THIRD ANNUAL REPORT

OF THE

BOTANICAL OFFICE

OF THE PROVINCE OF

BRITISH COLUMBIA, 1915

BY

J. DAVIDSON, F.L.S., F.B.S.E.

PROVINCIAL BOTANIST

VOLUME I.

PART THREE

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1916.

To His Honour FRANK STILLMAN BARNARD,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The undersigned has the honour to present herewith the Third Annual Report of the Botanical Office.

THOMAS TAYLOR,
Provincial Secretary.

Provincial Secretary's Office,
January, 1916.

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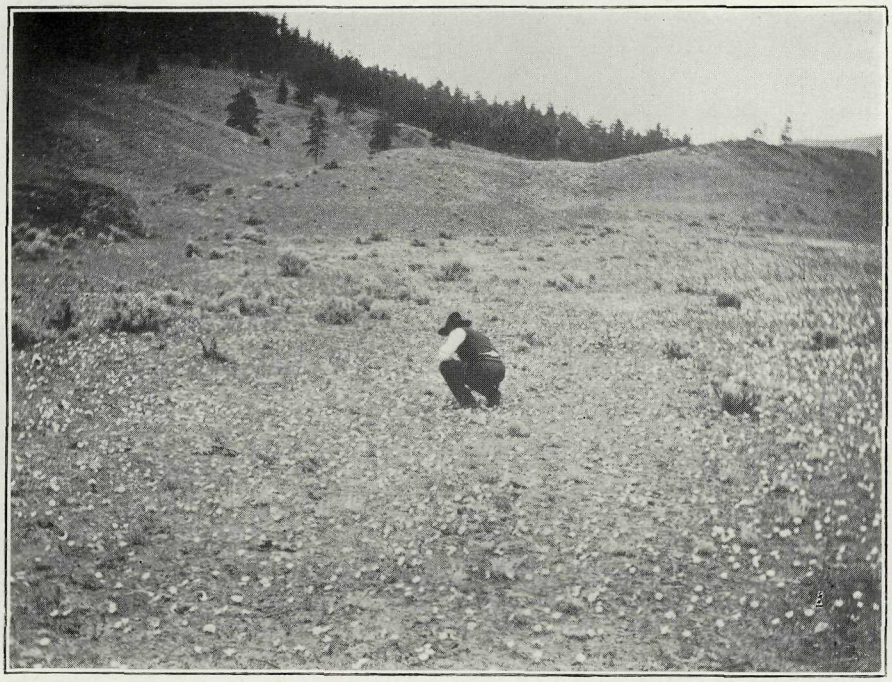

Fig. 62. A beautiful patch of bitter-root (*Lewisia rediviva*) in the Thompson Valley near Spatsum.

THIRD ANNUAL REPORT OF THE BOTANICAL OFFICE.

BOTANICAL OFFICE,
VANCOUVER, B.C., January, 1916.

To the Hon. Thomas Taylor,
Provincial Secretary and Minister of Education, Victoria, B.C.

SIR,—I have the honour to submit herewith my Third Annual Report of the British Columbia Botanical Office for the year ended December 31st, 1915.

In this Department the year just closed has been one of continuous and increased activity. The enthusiasm of botanical correspondents in the Province has spread with unabated vigour, and has manifested itself in the donation of thousands of specimens to the Herbarium, and in the supply of much valuable information and data relating to the distribution of our native flora. Besides retaining the co-operation of past correspondents, a number of new ones have been added to our list; most of these are teachers who have undertaken to supply specimens and data in return for botanical information and assistance in identifying the plants of their locality.

During the summer vacation several of those teachers who came to the Coast in connection with the summer school visited this office to get better acquainted with the work of our Department. They returned to their schools with renewed enthusiasm, and I have reason to believe that as a result a few additional herbaria will be established in schools throughout the Province. In this connection I am indebted to Mr. J. W. Gibson, Director of Elementary Agricultural Education in Schools, for his co-operation in arranging to supply teachers with standard-size herbarium paper to be used in mounting specimens for school purposes. This will ensure uniformity of all school herbaria throughout the Province, and encourage the exchange of specimens, thus aiding in the dissemination of a knowledge of the flora through the teachers to the pupils.

Another branch of our work which demanded some attention during the year was that relating to economic botany. The conditions in Europe have been the means of arousing the interest of many individuals regarding the utilization of native plants for industrial or other economic purposes. Inquiries have been received concerning the introduction of species which might be grown profitably in our climate, either for export or for home use. This, however, is dealt with under another heading later on in the report.

(1.) THE HERBARIUM.

The number of collections sent in during 1915 greatly exceeded the number received in any previous year. This was largely due to the increase in the number of correspondents and to the enthusiasm displayed by a few who deserve special mention.

From this source over 270 collections were received, and, with the exception of three or four, all have been worked out and recorded, necessitating the identification of 3,900 specimens and the preparation of lists of plants for each donor. Most of this was attended to by the Assistant Botanist, who was placed in charge of that particular branch, and the promptitude with which we were enabled to return the lists was largely due to his ability to cope with the collections as they came in; the care which he displayed permitted greater attention to be paid to other branches of work in the Department.

During the middle of the collecting season as many as fifty or sixty collections were received per month; some of these contained comparatively few specimens; others varied up to 290, the largest single collection. Some correspondents sent in several collections during the season, and their total in some instances reached well over 200 species.

The value of these collections will be better appreciated by a perusal of the following list showing the extent of the Province covered by them:—

Alberni.—W. R. Carter, Esq.
Albert Canyon.—Miss L. Carlson; Miss M. E. Slack (130 specimens).
Armstrong.—B. S. Freeman, Esq.
Atlin.—W. G. Paxton, Esq.; R. L. Pelton, Esq.; H. Whitford, Esq.
Barnston Island.—Miss E. Warren.
Big Bar.—Mrs. E. P. Simms.
Big Creek.—Miss C. Bertrand; Miss M. Church (141 specimens).
Blue River (*North Thompson*).—David McLaren, Esq., B.C.L.S.
Boswell.—Mrs. L. E. Wallace (120 specimens).
Brisco.—E. F. Clark, Esq.
Cassiar.—J. A. Teit, Esq.
Cheakamus Valley.—Geo. Barker, Esq. (Hollyburn).
Chu Chua (*North Thompson*).—Miss D. M. Jones.
Coal Creek.—John Keough, Esq.
Coquitlam.—R. C. Welch, Esq.
Corbin.—Andrew Flett, Esq.
Cortes Island.—G. H. Wailes, Esq., F.L.S.
Cowichan Lake.—G. B. Simpson, Esq.
Crawford Bay.—Walter Kidman, Esq.
Duncan, V.I.—R. Glendenning, Esq.; Mrs. Stoker.
East Kootenay.—A. G. Wilmot, Esq.
Fairview (*Okanagan*).—J. R. Brown, Esq.
Fort George.—Percy Warner, Esq.
Gellatly (*Okanagan*).—W. Gellatly, Esq.
Golden.—R. Landells, Esq., B.A.
Hanceville.—W. A. Newcombe, Esq. (169 specimens).
Hazelton.—Gustave Gervais, Esq. (290 specimens).
Hedley.—Miss G. Smith; Miss I. Tompkins.
Heriot Bay.—Miss K. E. Walker.
Hope.—T. L. Thacker, Esq.
Kamloops.—E. L. Burgess, Esq., B.C.L.S., etc.; R. Thorburn, Esq.
Kaslo.—C. Croft, Esq., B.A.
Kelowna.—Mrs. D. F. Kerr (218 specimens).
Kelowna (*East*).—Miss Alice Holman (249 specimens).
Keremeos.—W. G. Thompson, Esq.
Ladner.—E. H. Lock, Esq.
Liard and Toad Rivers.—E. B. Hart, Esq., F.R.G.S.
McMurdo.—Miss L. Nillson.
Mission.—Miss A. S. MacKenzie, B.A.
Mt. Wood.—F. Perry, Esq., collection included *Pedicularis ornithorhyncha* (a new record).
Moodyville.—W. Sinclair, Esq.
Nanaimo.—Miss Blanche MacDonald.

