Atlas of British Columbia
People, environment, and resource use

A.L. Farley
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.

Initial work toward conceptualization and design of the atlas was supported by a research grant from the Canada Council. Later stages of the project, notably compilation and colour separation, were made possible by grants from the provincial government, from industry, and from philanthropic organizations. Grateful recognition is made of financial help received from the Province of British Columbia, British Columbia Hydro and Power Authority, British Columbia Packers, Canadian Cellulose Company, Crown Zellerbach Canada, Finning Tractor and Equipment Company, Johnston Terminals, Kaiser Resources, Pacific Press, and Placer Development. It is also a pleasure to acknowledge the generous support of the Leon and Thea Koerner Foundation, the Samuel and Saimdy Bronfman Family Foundation, and the Vancouver Foundation. That support did much to offset the substantial costs of supplies and processing chemicals required. In addition, recognition is given to Canada Manpower for the opportunity to employ university students in atlas work under the Young Canada Works Program and to the provincial Ministry of Labour for similar opportunities under the Youth Employment Program.

I am grateful to all those who have extended their help and goodwill during the planning and execution of this atlas. In particular I wish to thank L.J. Wallace, former deputy provincial secretary, and R.I. Nelson, chairman and chief executive officer, British Columbia Packers Limited, for their active support of the project. I also wish to thank W.G. Hardwick, deputy minister of Education, and D.P. Brown, Office of the Premier, for helpful comments. At a critical time in planning the atlas, several former members of the British Columbia Natural Resources Conference, including Ian McT. Cowan, Dean H. Goard, Peter Larkin, Charles W. Nash, Paddy Sherman, and David B. Turner lent their encouragement.

Appreciation is also expressed to colleagues at the University of British Columbia — to H.V. Warren and W.C. Gibson who gave help and advice on funding the project; to J.D. Chapman and J.L. Robinson for valuable suggestions related to funding and about the substantive content of the atlas; to M.A. Church, V.J. Krajina, J.V. Powell, K.C. McTaggart, W.H. Matthews, O. Slaymaker, and N.J. Willimovsky for useful comments on parts of the manuscript; to A. Mackworth and D. Cameron in connection with the LANDSAT digital image and P.A. Murtha and K. Watson for providing an enlargement of the LANDSAT colour composite image; and to R.H.T. Smith and the Department of Geography for sympathetic interest and for the allocation of project space so critical during compilation and colour separation work.

During the planning stage, helpful suggestions concerning size, format, and topical content were received from many people, notably: Aileen Tufts and staff at the Vancouver Public Library; Basil Stuart-Stubbs, librarian at the University of British Columbia, and members of his staff; Richard Malinski, Simon Fraser University Library; David Huggins, director, Publications Services, British Columbia Ministry of Education; Jack H. Wallis, U.B.C. Faculty of Education; and Josef Schonfeld, former map librarian at U.B.C. John Raybould of the Fraser Institute, Vancouver, George Hill, Camosun College, Victoria, and Harvie L. Walker, Vancouver School Board, also provided information.

The facts upon which this atlas was based were derived from many sources. In addition to published data, machine tabulation and other specially compiled information was provided by several departments of the federal government. It is a pleasure to acknowledge the cooperation of W. Milne and R.P. Riddihough, Victoria Geophysical Observatory, Department of Energy, Mines and Resources; D.L. Tiffin and D. Seemann, Geological Survey of Canada; K.W. Studnicki-Gizbert and George Hariton, Canadian Transport Commission; Derek Bright, S.W. Wittuck, and A. Gallant, Census Field, Statistics Canada; P.K. Andrews, National Air Photo Library; Karen Calderbank, Vancouver Regional Office, Statistics Canada; and G. Barber and F.E.A. Wood, Fisheries Canada. Terry Lord and Keith Valentine, Agriculture Canada, provided manuscript from which the soils map and text were derived.

Various ministers of the provincial government also cooperated actively. I am especially indebted to D.K. O’Gorman, director, Environment and Land Use Committee Secretariat and to Environment and Land Use Technical Committee representatives R. Harding (Forests); E. McMinn and G. Simmons (Environment); E. Vernon (Recreation and Conservation); D. South (Highways), and R. Wilkinson (Agriculture). The interest they expressed was crucial to the project. Assistance in the provision of information was also extended by the Ministries of Mines and Petroleum Resources and of Economic Development. It is a pleasure to acknowledge the help rendered by W.A. Benson, director, Resource Analysis Branch, who gave counsel on a number of text presentations. Acknowledgement is also made to D.F. Pearson, Surveys and Mapping Branch, for help with projection system data, with material in the statistical summary, and with many other enquiries, and to the following government officers: C. Highsted (Forest Service); Y. Edwards (Provincial Museum); G. Howell-Jones (Resource Analysis Branch); L. Smith (Surveys and Mapping Branch); W. Tuthill (Water Resources Branch); A. Sutherland Brown, G. Jackson, W. Wilson, and A.F. Shepherd (Mines and Petroleum Resources); R. Halliday, G. Halsey, and R. Thomas (Fish and Wildlife Branch); C. Campbell and M. Collins (Parks Branch); G. Weir (Economics and Statistics Branch); J. Baker (Ministry of Highways); and G.D. Lloyd (Ministry of Transport and Communications). H.J. Goldie and C.C. Purves, B.C. Hydro, and C. McKechnie, B.C. Energy Commission, provided information and helpful comments concerning the energy maps. J.A. MacInnes, B.C. Telephone Company, kindly supplied data on telephone calls for the map showing regional linkages.

A word of special appreciation goes to my wife, J. Iris Farley, who, over the four years it has taken to prepare this atlas, has tolerated long hours, late meals, and broken holiday plans in order to see the project through.

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
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 cooperation; 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.
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 inter-relationships 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

**Acknowledgements**

Foreword

Project Acknowledgements

Guide to Atlas Use

Introduction

Gazetteer Map

## PEOPLE

<table>
<thead>
<tr>
<th>Map</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Population: Historical, 1911–1931</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Population, 1976</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Native Indians: Distribution of Ethnic Groups, 1850</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Native Indians: Occupied Reserves and Proportion of Status Indian Population in Total Population, 1974</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Exploration</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>The “Trutch Map,” 1871</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>LANDSAT Mosaic, 1975</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>Migration, 1966–1971</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>Net Migration and Change, 1966–1971</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>Migration, 1971–1976</td>
<td>20</td>
</tr>
</tbody>
</table>

## ENVIRONMENT

<table>
<thead>
<tr>
<th>Map</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Relief and Bathymetry</td>
<td>26</td>
</tr>
<tr>
<td>13</td>
<td>Bedrock Geology</td>
<td>28</td>
</tr>
<tr>
<td>14</td>
<td>Physiographic Regions</td>
<td>30</td>
</tr>
<tr>
<td>15</td>
<td>Vulcanism, Seismic Activity, and Major Groundwater Features</td>
<td>32</td>
</tr>
<tr>
<td>16</td>
<td>Glacial Features</td>
<td>34</td>
</tr>
<tr>
<td>17</td>
<td>Soils</td>
<td>36</td>
</tr>
<tr>
<td>18</td>
<td>Streamflows</td>
<td>38</td>
</tr>
<tr>
<td>19</td>
<td>Water Quality</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>Mean Annual Precipitation</td>
<td>42</td>
</tr>
<tr>
<td>21</td>
<td>Seasonal Temperature and Precipitation</td>
<td>44</td>
</tr>
<tr>
<td>22</td>
<td>Frost-Free Period and Moisture Index</td>
<td>46</td>
</tr>
<tr>
<td>23</td>
<td>Biogeoclimatic Zones</td>
<td>48</td>
</tr>
<tr>
<td>24</td>
<td>Land Capability for Wildlife — Ungulates</td>
<td>50</td>
</tr>
<tr>
<td>25</td>
<td>Game Animals: Distribution and Harvest, 1974</td>
<td>52</td>
</tr>
<tr>
<td>26</td>
<td>Freshwater Sport Fish</td>
<td>54</td>
</tr>
</tbody>
</table>

