36.1	37.8	41.1	37.8	36.7	27.2	18.9	14.4	41.1
	Mean	−5.0	−1.1	2.2	7.8	12.8	16.7	19.4	18.3	14.4	7.8	1.7	−2.2	7.8
	Minimum	−35.0	−31.7	−26.1	−12.8	−5.0	−1.1	1.7	1.7	−5.0	−9.4	−21.1	−31.7	−35.0
Precipitation (cm)	Max./24 hrs.	3.9	2.9	2.9	3.0	3.1	2.8	3.4	3.3	4.1	4.3	2.5	3.8	4.3
	Mean total	6.1	3.9	2.9	3.0	3.8	4.8	3.8	4.3	3.8	4.9	5.2	6.5	53.1
	Mean snow	52.6	24.6	8.9	1.8	0.0	0.0	0.0	0.0	0.0	0.5	18.0	49.8	156.2
Sunshine (hours)	Mean total	25	59	119	161	225	217	287	249	166	84	32	14	1,638
Sandspit (airport)	elev. 5m													
Temperature (°C)	Maximum	12.2	12.2	13.9	18.9	21.7	25.0	26.1	26.7	22.2	18.9	15.6	13.3	26.7
	Mean	2.2	3.3	3.9	6.1	8.9	11.7	13.9	14.4	12.8	8.9	5.6	3.3	7.8
	Minimum	−13.9	−12.2	−12.2	−2.8	−1.1	2.2	5.6	5.6	−0.6	−2.2	−6.7	−12.8	−13.9
Precipitation (cm)	Max./24 hrs.	5.7	3.5	3.4	8.0	4.8	2.7	2.2	3.9	4.9	4.9	4.3	5.6	8.0
	Mean total	15.5	11.1	10.2	8.1	4.6	4.7	4.8	4.8	8.6	18.5	18.5	16.7	126.1
	Mean snow	30.2	14.2	10.4	1.5	0.3	0.0	0.0	0.0	0.0	T	7.4	14.5	78.5
Sunshine (hours)	Mean total	57	84	121	158	213	180	195	168	133	86	61	37	1,493
Summerland (Canada Dept. of Agriculture)	elev. 454m (approx.)													
Temperature (°C)	Maximum	13.9	16.7	22.2	28.9	33.9	38.3	40.0	36.7	34.4	27.8	16.7	15.6	40.0
	Mean	−3.3	0.0	3.9	8.9	13.9	17.8	21.1	20.0	15.6	8.9	2.8	−1.1	8.9
	Minimum	−30.0	−26.7	−21.7	−10.0	−5.0	1.7	4.4	5.6	−3.9	−9.4	−18.9	−29.4	−30.0
Precipitation (cm)	Max./24 hrs.	1.2	1.0	1.3	2.5	2.7	3.4	4.2	2.2	2.3	4.5	1.7	2.3	4.5
	Mean total	3.0	1.8	1.3	2.2	2.6	3.5	2.6	2.5	1.9	2.2	2.6	3.2	29.6
	Mean snow	25.7	10.4	4.8	T	0.0	0.0	0.0	0.0	0.0	0.5	8.1	24.9	74.4
Sunshine (hours)	Mean total	47	84	149	190	245	249	317	278	205	129	60	39	1,992
Trail (Sunningdale)	elev. 579m (approx.)													
Temperature (°C)	Maximum	10.6	13.3	22.8	28.9	31.7	36.7	38.9	40.0	34.4	26.1	16.1	10.0	40.0
	Mean	−3.9	−0.6	3.3	8.9	13.9	17.2	20.0	19.4	15.0	8.9	2.2	−1.7	8.3
	Minimum	−24.4	−16.1	−12.8	−6.1	−1.7	2.2	5.6	3.3	−3.3	−6.1	−15.6	−32.2	−32.2
Precipitation (cm)	Max./24 hrs.	2.0	2.2	2.9	2.4	3.3	2.5	1.7	2.8	2.4	1.8	3.3	3.5	3.5
	Mean total	8.3	5.6	5.3	3.9	5.4	5.2	2.9	3.3	3.1	6.1	7.8	8.6	66.4
	Mean snow	60.2	24.9	10.7	1.0	0.3	0.0	0.0	0.0	0.0	0.3	17.0	52.6	166.9
Sunshine (hours)	Mean total	23	70	130	140	212	250	319	269	189	103	38	13	1,756