New Westminster.—J. K. Henry, Esq., B.A.
Nicola.—Miss E. A. Mercer; Miss B. Munro.
Parsnip River Region.—G. V. Copley, Esq. (195 specimens).
Pemberton Portage.—H. Whitford, Esq.
Porcher Island.—R. F. Worthington, Esq.
Prince Rupert.—M. L. Bird, Esq.
Princeton.—Miss A. L. Burpee.
Quesnel.—G. Milburn, Esq.; P. de Noe Walker, Esq.
Riondel.—Miss A. Holman.
Rossland.—H. C. A. Cornish, Esq., B.C.L.S.
Shawnigan Lake.—Miss A. Ravenhill.
Skagit.—C. Howlett, Esq.
Stapleby.—J. G. Darling, Esq., B.Sc.
Summerland.—A. A. Goldsmith, Esq.
Telegraph Creek.—W. J. Pake, Esq.
Tete Jaune Cache.—H. Whitford, Esq.
Ucluelet.—G. Fraser, Esq., F.R.H.S.
Vancouver.—A. E. Baggs, Esq.; Mrs. Cropley; H. Heskitt, Esq.; Mrs. Morris; T. Selwood; W. Taylor, Esq.
Victoria.—H. O. English, Esq.; Mrs. Higgins; Mrs. McVicker; W. T. MacDonald, Esq.; C. F. Newcombe, Esq., M.D.; W. H. Robertson, Esq.; W. E. Scott, Esq.; T. R. Terry, Esq.; H. Thornber, Esq.; E. S. Wilkinson, Esq., B.C.L.S.
Wardner.—Miss E. F. Murray.
Whonnock.—Mrs. W. G. Drummond.
Willow River.—L. M. Bower, Esq.
Windermere.—Mrs. W. Bell; Miss A. B. MacKenzie (239 specimens).

Several hundred specimens were collected in connection with the botanical survey of the Lower Thompson and of the Skagit Valley, and after being poisoned along with the specimens received from correspondents they were added to the Herbarium.

Owing to the pressure of work during the collecting season it was impossible to make much progress in overtaking previous arrears in the Herbarium; about 700 specimens were mounted and labelled, but there are many critical genera which require to be studied closely before the specimens can be permanently mounted.

(2.) BOTANICAL CORRESPONDENTS.

Of the eighty-four names mentioned in the foregoing list, fourteen are new correspondents who have been added since the publication of the Second Report, and we have received the names of eight others who have undertaken to act as botanical correspondents during 1916. They are:—

L. Boggs, Esq., Penticton.
Stanley Bosy, Esq., P.O., Albas, via Sicamous.
John Drury, Esq., Teslin Lake.
Miss M. E. Moser, Albert Canyon (to succeed Miss Slack).
C. A. Mitchell, Esq., Gibson Landing.
J. W. Tolmie, Esq., Victoria.
Mrs. W. Warren, Refuge Bay, Porcher Island (to succeed R. F. Worthington).
W. Wenman, Esq., Golden.

The system of volunteer correspondents which has been organized during the last three years seems to work splendidly. We have been fortunate in securing the co-operation of several enthusiastic and observant students of nature, and we have endeavoured to render such help and encouragement as will enable them to do some particular piece of botanical work with the satisfaction of knowing that they are making some real contribution to our knowledge of the flora.

Correspondent for the Windermere District.

Miss A. B. MacKenzie, one of our new correspondents, has sent in a fairly representative collection of 239 plants from Windermere. This collection includes many plants of particular interest and a few new records for British Columbia. Amongst these are :—

Adiantum capillus-veneris. (True maidenhair fern.) A new record for Canada.

Townsendia sericea. (Silky Townsendia.) A new record for British Columbia.

Lygodesmia juncea. A new record for British Columbia. This plant closely resembles *Stephanomeria minor*, and the casual observer may easily mistake the latter for this species. The pappus of *Lygodesmia* is light brown and is composed of barbellulate bristles, whereas the pappus of *Stephanomeria* is white and the bristles distinctly plumose.

Little is known concerning the botany of the Windermere District, and on this account I have pleasure in appending a list of the specimens sent in by Miss MacKenzie, as a preliminary contribution to our knowledge of the flora of the district.

Correspondents for Kelowna.

Mrs. Dora F. Kerr and Miss Alice Holman acted as our correspondents for Kelowna and Kelowna East respectively, and through their enthusiastic efforts we have obtained a good idea of the flora of that particular locality. From Kelowna 218 specimens were received, and 249 came in from Kelowna East.

By arrangement with the *Kelowna Courier* Mrs. Kerr conducted a column on "Botanical Notes," in which she supplied weekly lists of the plants as they came into flower. In most cases the names were verified at this office before being published ; a brief description was also given, sufficient to enable residents to recognize the plant referred to. By this means a considerable amount of local interest was aroused and many of the residents were enabled to become acquainted with the names of the common plants in that region.

Much useful and interesting information might be supplied by newspapers in other parts of the Province if they too would arrange to conduct a botanical column, and help their readers to know the common wild plants of their own locality.

Correspondent for Ucluelet District (Vancouver Island).

Geo. Fraser, F.R.H.S., who has for many years conducted a nursery business at Ucluelet, is keenly interested in the native flora, and has supplied many species for the Herbarium and Botanical Garden.

He is particularly interested in the utilization of native plants for garden purposes, and is one of the few nurserymen on the Pacific Coast who have raised supplies of our beautiful native evergreen rhododendron *(R. californicum)*.

Recently he has been engaged in experiments in hybridizing, with the object of utilizing some of our choice native species in the improvement of horticultural varieties, and for some time he has been interested in various native species of *Ribes*. I am glad to have the opportunity of officially recording his latest success in this direction.

Towards the end of August we received from Mr. Fraser a small collection of gooseberries; there was nothing unusual in their size, but the purple colour and rich flavour were distinctive, and if the plants prove to be more immune to the usual pests and diseases of ordinary gooseberries, this new variety is likely to prove of great horticultural value.

In response to our request, Mr. Fraser supplied full details as to how he obtained his new variety, and the following account is from information supplied by him: Some time before 1912, owing to the prevalence of several pests, he destroyed all his gooseberries and red and black currants, with the exception of a small bush of the "Red Jacket" gooseberry, which, though a poor fruiting kind at Ucluelet, is naturally a "clean" variety.

In 1912 this bush had four flowers on it; these were prepared for hybridizing by removing the stamens before they dehisced; they were then pollinated with pollen from *Ribes divaricatum* and the flowers covered with cheese-cloth. As a result he obtained about thirty hybrid seedlings, ten of which bore fruit during the summer of 1915. All the seedlings were similar and showed mostly the characters of the "male" parent.

Ribes divaricatum is one of our most common wild gooseberries in the humid-transition areas of British Columbia; it flowers and fruits profusely, but the berries, though possessing a rich currant-flavour, are too small to be of economic value.