## RESOURCE USE

<table>
<thead>
<tr>
<th>Map</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Forestry: Distribution of Forested Land</td>
<td>58</td>
</tr>
<tr>
<td>28</td>
<td>Forestry: Distribution of Commercial Species</td>
<td>60</td>
</tr>
<tr>
<td>29</td>
<td>Forestry: Forest Administration, 1976</td>
<td>62</td>
</tr>
<tr>
<td>30</td>
<td>Forestry, Historical: Location and Capacity of Sawmills, 1931–1961</td>
<td>64</td>
</tr>
<tr>
<td>31</td>
<td>Forestry: Location and Capacity of Sawmills, 1971</td>
<td>66</td>
</tr>
<tr>
<td>32</td>
<td>Forestry, Historical: Pulp and Paper Mills, 1911–1961</td>
<td>68</td>
</tr>
<tr>
<td>33</td>
<td>Forestry: Pulp and Paper Mills and Plywood Plants, 1975</td>
<td>70</td>
</tr>
<tr>
<td>34</td>
<td>Mining: Historical, 1909–1973</td>
<td>72</td>
</tr>
<tr>
<td>35</td>
<td>Mining: Mineral Value by Mining Division, 1975</td>
<td>74</td>
</tr>
<tr>
<td>36</td>
<td>Mining: Mine Production, Producing and Potential Mines, and Smelters, 1976</td>
<td>76</td>
</tr>
<tr>
<td>37</td>
<td>Agriculture: Historical, 1911–1971</td>
<td>78</td>
</tr>
<tr>
<td>38</td>
<td>Agriculture: Agricultural Land Reserves and Livestock Distribution, 1975</td>
<td>80</td>
</tr>
<tr>
<td>39</td>
<td>Agriculture: Capitalization and Farm Types</td>
<td>82</td>
</tr>
<tr>
<td>40</td>
<td>Agriculture: Crop Value by Census Division</td>
<td>84</td>
</tr>
<tr>
<td>41</td>
<td>Agriculture: Livestock Value and Livestock Enterprises</td>
<td>86</td>
</tr>
<tr>
<td>42</td>
<td>Fishing, Historical: Distribution of Operating Fish Processing Plants and Canneries, 1911–1975</td>
<td>88</td>
</tr>
<tr>
<td>43</td>
<td>Fishing Average, 1971–1975</td>
<td>90</td>
</tr>
<tr>
<td>44</td>
<td>Salmon Net and Troll Fishing and Major Salmon Spawning Streams</td>
<td>92</td>
</tr>
<tr>
<td>45</td>
<td>Energy: Historical Development of Electricity Generation, 1911–1971</td>
<td>94</td>
</tr>
<tr>
<td>46</td>
<td>Energy: Electricity Generation and Transmission, 1975</td>
<td>96</td>
</tr>
<tr>
<td>48</td>
<td>Energy: Electrical Energy Consumption by Electrical Service Areas, 1961 and 1971</td>
<td>100</td>
</tr>
<tr>
<td>49</td>
<td>Water Use, 1976</td>
<td>102</td>
</tr>
<tr>
<td>50</td>
<td>Manufacturing, 1951–1970</td>
<td>104</td>
</tr>
<tr>
<td>51</td>
<td>Manufacturing, 1972</td>
<td>106</td>
</tr>
<tr>
<td>52</td>
<td>Recreation and Tourism: Provincial and National Parks and Marine Parks, 1975</td>
<td>108</td>
</tr>
<tr>
<td>53</td>
<td>Recreation and Tourism: Ski Areas and Boat-Launching Ramps, 1975</td>
<td>110</td>
</tr>
<tr>
<td>54</td>
<td>Recreation and Tourism: Total Campground Attendance, 1975</td>
<td>112</td>
</tr>
<tr>
<td>55</td>
<td>Recreation and Tourism: Campground Attendance and Summer Vehicular Traffic Volumes, 1975</td>
<td>114</td>
</tr>
<tr>
<td>56</td>
<td>Recreation and Tourism: Flow of Campers to Selected Regions, 1976</td>
<td>116</td>
</tr>
<tr>
<td>57</td>
<td>Transportation: Land and Ferry Routes and Airports, 1976</td>
<td>118</td>
</tr>
<tr>
<td>58</td>
<td>Transportation: Traffic Flows (Percentage Change, 1966–1971)</td>
<td>120</td>
</tr>
<tr>
<td>59</td>
<td>Transportation: Rail Flows by Major Commodity Group</td>
<td>122</td>
</tr>
<tr>
<td>60</td>
<td>Communication: Regional Linkages Based on Telephone Calls, 1975</td>
<td>124</td>
</tr>
<tr>
<td>61</td>
<td>Gazetteer</td>
<td>126</td>
</tr>
</tbody>
</table>

## Historical and Statistical Summary

Photographic Credits
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 officials, 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 inventories. 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 distribution 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 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, 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.
People
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 the immediate hinterland. A small milltown on Burrard Inlet, was transformed from a collection of shacks to a city of over 13,000 people. 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. Linea
tions 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.

References

MAP 1. POPULATION: HISTORICAL, 1911-1931

POPULATION 1870-1931 (NUMBERS AND PERCENTAGES)

<table>
<thead>
<tr>
<th></th>
<th>1871</th>
<th>1881</th>
<th>Per Cent Increase</th>
<th>1891</th>
<th>Per Cent Increase</th>
<th>1901</th>
<th>Per Cent Increase</th>
<th>1911</th>
<th>Per Cent Increase</th>
<th>1921</th>
<th>Per Cent Increase</th>
<th>1931</th>
<th>Per Cent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British Columbia</td>
<td>3,689,257</td>
<td>4,324,810</td>
<td>17.2</td>
<td>4,833,239</td>
<td>11.8</td>
<td>5,371,315</td>
<td>11.1</td>
<td>7,208,834</td>
<td>34.1</td>
<td>8,787,949</td>
<td>21.9</td>
<td>10,376,786</td>
<td>18.1</td>
</tr>
<tr>
<td>% of Canadian total</td>
<td>36.20%</td>
<td>49.45%</td>
<td>36.5</td>
<td>98.173</td>
<td>98.5</td>
<td>178.657</td>
<td>82.0</td>
<td>390.774</td>
<td>119.7</td>
<td>524.382</td>
<td>33.7</td>
<td>694.263</td>
<td>32.4</td>
</tr>
<tr>
<td>Victoria (city)</td>
<td>4,161</td>
<td>7,301</td>
<td>73.5</td>
<td>18,358</td>
<td>23,688</td>
<td>31,660</td>
<td>36,727</td>
<td>39,082</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater Victoria</td>
<td>6,907</td>
<td>8,075</td>
<td>16.3</td>
<td>27,733</td>
<td>25,999</td>
<td>43,605</td>
<td>59,003</td>
<td>88,009</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of B.C. total</td>
<td>13.0</td>
<td>16.3</td>
<td>23.2</td>
<td>14.6</td>
<td>11.2</td>
<td>11.2</td>
<td>12.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancouver (city)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(New Westminster approx.)</td>
<td>1,356</td>
<td>13,709</td>
<td>10.3</td>
<td>27,010</td>
<td>123,320</td>
<td>163,220</td>
<td>246,593</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Fraser Valley</td>
<td>1,656</td>
<td>1,750</td>
<td>5.8</td>
<td>20,900</td>
<td>20,900</td>
<td>58,891</td>
<td>179,581</td>
<td>256,579</td>
<td>379,858</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of B.C. total</td>
<td>4.6</td>
<td>4.5</td>
<td>21.3</td>
<td>33.0</td>
<td>46.0</td>
<td>48.9</td>
<td>54.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1This figure is based upon the Colonial census of white population (10.586) plus an estimate of Native Indian population derived from the 1881 census.
2These figures represent non-Indian population only.
3Figures are approximations based on interpretation of available data.
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 transshipment 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 a dominant centre. 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 municipalities 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.

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

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.

### PERCENTAGE POPULATION BY ETHNIC ORIGIN: 1971

<table>
<thead>
<tr>
<th>Ethnic origin</th>
<th>Percentage of B.C. total</th>
<th>Percentage of Canadian total</th>
</tr>
</thead>
<tbody>
<tr>
<td>British</td>
<td>57.9</td>
<td>44.6</td>
</tr>
<tr>
<td>German</td>
<td>9.1</td>
<td>27.8</td>
</tr>
<tr>
<td>French</td>
<td>4.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Norwegian</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Polish</td>
<td>2.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Native Indian</td>
<td>1.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Chinese</td>
<td>2.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Netherlander</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Danish</td>
<td>1.5</td>
<td>.6</td>
</tr>
<tr>
<td>Russian</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>Norwegian</td>
<td>1.5</td>
<td>.8</td>
</tr>
<tr>
<td>Japanese</td>
<td>1.5</td>
<td>.5</td>
</tr>
<tr>
<td>Netherlander</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>French</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>Russian</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>Norwegian</td>
<td>1.5</td>
<td>.8</td>
</tr>
<tr>
<td>Chinese</td>
<td>1.5</td>
<td>.5</td>
</tr>
<tr>
<td>Native Indian</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>Jewish</td>
<td>1.0</td>
<td>.6</td>
</tr>
<tr>
<td>Russian</td>
<td>1.5</td>
<td>.8</td>
</tr>
<tr>
<td>Chinese</td>
<td>1.5</td>
<td>.5</td>
</tr>
<tr>
<td>Native Indian</td>
<td>1.1</td>
<td>.6</td>
</tr>
<tr>
<td>Jewish</td>
<td>1.0</td>
<td>.6</td>
</tr>
</tbody>
</table>

**References**


Population
1976

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".

© The University of British Columbia
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 neighboring tribes during travel or for trading and social purposes. The bonds of language, however, were enhanced by such contact. Over the millennia 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, Kuluskit, and Nazkoтен 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 have 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 Tingits 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.

References


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

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.
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 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 dispatched 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.

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 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, townships 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.