Station		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1/a
Vancouver (U.B.C.)	elev. 87m													
Temperature (°C)	Maximum	14.4	17.2	17.8	21.7	29.4	30.0	31.1	32.8	25.6	22.2	15.6	13.9	32.8
	Mean	2.8	4.4	6.1	8.9	12.2	15.0	17.2	16.7	14.4	10.6	6.1	3.9	10.0
	Minimum	−13.9	−6.1	−5.0	0.6	1.7	6.7	8.9	7.8	0.6	0.0	−7.2	−18.3	−18.3
Precipitation (cm)	Max./24 hrs.	8.8	5.1	4.3	2.9	2.4	2.1	3.1	3.8	4.4	4.6	5.5	5.0	8.8
	Mean total	16.9	13.2	10.1	6.8	5.3	4.8	3.2	4.8	6.7	15.0	16.7	19.5	123.0
	Mean snow	19.1	1.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	23.6	49.0
Sunshine (hours)	Mean total	49	92	131	164	246	244	303	247	183	119	69	46	1,893
Victoria (Gonzales)	elev. 69m													
Temperature (°C)	Maximum	13.3	16.7	20.6	23.9	29.4	35.0	35.0	32.8	31.7	25.0	18.9	15.0	35.0
	Mean	3.9	5.6	6.7	9.4	12.2	13.9	15.6	15.6	14.4	11.1	7.2	5.0	10.0
	Minimum	−14.4	−12.8	−7.2	−2.2	1.1	3.9	6.1	4.4	1.7	−2.8	−11.1	−15.6	−15.6
Precipitation (cm)	Max./24 hrs.	7.7	8.1	5.3	3.7	3.8	3.4	2.2	2.6	4.3	5.1	6.9	8.1	8.1
	Mean total	10.7	7.6	4.9	3.4	2.1	2.1	1.2	2.0	3.3	7.4	9.5	11.5	65.7
	Mean snow	14.5	4.3	4.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	7.6	32.8
Sunshine (hours)	Mean total	70	98	150	198	277	276	338	287	209	139	81	60	2,183
Williams Lake (Airport)	elev. 940m													
Temperature (°C)	Maximum	12.8	12.8	16.1	20.6	30.0	32.2	33.9	32.8	30.6	22.8	15.0	8.9	33.9
	Mean	−10.0	−5.0	−1.7	4.4	9.4	13.3	15.6	15.0	10.6	5.0	−2.2	−6.7	3.9
	Minimum	−42.2	−23.9	−30.6	−16.7	−5.6	−1.7	1.7	−0.6	−7.8	−8.3	−28.3	−42.8	−42.8
Precipitation (cm)	Max./24 hrs.	1.6	1.4	0.6	2.0	1.8	2.6	3.4	3.0	2.5	3.7	1.0	0.6	3.7
	Mean total	3.5	2.5	2.8	1.6	2.3	6.1	4.4	4.5	3.4	3.0	2.6	3.6	40.2
	Mean snow	31.0	21.3	22.6	8.1	4.3	0.0	0.0	0.0	1.5	8.9	20.8	34.0	152.7
Sunshine (hours)	Mean total	60	114	165	206	264	303	309	278	190	129	76	48	2,142

Source: These data are abstracted from:

Canada. Atmospheric Environment Service. *Climate of British Columbia: Climatic Normals 1941-1970, Extremes of Record.* British Columbia. Department of Agriculture, [n.d.].

———. *Climate of British Columbia, Tables of Temperature, Precipitation and Sunshine: Report for 1976.* British Columbia. Department of Agriculture, [n.d.].

* The climatic stations listed here are considered representative of the areas in which they are located. To facilitate comparison, only those stations with a long period of record were included. It should be noted that elevation, aspect, and local topography exert a strong influence upon climatic variables. On that account significant differences, especially of temperature and precipitation, may be observed between different locations within the same climatic region.

Official recorded temperatures are based on readings of instruments in a ventilated enclosure approximately 1.2m above ground level, hence maximum temperatures at ground level or in full sun would likely be considerably higher; ground-level minimum temperatures would be correspondingly lower.

The original data are expressed in Imperial units. Slight rounding errors may have been introduced in converting them to metric equivalents.

Total precipitation is computed by adding the rainfall and the water equivalent of the snowfall (normally, one-tenth of the snowfall).