"Red Jacket" was raised by the late Dr. Wm. Saunders, of the Dominion Experimental Farm, and was the result of crossing the famous English variety "Warrington" with an American kind called "Houghton's Seedling." If the latter is from an Eastern American species, the new gooseberry will have three species in its constitution.

Mr. Fraser is now endeavouring to improve the size, and still retain the excellent character of the fruit of *R. divaricatum.*

Many experiments of this genus have been carried out by agricultural and horticultural institutions in various parts of the Northern Hemisphere, but none seem to have succeeded in effecting this particular cross, and I am glad to be able to make the first announcement of its accomplishment, and that it has been done by one of our correspondents.

Mr. Fraser is also experimenting on our native strawberries; we are co-operating by supplying plants of different species from various parts of the Province. Several beds of native strawberries are established in the Botanical Nursery at Essondale for future systematic research.

Correspondent for the Hope District.

T. L. Thacker, J.P., has for the past few years taken a keen interest in the native flora in the vicinity of Hope, B.C. In this work he has the hearty co-operation of Mrs. Thacker, who is an ardent student of botany. Through their co-operation we have secured specimens of many rare and interesting plants, both for the Herbarium and the Botanical Garden.

During the year 1914 Mr. Thacker drew the attention of this Department to the fact that many unexpected species were found on what appears to be a large sand-bar on the Fraser River about two miles east of Hope.

On May 19th I visited that locality in company with Mr. Thacker, and decided that the flora should be studied from an ecological point of view, taking into account all the factors which combined to give to such a small area a flora so different from that of the adjacent country.

He supplied this office with specimens of all the plants found on the above area (now named Dryas Island) and furnished the necessary data regarding their environment and frequency, so that we are enabled to contribute some interesting details on plant-distribution; this is given in a later section of the report.

(3.) BOTANICAL GARDEN.

The collection at Essondale continues to increase; many new species have been added during the year, and considerable progress has been made in the propagation of choice or rare species.

This has necessitated the extension of the nursery to double its former size. Two plots of ground have been sown in lawn, and on one of these, permanent quarters have been prepared for 500 species of plants, arranged according to their families, beginning with the Ferns and ending in the Ranunculaceæ. It is hoped that during 1916 we shall be able to add permanent beds for other 500 species, from Ranunculaceæ onwards. Each bed measures 21 x 6 feet and accommodates twenty species.

The Botanical Gardener, in his report for 1915, supplies the following details:—

3,400 flowering shrubs have been propagated from cuttings made this year.

1,200 cactus cuttings were prepared from specimens of *Opuntia* in the garden, supplemented by others collected during a visit to the Bitter-root region near Ashcroft.

263 packets of seeds were sown in seed-boxes in frames, and over

10,000 young specimens planted out. Seeds of

130 different species of plants were collected in the garden.

157 species were received from different parts of British Columbia.

75 permanent lead lables have replaced former wooden ones.

189 species have been transferred from the nursery to their permanent beds; this necessitated the preparation of habitats to suit each specimen according to its natural environment, as described on page 41 of last year's report.

Donations of specimens for the Botanical Garden were received from the following:—

J. A. Brown, Esq., Kaslo.
J. G. Darling, Esq., Stapleby.
Geo. Fraser, Esq., Ucluelet (hybrid gooseberries, etc.).
B. S. Freeman, Esq., Armstrong.
Wm. Gellatly, Esq., Gellatly.
R. Glendenning, Esq., Duncan.
Miss A. Holman, Kelowna.
Mrs. J. T. Higgins, Victoria.
Mrs. D. F. Kerr, Kelowna.
R. Landells, Esq., Golden.
Miss A. B. MacKenzie, Windermere.
G. Milburn, Esq., Quesnel.
C. F. Newcombe, Esq., M.D., Victoria.
W. A. Newcombe, Esq., Hanceville.
W. G. Paxton, Esq., Atlin.
G. B. Simpson, Esq., Cowichan Lake.
Mrs. Stoker, Duncan.
J. A. Teit, Esq., Spences Bridge.
T. L. Thacker, Esq., Hope.
Miss Ida Tompkins, Hedley.
Miss K. E. Walker, Heriot Bay.
Mrs. L. E. Wallace, Boswell.
P. E. Warner, Esq., Fort George.
Miss E. Warren, Barnston Island.

Fig. 63. A bed of pink lady's-slipper orchid in the Botanical Garden. Note its single leaf, and the growth of moss (*Hypnum*) amongst which the pseudo-bulbs are formed.

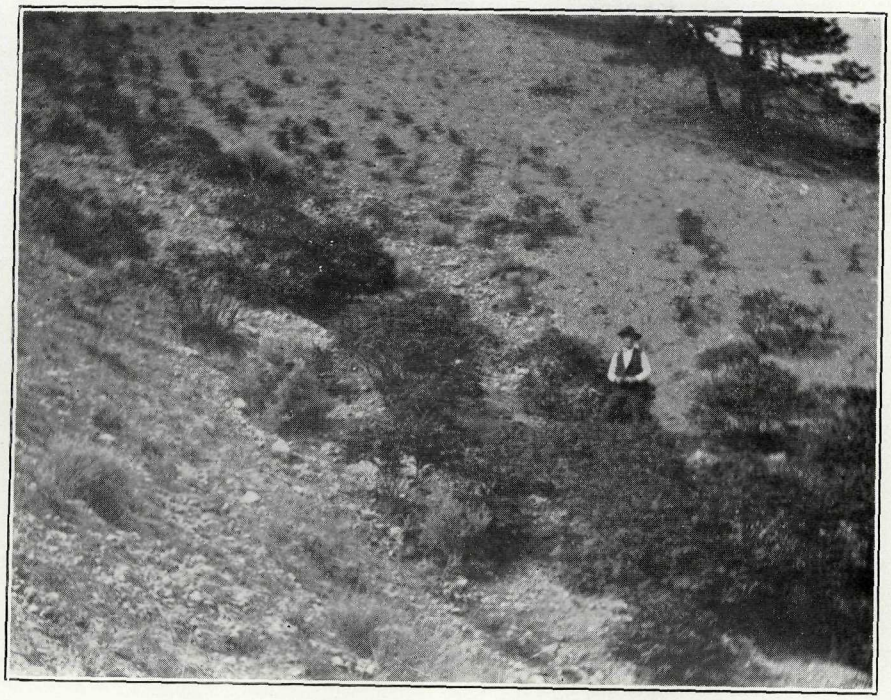

Fig. 64. *Rhus glabra,* a useful plant for prevention of surface erosion.

Fig. 65. *Rhus glabra,* showing how it spreads and sends up shoots.

In connection with the direction of the Botanical Garden twenty-three visits were made during the year, and on several of these I was accompanied by visitors or correspondents, amongst whom were:—

J. W. Gibson, Esq., Director of Elementary Agricultural Instruction in Schools, Victoria.
Reeve A. J. Harvey, Point Grey.
Magistrate F. C. Raney, Point Grey.
H. K. Wright, President, Point Grey Ratepayers' Central Executive.
W. B. Greig, Municipal Engineer, Point Grey.
Mrs. L. E. Wallace, Boswell.
A. Flett, Corbin.
Mr. and Mrs. Kerr, Kelowna.
G. H. Wailes, F.L.S., and Mrs. Wailes, Cortes Island.
David Fairchild, Explorer in Charge, Bureau of Plant Industry, Department of Agriculture, Washington, D.C.
Miss A. B. MacKenzie, Windermere.