References
Mayne, Richard C. Four Years in British Columbia and Vancouver Island. London: John Murray, 1862.
COAST AND INTERIOR TO 1791

Exploration

ACCOMPLISHMENTS TO 1813

SUMMARY TO 1871

SUMMARY TO 1900

- Discovered (Perez, Quadra, Cook, Dixon, Barkley and others 1774-1790)
- Explored by M. Quimper 1790
- Explored by J. Narvaez 1791
- Unexplored
- Explored and partly mapped (Galiano, Vancouver, Mackenzie 1792-1795; includes exploration by Frater 1805-1808)
- Explored by D. McGillivray, D. Thompson and other Nor'Westers 1800-1807
- Mapped by D. Thompson 1808-1811
- Explored by D. Stuart, J. La Roque, D. Harmon, J. Stuart and other traders 1811-1813
- Unexplored
- Explored and largely mapped by 1813
- Explored and partly mapped 1813-1871
- Unexplored
- Explored and partly mapped by 1871
- Explored and essentially mapped 1871-1900
- Unmapped and essentially unexplored

@ The University of British Columbia 11
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 considered 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-Harrisson-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 railway surveys but also as a result of the great geological explorations undertaken by the dominion government in western Canada.

References
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 Truch 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 Truch 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 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.

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.

References
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.
provinces has consistently been of overriding importance, population growth. Reasons for migration are varied, but employment opportunity appears to have been a major incentive. Cent of the interprovincial migrants in Canada had university level education.

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 underestimated, 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.

From 1966 to 1971, about 215,000 persons (one-third of the total) had 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 Lower Coast, internal migration accounted for over 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
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.

<table>
<thead>
<tr>
<th>Soil Area</th>
<th>Natural Increase</th>
<th>Net Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia total</td>
<td>+310,947</td>
<td>+135,480</td>
</tr>
<tr>
<td>Greater Vancouver</td>
<td>+127,507</td>
<td>+75,276</td>
</tr>
<tr>
<td>Natural increase</td>
<td>+224,145</td>
<td>172,507</td>
</tr>
<tr>
<td>Net migration</td>
<td>+224,145</td>
<td>+103,000</td>
</tr>
</tbody>
</table>

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 immigrants 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 immigrants 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.

References
Regional Net Migration
(as a percentage of the Census Division's 1966 population)

Provincial average 0%

10-19% 20-29% 30-39% Over 40%

Net Migration
In-migration Out-migration

0% - 10%
11% - 20%
21% - 30%
31% - 40%
Over 40%

Net Migration and Change
1966-1971

Census Divisions
1. Alberni - Clayoquot 16. Kitimat - Skeena
2. Bella Bella-Nechako 17. Kootenay Boundary
5. Central Fraser Valley 20. North Okanagan
7. Central Okanagan 22. Okanagan - Similkameen
10. Cowichan Valley 25. Sointula
12. East Kootenay 27. Siskiyou 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.

Percentage Change
Increase Decrease
0% - 10% 11% - 20%
21% - 30% 31% - 40%
Over 40%

Per Cent Population Change
(by Census Division)

Provincial average 17%
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 Asians 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.

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.

References
Migration
1971-1976
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 fulfillment 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 gathered 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 portion 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 and 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 provincial 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.

References

A web of steel dwarfs this worker during construction of the Asian Centre at the University of British Columbia.
Labour Force 1951-1971

Provincial total: 444,352

Regional proportion of provincial total
- Less than 3%
- 3% - 6%
- 15% - 20%
- Greater than 55%

Pie graph indicates industrial mix
- Primary
- Secondary
- Tertiary
- Unspecified

Regional proportion of provincial total
- Less than 3%
- 3% - 6%
- 15% - 20%
- Greater than 55%

Pie graph indicates industrial mix
- Primary
- Secondary
- Tertiary
- Unspecified

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

Provincial total: 573,648

Regional increase as compared to the provincial increase, all industrial labour force
- Above provincial average
  - Greater than 110%
  - 80% - 100%
  - 55% - 70%
  - Below provincial average
  - 1% - 5%
  - 15% - 20%
  - 35% - 40%
  - 55% - 70%
  - 80% - 100%

Graph indicates industrial mix
- Primary
- Secondary
- Tertiary
- Unspecified

Bar graphs show change in labour force, by major industrial sector, for each region. Calibration of graphs is in percentage above or below the regional average of all three industrial sectors. Regional average (increase) is shown in brackets.
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 well beyond 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 increase 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.

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 supports considerable areas of natural grassland as well as forest. The grassland areas have 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, particularly to the larger rivers, especially the Fraser, the Skeena, the Nass, and the Stikine (see Map 18).

The eastern system is broken by passes, and several have been utilized by early explorers. One such route travelled from the Peace River to the Pacific in 1793. 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 Colombians. 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.

References


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 British Columbia was extensive during the Mesozoic age, and this unit is composed mainly of heavily faulted, 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 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 mine 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 36).

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 1950s 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.

<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
<th>Epoch</th>
<th>Approximate Age before Present (thousands of yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesozoic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jurassic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triassic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carboniferous</td>
<td>Pennsylvanian</td>
<td>Mississippian</td>
<td></td>
</tr>
<tr>
<td>Devonian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silurian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordovician</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambrian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proterozoic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Archaea</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

References
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 kilometers 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, Coastal 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 upper strata and to reveal the substratum 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 the inland, as 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.

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

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.

References


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 episcopal 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 episcopal 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 Lkelise 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 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. Badium and Fairmont are better known and have been extensively developed as tourist resorts.

References
Vulcanism, Seismic Activity and Major Groundwater Features
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.

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.

References
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 soils 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 north-facing slope is drier and warmer than that on a south-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 leaves 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 moss 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. Luvis Gleysol has clay accumulation in the subsoil. A true Gleysol has neither.

**Luvic 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, Mertisols, 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, Mertisols moderately decomposed, and Humisols well decomposed. Follisols 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.

**Podsol 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 Podzols are characterized by an accumulation of organic matter in the subsoil; in Humo-ferric Podzols, 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.

**Solonetiztic 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 solonetiztic 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 Podzol type.

**References**

A Dominantly Brunisolic Soils
A1 Eutric Brunisol (Cryochrept, Eutrochrept)*
A2 Dystric Brunisol (Dystrochrept, Cryochrept)

B Dominantly Chernozemic Soils
B1 Brown Chernozem (Aridic Boroll subgroups)
B2 Dark Brown Chernozem (Typic Boroll subgroups)
B3 Black Chernozem (Udic Boroll subgroups)
B4 Dark Gray Chernozem (Bu Falk 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, Aquenl, Aquert)
D3 Luvic Gleysol (Argiuboll, Argiaquoll, Aquoll)

E Dominantly Luvisolic Soils
E1 Gray Luvisoil (Boroll)

F Dominantly Organic Soils
F1 Fibrisol, Messisol and Humisoliol - very poorly drained (Fibriss, Hemisoli, Saprisol)
F2 Folisol - well drained (Folisol)

G Dominantly Podzolic Soils
G1 Ferric Humic Podzol (Humic Cryorthod, Humic Haplorthod)
G2 Humic - Ferric Podzol (Cryorthod, Haplorthod)

H Dominantly Regosolic Soils
H1 Regosol (Entisol)

I Dominantly Ice Fields: nonsoil

J Dominantly Solonetzic Soils
J1 Solod (Glossi Nitra roll, Nitra roll)

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.
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.

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 profiles 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.

References

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

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 watermilfoil 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 groundwater and monitoring of the environment are fundamental to the future management of British Columbia's water resource.

References


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

Jackson Turbidity Units (JTU)
- 3.0 - 5.9
- 6.0 - 14.9
- 15.0 - 23.9
- 24.0 - 32.9
- Greater than 32.9

Water quality station

* The JTU is based upon the ability of a water sample to transmit light.

SUMMER WATER TEMPERATURE

Degrees Celsius (°C)
- 1.4 - 5.9
- 6.0 - 10.9
- 11.0 - 15.4
- 15.5 - 20.0

Water quality station

WATER HARDNESS

Milligrams per litre (mg/l) (Calcium carbonate equivalent)
- 18.5 - 21.9
- 22.0 - 62.4
- 62.5 - 102.9
- 103.0 - 143.9
- 144.0 - 185.0

Water quality station
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. Tadoussac 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

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. Tadoussac 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 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

References


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.
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.

References
Seasonal Temperature and Precipitation

Broken lines indicate very limited data.
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 on 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 agriculturists 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 transpiration 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 rain-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.

References

Greenhouses extend the growing season in southwestern British Columbia.
Frost-Free Period and Moisture Index

Moisture Index

- Less than 60 days
- 60 - 100 days
- 100 - 140 days
- 140 - 180 days
- 180 - 220 days
- Greater than 220 days

AVERAGE FROST-FREE PERIOD (DAYS)

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.

© The University of British Columbia 47
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

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

warmest region, the Pacific Coastal Subalpine Forest (M.Hem), 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 (I.Hem), 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 (I.Fir).

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.

<table>
<thead>
<tr>
<th>GEOCCLIMATIC CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone</td>
</tr>
<tr>
<td>CIHem</td>
</tr>
<tr>
<td>CIFir</td>
</tr>
<tr>
<td>Py</td>
</tr>
<tr>
<td>MIHem</td>
</tr>
<tr>
<td>ESPr</td>
</tr>
<tr>
<td>SW</td>
</tr>
<tr>
<td>BSpr</td>
</tr>
<tr>
<td>SSPr</td>
</tr>
<tr>
<td>CA</td>
</tr>
<tr>
<td>IHem</td>
</tr>
<tr>
<td>IFir</td>
</tr>
<tr>
<td>AT</td>
</tr>
</tbody>
</table>

References


The moss-hung undergrowth of this Queen Charlotte Island rainforest is characteristic of the Mesothermal Formation.
Glaciers
Alpine tundra (AT)
Subalpine mountain hemlock (MHem)
Subalpine Engelmann spruce-subalpine fir (ESpr)
Spruce - birch - willow (SW)
Boreal white and black spruce (BSpr)
Sub-boreal spruce (SSpr)
Cariboo aspen-lodgepole pine (CA)
Interior western hemlock (IHem)
Interior Douglas - fir (IFir)
Ponderosa pine-bunchgrass (Py)
Coastal Douglas - fir (CFir)
Coastal western hemlock (CHem)
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.