T = trace NA = data not available

POPULATION, 1951–1976

Cities and Towns with a Population over 5,000 in 1976

City	1976	1971	1966	1961	1956	1951
Vancouver	410,188	426,256	410,375	384,522	365,844	344,833
Victoria	62,551	61,761	57,453	54,941	54,584	51,331
Prince George	59,929	33,101	24,471	13,877	10,563	4,703
Kamloops	58,311	26,168*	10,759	10,076	9,096	8,099
Kelowna	51,955*	19,412	17,006	13,188	9,181	8,517
Nanaimo	40,336*	14,948	15,188	14,135	12,705	7,196
New Westminster	38,393	42,835	38,013	33,654	31,665	28,639
North Vancouver	31,934	31,847	26,851	23,656	19,951	15,687
Port Coquitlam	23,926	19,560	11,121	8,111	4,632	3,232
Penticton	21,344	18,146	15,330	13,859	11,894	10,548
Port Alberni	19,585	20,063	18,538	16,176**	14,320**	11,168**
Vernon	17,546	13,283	11,423	10,250	8,998	7,822
Prince Rupert	14,754	15,747	14,677	11,987	10,498	8,546
Cranbrook	13,510	12,000	7,849	5,549	4,562	3,621
White Rock	12,497	10,349	7,787	6,453	NA	NA
Port Moody	11,649	10,778	7,021	4,789	2,713	2,246
Dawson Creek	10,528	11,885	12,392	10,946	7,531	3,589(V)
Langley	10,123	4,684	2,800	2,365	2,131	12,267(D)
Trail	9,976	11,149	11,600	11,580	11,395	11,430
Nelson	9,235	9,400	9,504	7,074	7,226	6,772
Fort St. John	8,947	8,264	6,749	3,619(V)	1,908	884
Chilliwack	8,634	9,135	8,681	8,259	7,297	5,663
Courtenay	7,733	7,152	4,913	3,485	3,025	2,553
Kimberley	7,111	7,641	5,901	6,013	5,774	5,933
Castlegar	6,255	3,072(T)	3,440	2,253(V)	1,705	1,329
Town						
Quesnel	7,637	6,252	5,725	4,673	4,384	1,587(V)
Sidney	6,732	4,868	3,165(V)	1,558	1,371	NA
Williams Lake	6,199	4,072	3,167	2,120(V)	1,790	913
Merritt	5,680	5,289	4,500	3,039(V)	1,790(C)	1,251
Comox	5,359	3,980	2,671(V)	1,756	1,151	714

POPULATION, 1951–1976

District Municipalities with a Population over 10,000 in 1976

District Municipality	1976	1971	1966	1961	1956	1951
Burnaby	131,599	125,660	112,036	100,157	83,745	58,376
Surrey	116,497	98,601	81,826	70,838	49,366	33,676
Richmond	80,034	62,121	50,460	43,323	25,978	19,186
Saanich	73,383	65,040	58,845	48,876	38,358	28,481
Delta	64,492	45,860*	20,664	14,597	8,752	6,701
North Vancouver	63,471	57,861	48,124	38,971	26,252	14,469
Coquitlam	55,464	53,230	40,916	29,053	20,800	15,697
West Vancouver	37,144	36,440	31,987	24,454	19,197	13,990
Langley	36,659	21,936	15,767	14,585	12,441	12,267
Matsqui	31,178	23,554	16,161	14,293	11,521	10,308
Maple Ridge	29,462	24,476	19,287	16,748	12,502	9,891
Chilliwack	28,421	23,739	20,070	18,296	16,350	13,667
Oak Bay	17,658	18,426	18,123	16,935	14,857	11,960
North Cowichan	15,956	12,170	10,384	9,166	7,781	6,665
Esquimalt	15,053	12,922	12,891	12,048	10,384	10,153
Mission	14,997	10,220	5,351	5,324	4,711	4,467
Powell River	13,694	13,726	12,578	10,748	9,969	NA
Campbell River	12,072	10,000	7,825	3,737(V)	3,069	1,986
Kitimat	11,956	11,803	9,792	8,217	NA	—
Terrace	10,251	9,991	8,637	5,940	1,473(V)	961
Total British Columbia population	2,059,082	1,792,181	1,530,985	1,312,445	1,109,958	908,328

*Municipal boundaries were extended. Many adjustments to the boundaries of other municipalities are not recorded in the census data.

**Alberni and Port Alberni were amalgamated under the latter name in 1965. Figures for 1961 and earlier are for Alberni and Port Alberni combined.

NA = Data not available.

Changes in the status of communities are indicated by the symbols (T) = town (V) = village (D) = district (C) = city.

For some years substantial variation exists between British Columbia government and federal Census data.

Source: British Columbia. Department of Municipal Affairs. *Municipal Statistics* for the years listed.

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