Notwithstanding its inconvenient location, many of the public have visited the garden, and there is a growing feeling that it should be situated in some more accessible spot, in order that visitors to British Columbia may have an opportunity of seeing the wealth of our useful and showy plants, and also that the general public, including teachers and students, may be enabled to pay more frequent visits to it.

(4.) EXPERIMENTAL WORK.

For the past two years we have had an opportunity of securing hundreds of specimens from many parts of the world, in order to test their usefulness for horticultural or industrial purposes. Unfortunately, owing to the present lack of facilities for dealing with these, we have been unable to accept the offers extended to us by other botanical institutions.

The present might be a suitable time to consider the advisability of undertaking this work. Our climatic conditions are equal to and in some cases better than those prevailing in certain world-famed botanical gardens. Our mild winters and long summers are conducive to the full maturation of many species which fail to succeed in Eastern institutions, where they are exposed to severe winters and comparatively short or dry summers.

In connection with some researches on the prevention of surface erosion in the Dry Belt, we have introduced a few deciduous plants adapted for such hot and dry regions as prevail in certain parts of the Interior of British Columbia.

Through the courtesy of J. H. Maiden, Esq., Director of the Botanical Garden, Sydney, N.S.W., we obtained seeds of twenty-seven species of hardy plants which he found of value in the prevention of erosion in certain parts of Australia. Mr. Maiden is the greatest authority on the genus *Eucalyptus*, and out of about 200 species and varieties of this genus, he selected seeds of fourteen of the most hardy species and included them in the collection to see if they would succeed in this Province. These have been sown and planted out, and, although we are not sanguine in our expectations, it is interesting to note that up to the end of 1915 they withstood such frosts as we have had. There is no doubt that, given proper facilities, much valuable work could be done in the department of plant introduction.

(5.) INFORMATION ON THE FLORA.

Many letters have been addressed to this office and numerous visitors have called, desiring information on the flora, and more particularly on matters relating to various sides of economic botany.

For a time we were inundated with inquiries concerning our native medicinal plants; this was the result of several articles which appeared in various papers and magazines, in which a one-sided view of the subject was presented to readers.

Other inquiries related to the introduction and cultivation of exotic species such as ginseng and golden-seal, and some of our correspondents are now experimenting on the former with promising results.

Another side which called for some attention was the identification of alleged poisonous plants. Ranchers and others engaged in agriculture sent in specimens which they suspected were poisonous; these were often accompanied by accounts of poisoning horses, cattle, sheep, or pigs. In many instances, however, the particular specimens received were harmless; in some cases the specimens were either reputedly poisonous or were suspected on account of their relationship to well-known poisonous plants. In this connection it may be of interest to mention that specimens of *Conium maculatum* (poison-hemlock) measuring 11 feet in height were received from Victoria, where they were found on waste ground. This seems to be a record growth for that plant, though I am informed that other specimens in the same locality reached a height of 16 feet.

A request was received from the Department of Agriculture to investigate reports of poisoning of stock on Mayne and Curlew Islands, in the Gulf of Georgia, and on June 1st, accompanied by my assistant, Mr. J. A. Wattie, I visited these islands and secured the evidence of various ranchers located there. I then visited the particular localities where the animals had been feeding, and a careful survey was made not only of these areas, but of the adjacent districts, yet no trace was found of any reputedly dangerous plant. Two or three species were suspected, but curiously enough, these were more abundant on and around ranches where no stock had been poisoned.

Our investigation and survey occupied two and a half days, and resulted in our ascertaining: (1) That the reports of poisoning were exaggerated; (2) that the plant believed by the inhabitants to be "wild parsnip" or "water-parsnip" was a harmless species belonging to another genus which is common throughout the Coast area; (3) that the so-called poisoning took place in areas which had not been sufficiently cleared to encourage the growth of proper food-plants; (4) that in no instance were the contents of the stomach of the deceased animals examined; had this been done we might have obtained a clue to the identity of the alleged poisonous plant.

An exhaustive report of our investigation, embodying several suggestions for experiments, was prepared and presented to the Department of Agriculture for future action.

Visitors have also called making inquiries concerning the suitability of British Columbia for establishing a bulb industry and for growing fibre-producing plants for the manufacture of rope and twine, and in connection with other phases of economic botany.

(6.) OFFICE-WORK.

As predicted in my last report, the office correspondence has greatly increased. Over 1,200 letters were dictated during the past year, compared with 800 for the year 1914. This has necessitated the Herbarium Assistant devoting most of her time to stenographic work, with the result that our herbarium work is further in arrears. We have not been able to segregate our duplicates for exchange with other institutions, nor have we been able to overtake arrears in entering up the permanent plant records. This had to be deferred in order to cope with work demanding prompt attention.

Considerable progress has been made towards the completion of the card-index of plant records and literature dealing with native species.

A subject index has also been prepared of the volumes in the office library, so that we can bring to a focus all our literature dealing with any particular subject, systematic or economic.

Several hundreds of leaflets, bulletins, etc., on various branches of botany have been classified and filed in special binders made for the purpose, thus enabling them to be placed in our library along with books on the same subject.

A considerable number of additions have been made to our library, by purchase, donation, and exchange. Completed volumes of botanical publications were bound, and several books which suffered through constant usage were rebound.

We have been the recipients of many leaflets, bulletins, reprints, etc., from institutions and authors who have expressed a desire to obtain our publications in exchange. This brought us into touch with several expert systematists and taxonomists in the East who are engaged in research-work dealing with some of our native species.

For the purpose of verifying Professor Rosenberg's work on European Droseras, Professor M. Levine, of Columbia University, is studying the cytology of the Droseras on this continent. Fresh and preserved specimens of *D. longifolia* were supplied through the Botanical Office, and if Professor Rosenberg's observations on this genus are verified, the present researches of Professor Levine will result in proving that *Drosera intermedia* is most closely related to *D. rotundifolia* and not to *D. longifolia*, as is the common belief. This is based on the number of chromosomes in the nuclei of the above species.

Similarly, fresh specimens of four different kinds of *Opuntia* were sent from this office to Dr. D. Griffiths, Washington, D.C. (the authority on this genus), in order that he might include them in his studies on *Opuntia*.

Visitors to the Office.

Amongst the visitors who called at the Botanical Office during the year to see the nature of the work being done here, or to ascertain the progress made in the botanical survey of the Province, were the following:—

May—Honourable Dr. H. E. Young and Mrs. Young, Victoria.
June—H. N. Whitford, Esq., Conservation Commission, Ottawa.
September—Jas. M. Macoun, Esq., Curator, Victoria Memorial Museum, Ottawa.
October—David Fairchild, Esq., Explorer in Charge, Seed and Plant Introduction, Department of Agriculture, Washington D.C.
November—The Honourable the Earl of Aberdeen, Scotland and Ireland.

Visit to Botanical Department and Herbarium, University of Washington, Seattle.

In September a visit was paid to the Washington State University, Seattle, for the purpose of consulting the herbarium and library in connection with some of our Western critical genera.

Through the courtesy of Professors T. C. Frye and G. B. Rigg I was given every facility for inspecting the botanical department, library, and herbarium; the latter is reported to contain 13,000 specimens.

The herbarium is accommodated in the Forestry Building on another part of the campus and contains many interesting and valuable species. Unfortunately they have not been poisoned and many have suffered from the attacks of caterpillars and mites, and owing to the incorporation of amateur collections which had not been verified before adding to the herbarium, many instances of erroneous determination of species were observed.