References
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, 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 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

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.

References
——. ——. Wildlife Review.
Game Animals

DISTRIBUTION AND REGIONAL HARVEST 1974

Fish and Wildlife Regions
1. Vancouver Island
2. Mainland - Coast
3. Kamloops
4. Okanagan
5. Kootenay
6. Caribou - Coast
7. Prince George
8. Smithers
9. Fort St. John

Region boundary

Game animals harvested
21,500 animals
10,500
3,000
less than 60

Where harvest of both genera is small, symbols are shown side by side. Otherwise, symbols are concentric.
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. malka). The second of these was introduced from eastern North America where its common name was given to it. The 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. tschawytscha), 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. 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.

References


Freshwater Sport Fish

DISTRIBUTION AND CATCH*

BY

FISHERIES MANAGEMENT REGIONS

1969 - 1970

* Catch allocated to Fisheries Management Region in which angler is resident.
Resource Use
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 glacially derived soils. The Cassiar-Columbia Mountains and the Rocky Mountain area may be recognized by the non-forested land. 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.

References
———. Key Map . . . and Summary Zones of the Provincial Forest Inventory. (Map at a scale of 1:2 million.) Victoria: Forest Service Inventory Division. [n.d.].
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 paneling 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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total cut (millions of m³)</th>
<th>Coast</th>
<th>Interior</th>
<th>D. Fir</th>
<th>Hemlock</th>
<th>Spruce</th>
<th>Lodgepole Pine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>29.3</td>
<td>63%</td>
<td>37%</td>
<td>31%</td>
<td>20%</td>
<td>13%</td>
<td>no significant cut</td>
</tr>
<tr>
<td>1965</td>
<td>43.4</td>
<td>66%</td>
<td>34%</td>
<td>30%</td>
<td>22%</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>1976</td>
<td>69.5</td>
<td>66%</td>
<td>34%</td>
<td>23%</td>
<td>21%</td>
<td>16%</td>
<td>13%</td>
</tr>
</tbody>
</table>

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.

**References**


Forestry

Distribution of Commercial Species

HEMLOCK Tsuga heterophylla

DOUGLAS-FIR Pseudotsuga menziesii

BALSAM Abies*

RED CEDAR Thuja plicata

* 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.
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.

References

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-load 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.

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.

References

Forestry
HISTORICAL
LOCATION AND CAPACITY OF SAWMILLS
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
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 m³.

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. Telecoping 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.

References

Sawyer operating headsaw at MacMillan-Bloedel plant at Somass.

This large complex near Victoria is typical of integrated lumber mills.
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 tide-water 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 post-war 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 paper-making 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.

References
Forestry
HISTORICAL
PULP AND PAPER MILLS
1911-1961

1911
Provincial total
423
Metric tons per day

1931
Provincial total
1,155
Metric tons per day

1951
Provincial total
3,163
Metric tons per day

1961
Provincial total
6,909
Metric tons per day

Pulp and paper
- Sulphite
- Sulphate
- Groundwood
- Newprint
- Other

Symbol size proportionate
to total mill capacity.

Under construction
Unknown capacity

© The University of British Columbia
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.

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.

References
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 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.

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 Anwox, 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.

References
Mining
HISTORICAL VALUE OF PRODUCTION
BY MINING DIVISION 1909 - 1973

1909 - 1913
Provincial Average Value
1909 - 1913: $27.4 million

1929 - 1933
Provincial Average Value
1929 - 1933: $43.6 million

1949 - 1953
Provincial Average Value
1949 - 1953: $161.8 million

1969 - 1973
Provincial Average Value
1969 - 1973: $635.2 million

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

© The University of British Columbia
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 m³ to about 2.3 million m³. 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 $322 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.

References

Mining

MINERAL VALUE BY MINING DIVISION AS A PROPORTION OF THE PROVINCIAL TOTAL AND MAJOR MINERAL GROUPS IN MINING DIVISIONS 1975

Total provincial value of mineral production 1975: $1.296 billion

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 (aluminium 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 aluminium 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.

References
Mining

MINE PRODUCTION
PRODUCING AND POTENTIAL MINES,
AND SMELTERS
1976

- Industrial metals, precious metals, non-metallic minerals and coal are represented. Placer gold, structural materials, petroleum and natural gas are excluded.

MINERALS PRODUCED

Metallic

- Industrial metals
  - Copper
  - Lead
  - Zinc
  - Molybdenum
  - Iron
  - Aluminum
- Precious metals (excl. placer gold)
  - Gold
  - Silver
- Industrial and precious metals (same mine or locality)
- Non-metallic
  - Asbestos
  - Gypsum
  - Barite
- 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.
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 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 generally coincides with what were then the most productive agricultural areas.

The maps for 1931 and 1951 are more readily comparable 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 in 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.

References

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

Provincial total
$17,376,031

Provincial total
$36,408,347

Provincial total
$69,060,297

Provincial total
$209,397,960

© The University of British Columbia 79
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 favorably 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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**References**

British Columbia. Environment and Land Use Secretariat. *Agriculture Land Reserves of British Columbia.* (Map at a scale of 1:2,000,000.) Victoria, 1975.

---

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 southeastern 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.

References
### Agriculture

**CAPITALIZATION BY CENSUS DIVISION AS A PERCENTAGE OF THE PROVINCIAL TOTAL AND FARM TYPES BY MAJOR ENTERPRISE IN CENSUS DIVISION 1971**

<table>
<thead>
<tr>
<th>Pie-graphs Show Regional Mix of Farm Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dairy</strong></td>
</tr>
<tr>
<td><strong>Cattle (beef)</strong></td>
</tr>
<tr>
<td><strong>Poultry</strong></td>
</tr>
<tr>
<td><strong>Field crops</strong></td>
</tr>
<tr>
<td><strong>Fruits and vegetables</strong></td>
</tr>
<tr>
<td><strong>Miscellaneous, specialty and mixed</strong></td>
</tr>
</tbody>
</table>

#### Regional Proportion of Total Farm Capitalization

- Less than 1%
- 1% - 3%
- 3% - 6%
- 6% - 10%
- 10% - 15% (inset map)
- Greater than 15%

#### Farm Types – Provincial Averages

- 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%

© The University of British Columbia
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.

References
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.

References
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

Livestock Enterprises (by value)

<table>
<thead>
<tr>
<th>Livestock Enterprises</th>
<th>Piegraphs Show Regional Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cattle</td>
<td></td>
</tr>
<tr>
<td>Pigs, sheep, horses</td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
</tr>
<tr>
<td>Dairy products</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
</tr>
<tr>
<td>Greater than 20%</td>
<td></td>
</tr>
</tbody>
</table>

Less than 1%
1% - 3%
3% - 6%
6% - 10%
10% - 20% (inset map)
Greater than 20%

No significant livestock

Aggregated Census Divisions

Livestock Enterprises - Provincial Averages

- Beef cattle: 33.4%
- Dairy products: 33.2%
- Eggs: 13.9%
- Pigs, sheep, horses: 4.3%
- Total provincial livestock value, 1971 approx.: 1143 million.

© The University of British Columbia 87
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 long ago was 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 canning plant. 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, towards Vancouver. Shellfish plants remain concentrated in the Strait of Georgia area, where the Pacific oyster is managed by 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 decisions 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 fishery 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.

References
——. Department of Lands. Central British Columbia 1929. (Map at a scale of 2 miles-to-the-inch.) Victoria, 1929.
Doyle, H. “The Henry Doyle Papers.” University of British Columbia Library, Special Collections Division.
HISTORICAL DISTRIBUTION OF OPERATING FISH PROCESSING PLANTS AND SALMON CANNERIES 1911-1975

- Shellfish processing (only)
- Salmon canning (only)
- Shellfish processing and salmon canning

Other fish processing (i.e. exclusive of salmon canning and shellfish processing).

Black dot together with a colour symbol indicates a combination of plant activities, e.g. black dot on pink circle represents salmon canning and other fish processing.

Where plants are spatially concentrated, number of plants is indicated within circle. Circle size is proportionate to number of plants. Size of pie-graph segment is proportionate to the number of plants of the type indicated by colour.
Although the catch is declining halibut remain important to the commercial fishery.

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.

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.

References
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 con-

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

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.

References

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 )

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
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.

References
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 impounding 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.

<table>
<thead>
<tr>
<th>No. on map</th>
<th>Location</th>
<th>Name</th>
<th>Type</th>
<th>Capacity (MW)</th>
<th>Aggregate Capacity (MW)</th>
<th>% of total B.C. capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Peace River</td>
<td>Gordon Shrum</td>
<td>hydro</td>
<td>2,116.0</td>
<td>1,089.2</td>
<td>30.2</td>
</tr>
<tr>
<td>2</td>
<td>Vancouver</td>
<td>Burrard</td>
<td>hydro</td>
<td>912.5</td>
<td>812.8</td>
<td>11.6</td>
</tr>
<tr>
<td>3</td>
<td>Kemano</td>
<td>Kemanon</td>
<td>hydro</td>
<td>676.7</td>
<td>542.2</td>
<td>15.6</td>
</tr>
<tr>
<td>4</td>
<td>West Kootenay</td>
<td>Waneta</td>
<td>hydro</td>
<td>360.0</td>
<td>241.5</td>
<td>7.1</td>
</tr>
<tr>
<td>5</td>
<td>Bridge River</td>
<td>Bridge River</td>
<td>hydro</td>
<td>180.0</td>
<td>166.1</td>
<td>4.9</td>
</tr>
<tr>
<td>6</td>
<td>Campbell River</td>
<td>John Hart</td>
<td>hydro</td>
<td>120.0</td>
<td>105.6</td>
<td>3.0</td>
</tr>
<tr>
<td>7</td>
<td>Victoria</td>
<td>Ladore</td>
<td>hydro</td>
<td>67.5</td>
<td>52.5</td>
<td>1.4</td>
</tr>
<tr>
<td>8</td>
<td>Skeena</td>
<td>Cheakamus</td>
<td>hydro</td>
<td>42.0</td>
<td>38.7</td>
<td>1.1</td>
</tr>
<tr>
<td>9</td>
<td>Stave River</td>
<td>Ruskin</td>
<td>hydro</td>
<td>42.0</td>
<td>38.7</td>
<td>1.1</td>
</tr>
<tr>
<td>10</td>
<td>Prince Rupert</td>
<td>Watson Island</td>
<td>hydro</td>
<td>67.5</td>
<td>52.5</td>
<td>1.4</td>
</tr>
<tr>
<td>11</td>
<td>Fraser Valley</td>
<td>Whistleback</td>
<td>hydro</td>
<td>60.0</td>
<td>42.0</td>
<td>1.2</td>
</tr>
<tr>
<td>12</td>
<td>Arrow Lakes</td>
<td>Whistleback</td>
<td>hydro</td>
<td>50.0</td>
<td>38.7</td>
<td>1.1</td>
</tr>
<tr>
<td>13</td>
<td>Port Hardy</td>
<td>Keogh</td>
<td>hydro</td>
<td>40.5</td>
<td>38.7</td>
<td>1.1</td>
</tr>
<tr>
<td>14</td>
<td>Kemano</td>
<td>Kemano</td>
<td>hydro</td>
<td>360.0</td>
<td>241.5</td>
<td>7.1</td>
</tr>
</tbody>
</table>
| 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 many distant sites awaits 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.

References
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 (1,756 MW installed, 1977). Kitnacona 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: Capacities greater than 1.5 Megawatts
- Diesel: 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)
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 on 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.

Map 47 shows the total potential generation capacity for years to come. Some of this capacity would stem from new site development. Since 1976 a large block of potential generating capacity 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.

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 reactivity of petroleum and natural gas development in the province. The dramatic increase in coal output in the 1970s 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 m³. 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 m³, 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 1: PRODUCTION OF FOSSIL FUELS 1900-1976](image)

![FIGURE 2: FOSSIL FUEL RESERVES AND CUMULATIVE PRODUCTION (TRILLIONS OF BRITISH THERMAL UNITS)](image)

References


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 percent 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.

<table>
<thead>
<tr>
<th>End Use</th>
<th>1961</th>
<th>1971</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial</td>
<td>Provincial</td>
<td>Sales by B.C.</td>
<td>Sales by B.C.</td>
</tr>
<tr>
<td>Consumption</td>
<td>Hydro Only**</td>
<td>Hydro Only**</td>
<td>Hydro Only**</td>
</tr>
<tr>
<td>Residential</td>
<td>2,083.3</td>
<td>4,855.2</td>
<td>4,287</td>
</tr>
<tr>
<td>Commercial</td>
<td>1,260.8</td>
<td>3,629.1</td>
<td>1,352</td>
</tr>
<tr>
<td>Industrial</td>
<td>7,800.0</td>
<td>12,733.7</td>
<td>9,475</td>
</tr>
<tr>
<td>Other***</td>
<td>1,484.4</td>
<td>5,694.2</td>
<td>589</td>
</tr>
<tr>
<td>Total</td>
<td>12,628.5</td>
<td>26,912.2</td>
<td>15,701</td>
</tr>
</tbody>
</table>

*1 Gigawatt hour = 1 million kilowatt hours
**Sales by B.C. Hydro account for about 70 percent 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.

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 fulfillment 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 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.

References
Total Provincial Consumption, 1961: 12,629 gigawatt hours

Total Provincial Consumption, 1971: 26,912 gigawatt hours
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 quantitative 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 municipal uses, together accounting for about 4.5 million m$^3$ 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 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.$^2$ or 1,234 m$^3$). 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 m$^3$), 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 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.

References
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

References


Manufacturing
1951 - 1970

Regional Percentage of Provincial Total

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

Provincial Totals
1951: $592,449,000
1970: $1,617,192,000

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. Northeast
10. Northwest

Change in Value of Manufacturing Relative to the Provincial Average 1951 - 1970

Above Provincial Average
Greater than 350%
250% - 350%
150% - 250%
50% - 150%
1% - 50%

Below Provincial Average
1% - 50%
50% - 150%

(Percentages calculated by subtracting provincial average from census division average)
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 non-existent. In Region 7, on the other hand, manufacturing is associated with the forest industry which 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.

References
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.
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

<table>
<thead>
<tr>
<th>Name</th>
<th>Current Area (ha)</th>
<th>Date Established</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. National Parks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kootenay</td>
<td>140,600</td>
<td>1920</td>
</tr>
<tr>
<td>Glacier</td>
<td>135,000</td>
<td>1888</td>
</tr>
<tr>
<td>Yoho</td>
<td>131,400</td>
<td>1886</td>
</tr>
<tr>
<td>Mount Revelstoke</td>
<td>25,900</td>
<td>1914</td>
</tr>
<tr>
<td>Pacific Rim®</td>
<td>17,863</td>
<td>1975</td>
</tr>
<tr>
<td><strong>B. Provincial Parks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tweedsmuir</td>
<td>969,760</td>
<td>1938</td>
</tr>
<tr>
<td>Spatsizi Plateau Wilderness</td>
<td>667,208</td>
<td>1975</td>
</tr>
<tr>
<td>(Adjacent Tlatulit Park)</td>
<td>104,600</td>
<td>1973</td>
</tr>
<tr>
<td>Wells Gray</td>
<td>521,200</td>
<td>1939</td>
</tr>
<tr>
<td>Atlin</td>
<td>230,000</td>
<td>1973</td>
</tr>
<tr>
<td>(Adjacent Atlin Recreational Area*)</td>
<td>38,000</td>
<td>1973</td>
</tr>
<tr>
<td>Stratocum</td>
<td>219,741</td>
<td>1911</td>
</tr>
<tr>
<td>Mount Robson</td>
<td>217,283</td>
<td>1913</td>
</tr>
<tr>
<td>Garibaldi</td>
<td>193,596</td>
<td>1920</td>
</tr>
<tr>
<td>(Adjacent Golden Ears Park)</td>
<td>34,950</td>
<td>1967</td>
</tr>
<tr>
<td>Kwadacha Wilderness</td>
<td>365,600</td>
<td>1973</td>
</tr>
<tr>
<td>Mount Editha</td>
<td>130,000</td>
<td>1972</td>
</tr>
<tr>
<td>(Adjacent Mt. Editha Recreational Area®)</td>
<td>99,600</td>
<td>1972</td>
</tr>
<tr>
<td>Bowron Lake</td>
<td>121,662</td>
<td>1961</td>
</tr>
<tr>
<td>Munchu Lake</td>
<td>87,344</td>
<td>1967</td>
</tr>
<tr>
<td>Nakoon</td>
<td>71,800</td>
<td>1972</td>
</tr>
<tr>
<td>Mount Assiniboine</td>
<td>38,600</td>
<td>1922</td>
</tr>
<tr>
<td>Kokanee Glacier</td>
<td>25,600</td>
<td>1922</td>
</tr>
<tr>
<td>Cathedral</td>
<td>33,273**</td>
<td>1968</td>
</tr>
<tr>
<td>Stone Mountain</td>
<td>24,686</td>
<td>1957</td>
</tr>
<tr>
<td>Hatter</td>
<td>24,234</td>
<td>1941</td>
</tr>
<tr>
<td>Cape Lake</td>
<td>19,120</td>
<td>1973</td>
</tr>
<tr>
<td>Cape Scott</td>
<td>14,880</td>
<td>1973</td>
</tr>
<tr>
<td>Manning</td>
<td>7,573</td>
<td>1941</td>
</tr>
<tr>
<td>(Adjacent Skagit Valley Recreational Area®)</td>
<td>32,200</td>
<td>1973</td>
</tr>
</tbody>
</table>

* 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 1973.

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. 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 Mountaine 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.

References
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 Van-

couver 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.

References
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 1.3 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 camppites 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.

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 Lake Louise, 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.

References


Recreation and Tourism

TOTAL CAMPGROUND ATTENDANCE
1975

Total campground attendance expressed as camper-nights for the 1975 season.
Total provincial camper-nights, 1975: 1.75 million
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:

\[
\text{camper nights/season} = \frac{\text{number of campers/season}}{\text{number of campsites/season}}
\]

Using this measure, a small, heavily used campground with few campers 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 camp sites 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 vehicular 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 classified 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 not surprising 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.