There is no Botanical Museum or Botanical Garden in connection with Washington University; in this respect the University of British Columbia will be better equipped, and students will have an opportunity for experimenting with plants growing under natural conditions.

I spent some time in the botanical library and obtained much useful information, especially on the literature of the Thallophyta; additional information was supplied by Dr. J. W. Hotson, Mycologist.

One was favourably impressed with the manner in which the campus is laid out. The utilization of native trees for landscape purposes is much to be commended; the value of *Arbutus Menziesii* (Madrona) in such work was beautifully illustrated. Other native plants used were *Thuja plicata* (giant cedar), *Pseudotsuga taxifolia* (Douglas fir), *Salix Scouleriana*, *Corylus californica* (hazel), *Rhododendron californicum* (evergreen rhododendron), *Cornus stolonifera* (red-stemmed dogwood), *Cornus Nuttallii* (Nuttall's dogwood), and the effect produced by the artistic grouping of these and other native species justifies their free use in the beautification of University and school grounds.

(7.) LECTURES, ETC., ON BOTANY.

Following the custom of the past few years, evening classes in botany were held under the auspices of the Botanical Section of the British Columbia Mountaineering Club.

This year the classes are held in the Central School, on Pender and Hamilton Streets. The opening lecture was given on Thursday, November 4th, when over fifty students enrolled. On the following Tuesday this number increased to almost eighty, and, as the capacity of the room was taxed to its utmost, it was necessary to close the roll to further applicants; this was unfortunate, because a number of teachers were unable to join.

The classes meet every Tuesday from 7.30 to 9.30. The first hour's work—elementary—comprises the study of the morphology, histology, and physiology of the higher plants, from the germination of the seed to the production and distribution of seeds, ending with a summary of the principles of classification of plants into families.

The second hour's work, which is a little more advanced, includes a general survey of the various forms of life found in the vegetable kingdom. Certain types are selected from the Algæ, Fungi, Bryophytes, and Pteridophytes, and the life-history of each is studied with a view to tracing the evolution in complexity of structure and reproduction from the lower forms to the higher. This course terminates with instruction on field-work, the relation of plants to environment, the classification of plants into families, subfamilies, and genera, and instruction on the preparation of specimens for the herbarium.

Of the seventy-eight students taking the course a large number are teachers and gardeners; the others, as in former years, represent various trades and professions. This year it is proposed to give special lectures on applied botany approximately once a month; these are illustrated by lantern views. The first of this series was given on Tuesday, November 30th, and was entitled "Botany for Gardeners." A verbatim report of this lecture appeared in the Vancouver *News-Advertiser* on December 12th. Other lectures of this series will deal with "Botany for Agriculturists" and "Botany in Relation to Nature-study," "Economic Botany of British Columbia," etc.

A class excursion was held on June 12th, when the students of the previous winter's class visited the Botanical Garden at Essondale. Here they had an opportunity of seeing live plants of species referred to during the lectures, and were enabled to put into practice what they had learned in theory the previous session. Owing to pressure of departmental work we were unable to complete the full programme of four excursions during the summer.

As a result of the assistance rendered to the Mountaineering Club, several members of the Botanical Section have undertaken to prepare a "local list" of the plants found on Grouse Mountain and adjacent peaks. When this is published it will constitute a valuable and interesting contribution to our knowledge of the flora of the vicinity of Vancouver.

In addition to the classes held in Vancouver, several public lectures were given; these, as a rule, being illustrated by lantern-slides and harbarium preparations.

On March 11th a lecture entitled "Wild Plants and their relation to the Beautification of Point Grey" was given in the Municipal Hall, Kerrisdale. This lecture had direct results, for on March 20th the ratepayers turned out in large numbers and planted nearly 300 shade-trees on the East and West Boulevards from Strathcona to Magee Stations. Locations were previously staked out by the Municipal Engineer; the trees *Acer macrophyllum* (large-leaved maple), were collected in Point Grey by the municipal staff.

In connection with the Point Grey Horticultural Society's Exhibition on September 4th, we were requested to contribute a display of herbarium preparations. The exhibit was divided into three sections: (1) Introduced weeds; (2) native herbs, shrubs, and trees suitable for garden decoration; (3) medicinal plants.

On October 20th an illustrated lecture entitled "The Botanical Exploration of British Columbia" was given in St. Stephen's Church, New Westminster.

On November 19th, in connection with the Fourth Annual Convention of the Fraser Valley Teachers' Institute, a public lecture entitled "Plant-life in British Columbia" was delivered in the Victor Theatre, Mission City. A full report appeared in the *Weekly Gazette* (Eburne, B.C.) of December 4th. The lecture was illustrated by lantern-slides and herbarium specimens.

(8.) GARDEN COMPETITIONS.

Under the combined auspices of the Vancouver Town Planning Association, the Local Council of Women, and the Vancouver School Board, a Home-garden Competition was arranged for 1915; the competitors were school-children ranging from seven to sixteen years of age.

The objects of the competition were threefold:—

(1.) *Æsthetic.*—In beautifying their garden, competitors helped to beautify the city.

(2.) *Moral.*—In developing a love for the garden, competitors are employed at home, and their time is more profitably spent than might otherwise be the case.

(3.) *Educational.*—To quicken the powers of observation by encouraging competitors to make notes on the appearance and development of plants or insects in the garden. To inculcate methodical habits through their keeping a record of work done, expenses incurred, etc. To aid or supplement nature-study in schools by giving the child an opportunity of practising at home what is taught at school.

Principal F. A. Jewett, of Vancouver, was appointed by the Home-garden Committee to secure our co-operation in formulating a plan for the competition and, at the close of the season, assist in the final judging. As a result, a supply of leaflets were printed, sufficient to provide one copy to each competitor. The leaflet indicated the eight points taken into account by the judges, and gave the maximum number of marks obtainable on each point; a number of helpful suggestions were also included.

The following is a copy of the leaflet:—

HOME-GARDEN COMPETITION.

By JOHN DAVIDSON, F.L.S., F.B.S.E.

1. SIZE OF PLOT. (5 MARKS.)

The size of the plot is a point of little importance; this is emphasized by the maximum number of marks allowed.

There are advantages and disadvantages in having either a large or a small plot.

ADVANTAGES OF A SMALL PLOT.

1. It is easier to attend to the *weeding* and *cultivation.*
2. More attention can be paid to the individual plants in order to obtain greater perfection or *quality* of specimens.
3. More time is given to make *observations and records.*

ADVANTAGES OF A LARGE PLOT.

1. More scope is given for general *design.*
2. A greater *number of varieties* can be accommodated.
3. A better opportunity is afforded for *arranging plants* for effective display.

2. GENERAL DESIGN. (10 MARKS.)

Design does not necessarily mean fancy-shaped flower-beds, stars, diamonds, crescents, circles, and other geometrical designs.

It is impossible to give a design which will suit every garden, but one or two suggestions may be helpful:—

1. Decide the most convenient positions for the paths, and remove the good soil from them to flower-beds. All stones which have been dug up and raked off the flower-beds should be deposited on the paths. This will help to keep them from becoming muddy in wet weather.
2. The garden should not be cut up with a lot of unnecessary walks.
3. It is not necessary that all the flower-beds on one side of a path should be of exactly the size and shape as those on the opposite side. In most cases geometrical symmetry should be avoided.
4. All parts of the flower-bed should be readily accessible; that is to say, the beds should not be so large that weeds cannot be easily reached.
5. Whatever shape the beds are, the outline should be clearly defined. This is sometimes done by a wooden edging, sometimes by a border of flowers, and sometimes by rocks or tiles imbedded in the soil. Whatever is used should clearly separate the ground belonging to the flower-beds from the ground belonging to the path.

3. CULTIVATION. (10 MARKS.)

The soil should be dug and all large stones, roots, and underground runners of weeds removed. Porous sandy soil may require a supply of horse or preferably cow mature to retain moisture in the soil. Peaty soil may require a dressing of slaked lime or a supply of sandy soil mixed with it.

Throughout the season the surface of the soil should be kept open by frequent raking, especially after rain, which beats down the soil and tends to hinder the aeration necessary to supply the roots with oxygen.

All weak plants should be neatly tied to supports, and the supports should not be more conspicuous than the plant.

Do not water the plants too often. Too much water results in an excess of foliage and a scarcity of flowers.

The garden and paths should be kept tidy.

4. NUMBER OF VARIETIES. (15 MARKS.)

Various circumstances may hinder a competitor from having many varieties; but as each packet of seeds usually contains more than is necessary, one child may sow a number of seeds and exchange the balance for seeds of another plant sown by another child.

Too many varieties will cause the competitor to loose marks in the fifth and seventh points. In his eagerness to install a greater number of varieties he is liable to overlook the *arrangement* of the plants, or, by crushing them too much, impair the *quality* of the individual specimens.

5. ARRANGEMENT OF PLANTS. (15 MARKS.)

Before sowing the seeds in beds, or placing your plants in their permanent positions, competitors should take into account the height, habit, colour, and date of flowering of each variety.

Tall varieties should not be placed in front of low growing plants, because the tall ones will not only hide the low ones, but will shade them, and hinder them from blooming so well as if exposed to the sun.

Sufficient space should be allowed for plants of low bushy habit. In the case of a border of plants along a wall, the tallest plants should be at the back and the lowest at the front of the bed.

Plants should be arranged so that the different colours of flowers will harmonize or contrast with each other to give a showy effect, and should be arranged so that there will be flowers in each of the beds throughout the season.

6. FREEDOM FROM WEEDS. (15 MARKS.)

This is necessary not only for the appearance of the garden, but also for the health of the plants. Neglecting the weeds will affect the marks in the seventh point, because the weeds use up the food which the garden plants require, and do much to hinder them from being of the best quality.

Many weeds have the power of ripening their seeds after being pulled. They should therefore be stacked in a heap to dry and then burned. The ashes of burned weeds constitute one of the best fertilizers for flowering plants. If all weeds in the neighbourhood of the garden are treated in this way it will help to keep the garden clear.

Do not leave the weeds until a short time before the judging. The judges can tell by the condition of the plants that the competitors have neglected this point.

7. QUALITY. (15 MARKS.)

This largely depends on *cultivation*, *arrangement of plants*, and *freedom from weeds*. Unhealthy plants are more liable to be attacked by insects. Competitors should be on the look-out for traces of eaten leaves, and endeavour to catch the caterpillars or destroy the green-fly or whatever the pest may be, otherwise the plants will become poor, scraggy specimens.

8. RECORD AND OBSERVATIONS. (15 MARKS.)

Competitors who take an interest in their garden have many opportunities for making observations and notes on the different stages of development of their plants.

Notes might be made on the shape, size, and colour of the different kinds of seeds sown. Date of sowing, date of appearance above ground, the shape and size of the first leaves (seed-leaves), and whether they differ from the ordinary leaves of the plant, date of first appearance of flower-buds, date when the buds open, what kind of insects visit the flowers, whether the flowers close or open at night, what the fruits or seed-vessels are like, and so on.

Notes might also be made on the weeds, observing whether the root spreads on the surface or goes deep down into the soil. Note the date of appearance of butterflies or moths, do they alight on the leaves or flowers; if on leaves, examine closely and see if they have laid tiny eggs. The leaf and eggs may be placed in a glass jar for the caterpillars to hatch and a fresh leaf added occasionally, so that, if other caterpillars of the same kind are found in the garden, the competitor will know what butterfly or moth they belong to. In this way he can observe which are harmful and which are useful insects. Those insects which visit the flowers should not be destroyed. Notes may be made on the various kinds of insects and the flowers they visit. Note when green-flies, etc., make their appearance and which plants are attacked.

Some children will be able to make drawings to accompany their notes, and where possible a plan of their garden should be drawn to scale.

Teachers should occasionally examine these records and can help to maintain the child's interest by prompting him with a few questions on points omitted from the notes, leaving the actual observation to be done by the child.

The competitor should also keep a record of all work done, dates of all gardening operations, and a note of all money spent.

The whole aim of this point is to develop the child's powers of observation, to get him into methodical habits, and to keep him interested in the garden when there is little gardening to be done.

Over 600 competitors entered the contest; this meant 600 gardens varying in size from a few square yards to almost a quarter of an acre. Each garden was visited twice during the summer by one or two members of a large committee convened by Mrs. S. D. Scott. The visitors made notes and selected those gardens worthy of entry for the final inspection.

Two judges were appointed, Professor L. S. Klinck, Dean of the Faculty of Agriculture, with whom I had the honour of acting as colleague; ninety-one gardens were inspected and seventy-eight were awarded prizes or certificates.

In connection with the Children's Home on Wall Street, Vancouver, twenty-three garden-plots were entered in this competition, but these were classed by themselves and judged accordingly.

We also acted as judges in the Mayor's Cup Competition held under the auspices of the Vancouver Town Planning Association. This is for adults who compete for the best amateur's garden in the city; the winner is awarded a cup donated by the Mayor. In this competition twenty-one gardens were inspected, and five were recommended for prizes. Altogether 135 gardens were judged and places awarded to the competitors.

By encouraging such competitions amateur gardeners are stimulated to raise the standard of production and quality; and children are provided with healthy exercise and an opportunity for obtaining information and experience which may be invaluable to them in later years.

As similar competitions are being contemplated in other parts of the Province, this résumé may help to give an impetus to the movement.

(9.) BOTANICAL EXPLORATION OF THE PROVINCE.

In order to ascertain the botanical resources of the Province a record is kept of every specimen found or reported as found in British Columbia, and the literature containing such reports is indexed, so that it may be referred to in future when determining the distribution of any individual species.

Regarding the vegetation of many parts of the Province, there is practically no available information, and in some instances information is unreliable owing to reports having been made by unqualified observers.

Of the fourteen river-basins indicated on our distribution maps, four are botanically unknown; one need not infer from this that there is a satisfactory knowledge of the other ten river-basins; within each of these much botanical exploration remains to be done.

(9*a*.) BOTANICAL EXPLORATION OF THE SKAGIT RIVER BASIN, B.C.

The Skagit Valley is one of the four river-basins about which practically no botanical information has been published. Geologists, surveyors, and numerous prospectors have worked in that region, and reports of the geology and mineralogy have been issued from time to time; but, with the exception of a casual reference to one or two timber trees, nothing has been written of the flora and its ecological conditions.

The trail from Hope to Princeton passes through part of the Skagit Valley; in early days this trail was much used, and as it passes through one of the areas in which the evergreen rhododendron abounds, every one who has gone over the trail must be familiar with this lovely shrub.

Professor John Macoun, in his valuable "Catalogue of Canadian Plants," records a few trees observed by Dr. G. M. Dawson, and notes the rhododendron as being found on the mountains near Hope.

Mr. James M. Macoun, F.L.S., Assistant Naturalist to the Dominion Government Geological Survey, made a collection in 1905 during the International Boundary Survey in that vicinity, but the results have not been published.