References


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.
Recreation and Tourism

INTENSITY OF CAMPGROUND USE AND SUMMER VEHICULAR TRAFFIC VOLUMES 1975

Average Daily Traffic Volumes; Number of Vehicles, (July - August 1975)

<table>
<thead>
<tr>
<th>Number of Vehicles</th>
<th>Nights per Unit, per Season.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 4,400</td>
<td>Less than 87</td>
</tr>
<tr>
<td>4,400 - 8,700</td>
<td>87 - 250</td>
</tr>
<tr>
<td>8,700 - 13,000</td>
<td>250 - 400</td>
</tr>
<tr>
<td>Greater than 13,000</td>
<td>400 - 575</td>
</tr>
<tr>
<td>Greater than 575</td>
<td></td>
</tr>
</tbody>
</table>

*Derived from total campground attendance and number of camping units (campsites) per campground.
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.

References

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

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

References

Major Commodities

**International Shipping 1976**

<table>
<thead>
<tr>
<th>Major Commodities</th>
<th>Tonnage (total tonnes: 17,616,832)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, bituminous</td>
<td>500,000</td>
</tr>
<tr>
<td>Metals incl. ores and concentrates</td>
<td>7,500,000</td>
</tr>
<tr>
<td>Lumber and Timber incl. plywood</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Grains</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>5,000,000</td>
</tr>
</tbody>
</table>

**Seaborne Shipping 1976**

<table>
<thead>
<tr>
<th>Major Commodities</th>
<th>Tonnage (total tonnes: 22,102,110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, bituminous</td>
<td>7,500,000</td>
</tr>
<tr>
<td>Metals incl. ores and concentrates</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Lumber and Timber incl. plywood</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Grains</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>5,000,000</td>
</tr>
</tbody>
</table>

**Coastwise Shipping 1976**

<table>
<thead>
<tr>
<th>Major Commodities</th>
<th>Tonnage (total tonnes: 22,102,110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, bituminous</td>
<td>7,500,000</td>
</tr>
<tr>
<td>Metals incl. ores and concentrates</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Lumber and Timber incl. plywood</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Grains</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>5,000,000</td>
</tr>
</tbody>
</table>
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 summertime 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.

References


Department of Travel Industry. Beautiful British Columbia Road Map. (Map at a scale of 1:2,400,000.) Victoria, 1977.
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 (transshipment) 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 transshipment 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 transshipment 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.

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
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.

References
Communication

REGIONAL LINKAGES
BASED ON TELEPHONE CALLS
1975

Circle size is proportionate to number of outgoing calls (daily average). Average is indicated on map for major centres.

Line width is proportionate to daily volume of long distance traffic from each centre to the five most frequently called places in Canada.
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-L, 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. listings in this Gazetteer. Names and their associated boundaries are labelled I within large rectangle 92.

Following is a selected list of names of places, features, and areas immediately adjacent to British Columbia that are relevant to this atlas and are indicated 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 = PI 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 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 Geographic Names, see: Canada, Department of Energy, Mines and Resources, Gazetteer of Canada (British Columbia), Ottawa, 1966, and Cumulative Supplement to December 1976.

Places or features in areas immediately adjacent to British Columbia that are relevant to this atlas are indicated 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 = PI 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 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 Geographic Names, see: Canada, Department of Energy, Mines and Resources, Gazetteer of Canada (British Columbia), Ottawa, 1966, and Cumulative Supplement to 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 underwater terrain feature; bay; cape; channel; cove; entrance; estuary; gulf; inlet; passage; reach; rock; sound; strait
Hdfm = hydrological 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
WA = Washington
YKT = Yukon Territory

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

Overview of the National Topographic System (N.T.S.)

This section provides a general locational orientation, the designation 82-G is of no help in choosing the appropriate United States topographic sheets because their numbering 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 Geographic Names, see: Canada, Department of Energy, Mines and Resources, Gazetteer of Canada (British Columbia), Ottawa, 1966, and Cumulative Supplement to 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 underwater terrain feature; bay; cape; channel; cove; entrance; estuary; gulf; inlet; passage; reach; rock; sound; strait
Hdfm = hydrological 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
WA = Washington
YKT = Yukon Territory

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

<table>
<thead>
<tr>
<th>Selected Historical Events</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bering and Chirikof sight Alaskan coast sailing from Kamchatka</td>
<td>1740–41</td>
</tr>
<tr>
<td>Pérez, Heceta, and Quadra establish general trend of the coast from California to Alaska</td>
<td>1774–75</td>
</tr>
<tr>
<td>Cook visits Nootka Sound</td>
<td>1778</td>
</tr>
<tr>
<td>Maritime fur-trading begins with the arrival at Nootka of the Sea Otter commanded by James Hanna</td>
<td>1785</td>
</tr>
<tr>
<td>Fraser establishes fur-trading posts in central B.C. and descends the Fraser River</td>
<td>1792–94</td>
</tr>
<tr>
<td>Vancouver surveys the coastline from the Columbia River to Cross Sound</td>
<td>1793</td>
</tr>
<tr>
<td>Mackenzie reaches the coast overland from Canada via Peace River gap</td>
<td>1805–08</td>
</tr>
<tr>
<td>Thompson explores and maps much of the Columbia drainage system</td>
<td>1807–12</td>
</tr>
<tr>
<td>Lewis and Clark reach the Lower Columbia River</td>
<td>1812</td>
</tr>
<tr>
<td>North West Company and Hudson’s Bay Company amalgamate</td>
<td>1821</td>
</tr>
<tr>
<td>American immigration to the Lower Columbia country (via Oregon Trail)</td>
<td>1840–45</td>
</tr>
<tr>
<td>Fort Victoria built to replace Fort Vancouver (Washington) as western headquarters of the Hudson’s Bay Company</td>
<td>1843</td>
</tr>
<tr>
<td>Oregon Treaty establishes 49th parallel as land border between American and British territory west of the Rocky Mountains</td>
<td>1846</td>
</tr>
<tr>
<td>Vancouver Island made a crown colony</td>
<td>1848</td>
</tr>
<tr>
<td>Fort Hope established</td>
<td>1849</td>
</tr>
<tr>
<td>California gold rush</td>
<td>1851</td>
</tr>
<tr>
<td>Hudson’s Bay Company begins mining coal at Nanaimo, the only known coastal field north of Chile</td>
<td>1851–56</td>
</tr>
<tr>
<td>Esquimalt serves as supply base for Pacific Squadron during the Crimean War</td>
<td>1854–56</td>
</tr>
<tr>
<td>Gold discovered on the North Thompson</td>
<td>1857</td>
</tr>
<tr>
<td>Fraser River gold rush</td>
<td>1858</td>
</tr>
<tr>
<td>British Columbia mainland established as a separate colony</td>
<td>1858</td>
</tr>
<tr>
<td>Detachment of Royal Engineers arrives to undertake surveys and to build public works</td>
<td>1859</td>
</tr>
<tr>
<td>New Westminster selected as capital of British Columbia</td>
<td>1859–60</td>
</tr>
<tr>
<td>Gold-seekers move north on the Fraser and into the Cariboo</td>
<td>1860</td>
</tr>
<tr>
<td>Dewdney Trail begun from Hope to Similkameen</td>
<td>1862</td>
</tr>
<tr>
<td>Cariboo Road begun from Yale</td>
<td>1865</td>
</tr>
<tr>
<td>Buildings erected at Esquimalt, which had been selected to replace Valparaiso as headquarters of the Royal Navy’s Pacific Squadron</td>
<td>1866</td>
</tr>
<tr>
<td>Union of the colonies of British Columbia and Vancouver Island</td>
<td>1867</td>
</tr>
</tbody>
</table>

1867 Confederation of Nova Scotia, New Brunswick, Canada East, and Canada West

1868 United States purchases Alaska from Russia

1871 British Columbia enters Confederation

1874–76 Salmon canning industry established in British Columbia

1880-12 Thompson explores and maps much of the Columbia

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

1900 Yoho and Glacier established as first National Parks in British Columbia

1906 Esquimalt and Nanaimo Railway completed to Nanaimo

1909 First mechanical conversion pulp mill opens in Port Alberni area

1918 Idel mining boom begins in the West Kootenay-Boundary area

1920 Kettle Valley Railway (C.P. R.) completed from Penticton to Vernon

1929-35 Work begun on John Hart development and generating station, Vancouver Island

1930 Union of the colonies of British Columbia and Vancouver Island

1931 Construction begins on the Pacific Great Eastern Railway (now C.N.R.)

1935 Construction begins on the Pacific Great Eastern Railway (now C.B.C.R.)

1936 Work begun on Black Ball Steamship Company and B.C. Ferry Authority established

1938 Province of British Columbia established

1940 Railroad construction begins to extend from Seattle (Washington) to Vancouver (British Columbia)

1941 Construction of the Alaska Highway begins

1945 Union of the colonies of British Columbia and Vancouver Island

1946 Construction of the Alaska Highway begins

1947 Work begun on John Hart development and generating station. Vancouver Island

1948 Bridge River hydro-electric complex begun

1949 Hope to Princeton Highway opened

1950 Trans Mountain crude oil pipeline completed from Edmonton to Vancouver

1951 Kigmat aluminum smelter brought into production

1952 Kemano generating site begins to deliver power

1953 Sloan Commission report recommends major changes in forest land tenure

1954 Westcoast Transmission gas pipeline completed from Peace River to the Lower Mainland

1955 B.C. Government takes over Black Ball Steamship Company and B.C. Ferry Authority established

1956 Rogers Pass route (Trans-Canada Highway) opened

1957 Columbia River Treaty between the United States and Canada initiated; joint development of hydro-electric power on the Columbia River