The Skagit Valley is probably the only locality in Canada where *Rhododendron californicum* is native, and, as so little was known of the flora, it was decided to include this in our botanical exploration for 1915.

I am indebted to Mr. T. L. Thacker, J.P., and Mr. N. Thacker, Game Warden, for their co-operation and assistance in procuring guides and making the necessary arrangements for the expedition.

One of the difficulties we had to contend with was the unreliability and incompleteness of the maps of this district. In one map of recent date we find a range of mountains where in reality there exists a chain of lakes which are not represented in the map. A long creek is shown flowing east and ultimately draining into the Okanagan, whereas in reality it flows west, draining into the Skagit. Certain trails are shown on one map and not on the others; indeed, there existed so much variation that it was impossible to ascertain the necessary details of the region we proposed to botanize over.

I was fortunate in securing the services of two trappers who had been hunting game over that region for the previous two years, and who were familiar with the mountains, valleys, rivers, and trails throughout the district.

The Skagit Valley is most accessible from Hope, and that town was made the base for fitting out the expedition, which consisted of three pack-horses, provisions for eleven days, botanical and photographic equipment, tents, etc. I was accompanied by Mr. J. A. Wattie, Assistant Botanist; Mr. T. L. Thacker, Botanical Correspondent for the Hope District; Mr. E. L. Marshall, guide; and Mr. C. J. Howlett, camp cook.

Account of the Expedition.

On Saturday, July 3rd, I left Vancouver for Hope (eighty-nine miles east of Vancouver, altitude 209 feet); here I met the guide, and after discussing our route arranged to start on the following morning.

On July 4th we left Hope at 10.15 a.m., noting the reading on the aneroid before starting. The route lay along Hope Trail up the valley of the Nicolum River.

Notes were made of the flora near Hope at a place known as Coquihalla Flats, near the mill-lead. The dominant trees in that vicinity were *Pseudotsuga taxifolia* (Douglas fir) and *Thuja plicata* (giant cedar), with a fairly abundant supply of *Alnus rubra*, *Rhamnus Purshiana*, *Cornus Nuttallii*, *Acer macrophyllum*, *Sambucus racemosus*, *Corylus rostrata*, and a few of *Chamæcyparis nootkænis*. The underbrush was mostly composed of *Ribes divaricatum*, *Ribes lacustre*, *Cornus stolonifera*, *Symphoricarpos racemosus*, and *Physocarpus opulifolius*; the herbage was characteristic of that associated with a mixture of alluvial deposits and humus and a cool, moist atmosphere. The following were the dominant herbs: *Claytonia sibirica*, *Tiarella unifoliata*, *Achyls triphylla*, *Actæa arguta*, *Petasites palmatus*, *Heracleum lanatum*, *Thalictrum occidentalis*, and *Trillium ovatum*. The following were less common: *Aruncus sylvester*, *Dicentra formosa*, *Trientalis latifolia*, *Osmorhiza nuda*, *Botryckium virginianum*, *Phegopteris Dryopteris*, *Viola canadensis*, *Galium triflorum*, *Erigeron philadelphicus*, *Habenaria rotundifolia*, and *Streptopus amplexifolius*.

For a considerable distance along the trail the vegetation is of the characteristic Coast formation, containing many of the above species associated with *Gaultheria shallon* (salal), *Pteris aquilina* (bracken), *Polystichum munitum*, and *Rubus spectablis* (salmon-berry). Occasionally one found other species, but, being comparatively rare, it was difficult to ascertain definitely which plant association they belonged to. At one point near the "Bridal Falls" we found *Phegopteris polypodioides* (beech-fern), associated with *Saxifraga punctata*; although the latter has been found in several parts of the Coast area, I had not previously seen the beech-fern associated with it.

At Six-mile Bridge (altitude 810 feet) the trees are chiefly Douglas fir, giant cedar, and red alder, with vine-maple, salmon-berry, and wild currant (*Ribes bracteosum*) forming the dominant underbrush. For one or two miles after passing Nine-mile Bridge the ascent increases until an altitude of 2,310 feet is reached in the vicinity of Summit Lake. There is a comparatively large divide between the Nicolum Valley and the Sumallo Valley (a division of the Skagit River basin). This divide forms the collecting-grounds for the headwaters of both rivers, there being two lakes situated there, Beaver Lake and Summit Lake. The latter is at a somewhat lower level and has comparatively steep sides. The former is surrounded by low marshy ground with large areas of sedges and willows; beaver-dams are frequent, hence the name.

The trail skirts the north side of both lakes at an altitude varying between 2,160 and 2,360 feet. *Cryptogramma acrostichoides* (cliff-brake fern) and *Woodsia scopulina* were common on rock-slides on the left side of the trail, while at the edges of Beaver Lake and the adjacent ground *Nuphar polysepalum*, *Habenaria dilatata*, *Eriogynia pectinata*, *Spiræa Menziesii*, *Phyllodoce empetriformis*, *Erigeron salsuginosus*, *Potentilla flabellifolia*, *Gaultheria ovatifolia*,

and *Ranunculus Cymbalaria* were common, and *Collinsia parviflora*, *Pentstemon diffusus*, *Potentilla pennsylvanica var. strigosa*, *Pyrola chlorantha*, and *Arnica amplexicaulis* were frequent.

One of the most common herbs along the trail, after reaching 2,300 feet, was *Chimaphila umbellata* (pipsissewa), one of the well-known medicinal plants. In some places this species was so abundant that one could cut it with a scythe and pack it into sacks without much trouble. The dried leaves fetch about 4 cents per pound, by no means too much when one considers that it has to be brought out by pack-horses. Pipsissewa is employed in rheumatic and kidney affections, and is sometimes applied externally to ulcers.

At 7.35 p.m. we camped for the night near the Fourteen-mile post at Beaver Lake (altitude 2,360 feet).

On Monday, July 5th, we resumed our journey at 7.20 a.m., and before we reached Seventeen-mile Hill the trail passed through a comparatively small area with a very distinctive association of plants, largely due to the fact that the dominant trees were nearly all deciduous, these, in the order of dominance, were: *Salix Scouleriana*, *Thuja plicata*, *Alnus sitchensis*, *Acer circinata*, *Pseudotsuga taxifolia*, *Prunus emarginata*, *Populus trichocarpa*, and a few of *Abies grandis*. These did not form dense forest; being fairly open, they provided space for such shrubs as *Ribes divaricatum*, *Ribes lacustre*, *Symphoricarpos racemosus*, *Lonicera involucrata*, *Holodicus discolor*, *Menziesia ferruginea*, and *Rubus parviflorus*.

Naturally, the foliage of so many deciduous trees and shrubs provided a liberal supply of humus, and gave to the herbaceous plants a considerable amount of protection from frost. The dominant herbs were: *Heracleum lanatum*, *Fragaria platypetala*, and *Fragaria bracteata*, while the following were common: *Castilleia miniata*, *Lilium parviflorum*, *Eriophyllum lanatum*, *Campanula rotundifolia*, *Pentstemon diffusus*, *Cnicus edulis*, *Cornus canadensis*, and a few of *Arnica Parryi*, *Pyrola chlorantha*, *Pyrola bracteata*, and *Pyrola secunda*.

The above association agrees very well with what might be found on the western slopes of a lightly timbered mountain in the Coast area near the sea, but this was the only locality in the Skagit River basin where this was seen; the altitude was 2,260 feet.