1958 Peace River development begins to deliver power

1959 Canada Water Act established

1960 Yellowhead Highway completed

1961 B.C. Government takes over Black Ball Steamship Company and B.C. Ferry Authority established

1962 Provincial Land Commission established to reserve agricultural land

1963 Mica Dam begins to deliver power

1964 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 (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. (119°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 East to West: approx. 1,062 km (660 mi.) (along meridian 123°33'W)
Shortest distance North to South: approx. 2,005 km (1,246 mi.)
Longest distance East to West: approx. 625 km (388 mi.) (along meridian 135°30'W)
Point farthest from the sea: N.E. corner, 747 km (464 mi.)
Highest waterfall: Delia Falls (Vancouver Island), 440 m (1,443')
Longest distance North to South: approx. 1,300 km (808 mi.)
Highest city elevation: Kimberley, 1,115 m (3,660')
Highest waterfall: Delia Falls (Vancouver Island), 440 m (1,443')
Longest inlet (fjord channel): Gardner Canal, approx. 114 km (71 mi.)
Deepest recorded sounding, coastal area: 764 m (2,508') in McNaughton (reservoir)
Number of coastal islands: approx. 6,500 (excluding islets)
Largest Islands:
Vancouver 32,137 km²
Graham (QCI) 6,436 km²
Moresby (QCI) 2,278 km²
Princess Royal 1,373 km²
Pitt 855 km²
Helmcken (QCI) 984 km²
Banks 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
Babine 497 km²
McNaughton (reservoir) 445 km²
Kootenay 427 km²
Stuart 360 km²
Okanagan 352 km²
Shuswap 319 km²
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
Highest measured waterfalls and cascades:
Takakkaw Falls 366 m (Yoho National Park)
Bermuda Falls 60 m (Mount Robson Provincial Park)
Kicking Horse Falls 137 m (Wells Gray Provincial Park)
Garibaldi Falls 69 m (N. of Monkman Pass)
Rainbow Falls 51 m (Wells Gray Provincial Park)
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)

Major fjords:
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
Nootkosoos Inlet 52 km 247 m

Major Passes:
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
Chillitk (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
Chilko (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**

<table>
<thead>
<tr>
<th>Metric Equivalent</th>
<th>Imperial Units</th>
<th>Approximate Conversion Factor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Linear</td>
<td>inches</td>
<td>2.540 centimetres (cm)</td>
</tr>
<tr>
<td></td>
<td>feet</td>
<td>.3048 metres (m)</td>
</tr>
<tr>
<td></td>
<td>yards</td>
<td>.9144 metres (m)</td>
</tr>
<tr>
<td></td>
<td>miles</td>
<td>1.609 kilometres (km)</td>
</tr>
<tr>
<td>b) Area</td>
<td>square feet</td>
<td>.0929 square metres (m²)</td>
</tr>
<tr>
<td></td>
<td>acres</td>
<td>.4047 hectares (ha)</td>
</tr>
<tr>
<td></td>
<td>square miles</td>
<td>2.590 square kilometres (km²)</td>
</tr>
<tr>
<td>c) Volume</td>
<td>quarts</td>
<td>1.1359 litres (l)</td>
</tr>
<tr>
<td></td>
<td>litres (l)</td>
<td>4.546 gallons</td>
</tr>
<tr>
<td></td>
<td>gallons (g)</td>
<td>.0045 cubic metres (m³)</td>
</tr>
<tr>
<td></td>
<td>acre-feet</td>
<td>1.233 cubic metres (m³)</td>
</tr>
<tr>
<td>d) Lumber</td>
<td>board feet (fbm)</td>
<td>.0024 cubic metres (m³)</td>
</tr>
<tr>
<td></td>
<td>M.B.F. (exclud­</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ing saw kerf)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>millions</td>
<td>2.359 cubic metres (m³)</td>
</tr>
<tr>
<td></td>
<td>of square feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(%) basis</td>
<td></td>
</tr>
</tbody>
</table>

**Other Conversions**

<table>
<thead>
<tr>
<th>Metric Equivalent</th>
<th>Imperial Units</th>
<th>Approximate Conversion Factor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Mass</td>
<td>pounds</td>
<td>.4536 kilograms (kg)</td>
</tr>
<tr>
<td></td>
<td>tons (2,000 lb.)</td>
<td>.907 tonnes (MT or t)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.746 kilowatts (kW)</td>
</tr>
<tr>
<td>f) Energy</td>
<td>horsepower</td>
<td>5.9 (F-32) degrees Fahrenheit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 degrees Celsius (°C)</td>
</tr>
</tbody>
</table>

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

IMPERIAL/METRIC CONVERSION TABLE

<table>
<thead>
<tr>
<th>Units</th>
<th>Metric Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Linear</td>
<td>inches x .03937</td>
</tr>
<tr>
<td>b) Area</td>
<td>square miles x .3861</td>
</tr>
<tr>
<td>c) Volume</td>
<td>quarts x .9081</td>
</tr>
<tr>
<td>d) Lumber</td>
<td>board feet (fbm) x 2.24</td>
</tr>
<tr>
<td></td>
<td>M.B.F. (exclud­</td>
</tr>
<tr>
<td></td>
<td>ing saw kerf) x 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Units</th>
<th>Imperial Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Mass</td>
<td>pounds x .4536</td>
</tr>
<tr>
<td>b) Area</td>
<td>square miles x 1.5504</td>
</tr>
<tr>
<td>c) Volume</td>
<td>quarts x .9079</td>
</tr>
<tr>
<td>d) Lumber</td>
<td>board feet (fbm) x 4</td>
</tr>
<tr>
<td></td>
<td>M.B.F. (exclud­</td>
</tr>
<tr>
<td></td>
<td>ing saw kerf) x 2.56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Units</th>
<th>Imperial Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Mass</td>
<td>pounds x .4536</td>
</tr>
<tr>
<td>b) Area</td>
<td>square miles x 1.5504</td>
</tr>
<tr>
<td>c) Volume</td>
<td>quarts x .9079</td>
</tr>
<tr>
<td>d) Lumber</td>
<td>board feet (fbm) x 4</td>
</tr>
<tr>
<td></td>
<td>M.B.F. (exclud­</td>
</tr>
<tr>
<td></td>
<td>ing saw kerf) x 2.56</td>
</tr>
</tbody>
</table>

* To convert Imperial to metric units, multiply by conversion factor.
  To convert metric to Imperial, divide by conversion factor.
ECONOMIC REGIONS AND REGIONAL DISTRICTS

"Old" economic regions (prior to 1971)
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

"New" economic regions (1971-)
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–Silkine
9. Peace River–Liard

The "new" economic regions are aggregations of Regional Districts. As shown on several maps in this atlas, there are 29 Regional Districts in British Columbia. Their boundaries are identical to those of Census Divisions, but 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.

ROAD DISTANCE CHART

Key

MILES

378

235

Kilometres

38

16

BRITISH COLUMBIA EMPLOYMENT BY INDUSTRY

(Canada Census data; figures are rounded)

<table>
<thead>
<tr>
<th>Industry</th>
<th>1911</th>
<th>1913</th>
<th>1951</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture (farmers)</td>
<td>24,400</td>
<td>43,600</td>
<td>28,400</td>
<td>23,100</td>
</tr>
<tr>
<td>Forestry (lumbermen; chiefly loggers)</td>
<td>11,800</td>
<td>12,900</td>
<td>19,200</td>
<td>27,700</td>
</tr>
<tr>
<td>Fishing &amp; trapping (fishermen and trappers)</td>
<td>4,600</td>
<td>9,400</td>
<td>5,300</td>
<td>3,800</td>
</tr>
<tr>
<td>Mining, quarrying &amp; drilling (miners)</td>
<td>15,500</td>
<td>10,300</td>
<td>7,600</td>
<td>14,700</td>
</tr>
<tr>
<td>Manufacturing &amp; mechanical</td>
<td>21,300</td>
<td>35,000</td>
<td>74,500</td>
<td>146,900</td>
</tr>
<tr>
<td>Construction (labourers)</td>
<td>18,600</td>
<td>19,000</td>
<td>29,900</td>
<td>63,900</td>
</tr>
<tr>
<td>Transportation &amp; communication</td>
<td>40,700</td>
<td>41,800</td>
<td>30,900</td>
<td>—</td>
</tr>
<tr>
<td>Trade, finance, insurance and real estate</td>
<td>15,800</td>
<td>30,300</td>
<td>51,400</td>
<td>86,600</td>
</tr>
<tr>
<td>Community, business and personal services</td>
<td>18,000</td>
<td>30,900</td>
<td>52,000</td>
<td>189,000</td>
</tr>
<tr>
<td>Public administration &amp; defence</td>
<td>33,500</td>
<td>72,800</td>
<td>139,000</td>
<td>225,600</td>
</tr>
<tr>
<td>Miscellaneous industry</td>
<td>—</td>
<td>100</td>
<td>6,200</td>
<td>71,700</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Industry</th>
<th>1911</th>
<th>1913</th>
<th>1951</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>11,500</td>
<td>37,300</td>
<td>64,800</td>
<td>134,800</td>
</tr>
<tr>
<td>Forestry (chiefly logging)</td>
<td>21,200</td>
<td>58,300</td>
<td>162,300</td>
<td>357,500</td>
</tr>
<tr>
<td>Fisherman</td>
<td>9,200</td>
<td>15,000</td>
<td>30,200</td>
<td>58,600</td>
</tr>
<tr>
<td>Logging</td>
<td>293</td>
<td>600</td>
<td>397</td>
<td>700</td>
</tr>
<tr>
<td>Mining</td>
<td>21,300</td>
<td>42,700</td>
<td>115,300</td>
<td>316,900</td>
</tr>
<tr>
<td>Electric power generation</td>
<td>72,700</td>
<td>—</td>
<td>41,300</td>
<td>219,100</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>65,200</td>
<td>184,000</td>
<td>556,200</td>
<td>912,900</td>
</tr>
<tr>
<td>Construction</td>
<td>—</td>
<td>29,700</td>
<td>268,600</td>
<td>1,099,300</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agassiz</strong>&lt;br&gt;(Canada Dept. of Agriculture)**</td>
<td>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</td>
<td>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</td>
<td>Minimum -25.0 -24.4 -14.4 -3.9 -11.1 1.7 3.3 1.7 -11.1 -6.7 -14.4 -21.1 -25.0</td>
<td>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</td>
</tr>
<tr>
<td><strong>Dease Lake</strong>&lt;br&gt;(Canada Dept. of Agriculture)**</td>
<td>Mean 43.8 68.5 95.9 116.7 156.6 198.9 147.9 50 33 114.9</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Estevan Point</strong></td>
<td>Mean 43.8 68.5 95.9 116.7 156.6 198.9 147.9 50 33 114.9</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prince Rupert</strong>&lt;br&gt;(airport)**</td>
<td>Minimum -25.0 -24.4 -14.4 -3.9 -11.1 1.7 3.3 1.7 -11.1 -6.7 -14.4 -21.1 -25.0</td>
<td>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</td>
<td>Mean total 21.5 17.3 14.4 11.6 8.0 7.6 4.8 6.0 10.1 9.0 24.0 23.5 166.8</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
</tr>
<tr>
<td><strong>Fort Nelson</strong>&lt;br&gt;(airport)**</td>
<td>Maximum 157 172 17.8 20.0 22.8 26.7 28.9 26.1 25.0 21.1 17.8 14.4 28.9</td>
<td>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</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
</tr>
<tr>
<td><strong>Fort St. John</strong>&lt;br&gt;(airport)**</td>
<td>Maximum 157 172 17.8 20.0 22.8 26.7 28.9 26.1 25.0 21.1 17.8 14.4 28.9</td>
<td>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</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
</tr>
<tr>
<td><strong>Germans Landing</strong>&lt;br&gt;(airport)**</td>
<td>Maximum 157 172 17.8 20.0 22.8 26.7 28.9 26.1 25.0 21.1 17.8 14.4 28.9</td>
<td>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</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
</tr>
<tr>
<td><strong>Kamloops</strong>&lt;br&gt;(airport)**</td>
<td>Maximum 157 172 17.8 20.0 22.8 26.7 28.9 26.1 25.0 21.1 17.8 14.4 28.9</td>
<td>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</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
</tr>
<tr>
<td><strong>Prince George</strong>&lt;br&gt;(airport)**</td>
<td>Maximum 157 172 17.8 20.0 22.8 26.7 28.9 26.1 25.0 21.1 17.8 14.4 28.9</td>
<td>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</td>
<td>Mean snow 34.3 14.2 8.1 0.8 0.0 0.0 0.0 0.0 0.0 53.1 218.8 46.5</td>
<td></td>
</tr>
<tr>
<td><strong>Prince Rupert</strong>&lt;br&gt;(airport)**</td>
<td>Mean total 21.4 20.9 18.0 14.8 12.3 10.7 12.1 14.7 24.2 35.9 26.9 25.9 241.5</td>
<td>Mean snow 34.3 19.3 19.1 3.3 0.0 0.0 0.0 0.0 3.3 51.1 113.0 6.8 5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Salmon Arm</strong>&lt;br&gt;(airport)**</td>
<td>Mean total 21.4 20.9 18.0 14.8 12.3 10.7 12.1 14.7 24.2 35.9 26.9 25.9 241.5</td>
<td>Mean snow 34.3 19.3 19.1 3.3 0.0 0.0 0.0 0.0 3.3 51.1 113.0 6.8 5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sandspit</strong>&lt;br&gt;(airport)**</td>
<td>Mean total 21.4 20.9 18.0 14.8 12.3 10.7 12.1 14.7 24.2 35.9 26.9 25.9 241.5</td>
<td>Mean snow 34.3 19.3 19.1 3.3 0.0 0.0 0.0 0.0 3.3 51.1 113.0 6.8 5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Summerland</strong>&lt;br&gt;(Canada Dept. of Agriculture)**</td>
<td>Mean total 21.4 20.9 18.0 14.8 12.3 10.7 12.1 14.7 24.2 35.9 26.9 25.9 241.5</td>
<td>Mean snow 34.3 19.3 19.1 3.3 0.0 0.0 0.0 0.0 3.3 51.1 113.0 6.8 5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trail</strong>&lt;br&gt;(Sunndalng)**</td>
<td>Mean total 21.4 20.9 18.0 14.8 12.3 10.7 12.1 14.7 24.2 35.9 26.9 25.9 241.5</td>
<td>Mean snow 34.3 19.3 19.1 3.3 0.0 0.0 0.0 0.0 3.3 51.1 113.0 6.8 5.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**<br>1) Elevations in metres<br>2) Precipitation in millimetres<br>3) Mean snow in millimetres
These data are abstracted from:

Williams Lake elev. 940m

Vancouver (Gonzales) | 87m | 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 | 28.9 | 41.0 | 52.7 | 61.0 | 69.6 | 78.6 |
Temperature (°C) | 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 | 7.8 | 5.6 | 4.0 | 2.7 | 1.8 |
| Minimum | -1.9 | -6.1 | -5.0 | 0.6 | 1.7 | 6.7 | 8.9 | 7.8 | 6.0 | 0.0 | -7.2 | -18.3 | -18.3 |
| 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 |
Precipitation (cm) | Mean total | 1.6 | 3.2 | 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 | 1.8 | 23.6 | 49.0 |
Sunshine (hours) | Mean total | 49 | 92 | 131 | 164 | 246 | 244 | 303 | 247 | 183 | 119 | 69 | 46 | 1,893 |
| Mean snow | 19.1 | 1.3 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 23.6 | 49.0 |
Source: These data are abstracted from:


* 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).

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.
Photographic Credits

The publishers would like to acknowledge the co-operation of the following firms, institutions, and individuals in providing photographs for the Atlas.

**Beautiful British Columbia Magazine**

iii, 20, 30, 34, 40, 48, 50, 54, 84, 86 (top), 108, 110 (left), 112, 114, 116

**British Columbia. Ministry of Agriculture**

80

**British Columbia. Ministry of Recreation and Conservation**

45, 48 (left), 64, 82 (Mark Schretlen)

**British Columbia. Ministry of the Environment. Surveys and Mapping Branch**

4

**British Columbia. Ministry of the Provincial Secretary and Travel Industry**

42 (right)

**British Columbia Hydro and Power Authority**

100

**B.C. Sugar Refining Company Ltd.**

106 (left)

**B.C. Telephone Company Ltd.**

124 (Graham Stewart)

**Burrard Drydock Company Ltd.**

104, back jacket (left)

**Canada. Department of Fisheries**

88 (left), 90, 92


vii

**Canadian Hydrographic Service. Institute of Ocean Sciences**

26

**Canadian National Railway**

38

**Clayburn Industries Ltd.**

106 (right)

**Cominco Ltd.**

72 (top)

**Council of Forest Industries of B.C.**

70

**W.R. Danner, Department of Geological Sciences, U.B.C.**

74

**Fisheries Association of B.C.**

88 (right)

**Geological Survey of Canada**

28

**Glenbow-Alberta Archives**

78

**Greater Vancouver Water District**

102 (Bob Dibble)

**Grouse Mountain Resorts Ltd.**

110 (right)

**Journal of Commerce Publications Ltd.**

96

**Kaiser Resources Ltd.**

122

**MacMillan Bloedel Ltd.**

58, 60, 62 (top), 66 (top), 68 (bottom)

**Newmont Mining Corporation**

76 (Allen Aerial Photos)

**Seaport Greenhouses Ltd.**

46

**University of British Columbia Library. Special Collections Division**

10

**Vancouver Island Real Estate Board**

50 (bottom) (Richard Brown)

**Vancouver Sun**

22, 42 (left), back jacket (right)

**John Veillette and Gary White**

8 (top)

**Victoria City Archives**

16 (bottom)

**J. Michael Yates**

8 (bottom), 16 (top)