In the vicinity of Seventeen-mile Hill there is a large rock-slide, round which the trail has been excellently built; the rocks composing the slide are too large to permit the growth of vegetation between them, except in a few places where fallen trees have decayed and filled the interspaces; in such instances *Sedum divergens*, *Saxifraga bronchialis*, and *Pentstemon Menziesii* obtain a foothold. The trail at Seventeen-mile Hill reaches an altitude of approximately 2,460 feet. (Fig. 66.)

After this point the trail runs close to the Sumallo River, a large tributary of the Skagit, and here we found the first appearance of *Lysichiton camtschatcense* (yellow arum), and in the same vicinity, though in a drier habitat, were found *Lycopodium complanatum*, *Lycopodium clavatum*, *L. annotinum*, *Polypodium vulgare* (typical), *Clintonia uniflora*, *Lilium parvflorum*, *Asarum caudatum*, *Tellima grandiflora*, *Aquilegia formosa*, *Senecio aureus discoideus*, *Rubus parviflorus*, *Viburnum pauciflorum*, *Cornus stolonifera*, and *Rosa gymnocarpa*. By the side of the trail were found *Agropyron caninum*, *Epilobium angustifolum*, *Prunella vulgaris*, *Veronica serpyllifolia*, *V. americana*, *Claytonia sibirica*, *Geum macrophyllum*, *Equisetum hyemale*, *Galium triflorum*, *Ranunculus Bongardi*, and *Apocynum androsæmifolium*; some of these are confined to the immediate vicinity of the trail and are evidently introduced.

Farther down, the valley becomes comparatively narrow, the sides being formed of steep mountains wooded to the top. In places it widens a little and the bottom land is occupied by a dense forest of Douglas fir and giant cedar, affording an ideal habitat for *Adiantum pedatum*

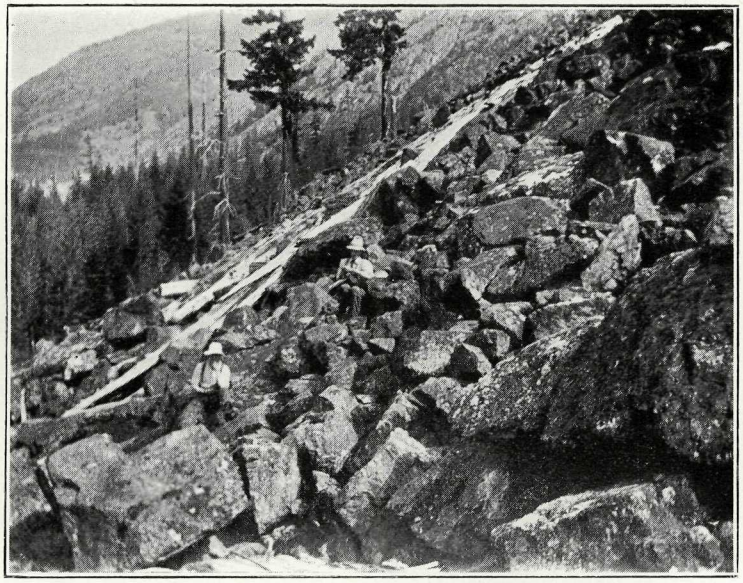

Fig. 66. Rock-slide at Seventeen-mile Hill, Sumallo Valley.

Fig. 67. *Rhododendron californicum* near the junction of Sumallo and Skagit Rivers.

(maidenhair fern), *Phegopteris dryopteris* (oak-fern), *Trillium ovatum*, *Disporum oreganum*, *Actæa spicata*, *Actæa arguta*, and *Streptopus roseus*.

At several points along the valley where the trail skirts the base of rock-slides specimens are frequently found of *Phacelia circinata*, with yellowish-white flowers.

By the side of the trail, near the Twenty-two-mile House, *Parnassia fimbriata* is common, growing at an altitude of 2,160 feet, in a comparatively open part of the forest. The trees were chiefly large cedars (*Thuja plicata*), one specimen, quite close to the trail, measuring 10 feet in diameter; in the underbrush *Berberis aquifolium* and *B. nervosa* were noted, while on an open, flat piece of ground adjacent to the Twenty-two-mile House specimens of *Botrychium lunaria* were collected (altitude 2,070 feet).

After crossing the Sumallo River we left the trail and visited a piece of bench land on our right. Here the trees were predominantly Douglas fir, with a few *Pinus contorta* (black or lodge-pole pine) and some *Pinus monticola* (western white pine). In this situation at the foot of Mount Hopeless, near the junction of the Sumallo and Skagit Rivers, we found our first specimens of *Rhododendron californicum*, and although rather late to see it at its best, we were fortunate in finding specimens in flower; many had their fruits well formed, and it was evident that during the earlier part of the season this locality must have been ablaze with colour. The plants were all vigorous and healthy, and in places constituted the dominant underbrush. (Fig. 67.)

An intensive study was made of the habitat, particularly on account of statements which had been made by travellers in that district to the effect that this rhododendron grew and flourished in a soil which was rich in lime. Although no credence was placed on these statements, I wished to ascertain whether their authors had any reason to suspect the presence of lime in the soil (lime in the soil is fatal to the success of most rhododendrons).

The whole bench was apparently composed of glacial drift, the surface being liberally strewn with fragments of rock. The soil was composed of similar rocks imbedded in sand which in some places was coarse and in others formed a fine silt; in the latter area the rhododendron was most abundant.

Although Douglas fir was the dominant tree, a few of each of *Salix Scouleriana*, *Abies grandis*, and *Picea sitchensis* were associated with the rhododendron. The underbrush was a low growth of *Pachystima myrinsites* (false box), *Vaccinium macrophyllum* (blueberry), *Chimaphila umbellata* (pipsissewa), and *Pteris aquilina* (bracken), while in the immediate vicinity of the rhododendron the surface of the ground was covered by mosses (*Polytrichum*) and lichens (*Peltigera* and *Cladonia*).

The rocks were evidently composed of thin-bedded quartzite of a bluish-grey colour, and this, together with the fine ochraceous sandy silt, may have given the impression that the soil was limy. Samples of soil and rock were collected, and when tested in the laboratory no trace of lime was found in either; we have therefore no reason to believe that this species of rhododendron is an exception to the well-known horticultural rule.

This rhododendron is fairly common in various localities throughout the main Skagit Valley and also on the Skaist. No specimens were found in the valleys of Canyon Creek nor Lightning Creek, though it is possible they may be found on the Canyon Creek side of the ridge leading up to Mount Snaas.

The Hope-Princeton Trail was followed for about a mile across Canyon Creek; here it becomes very steep and the valley deep and narrow; the mountains on both sides are wooded from top to bottom. Along the trail at this point several specimens of *Ceanothus sanguineus* were found, and rhododendron was again quite frequent.

Returning to Canyon Creek, Camp No. 2 was made on the west bank at 5.30 p.m. (altitude 2,610 feet) on a comparatively flat piece of ground which provided sufficient food for the horses. The vegetation was fairly characteristic of a sub-alpine valley, *Lupinus arcticus*, *Heracleum lanatum*, and *Pedicularis bracteosa* being most conspicuous; *Thalictrum occidentale* and *Botrychium virginianum* were common.

The morning of Tuesday, July 6th, was wet, and everything pointed to the likelihood of further precipitation. Our start was delayed till about 9.30 a.m. in the hope that the combined efforts of wind and sun might dry the herbage, but no sooner had we left camp than a drizzling rain set in, which developed into a regular mountain downpour. This continued intermittently until well into the afternoon, when it cleared up.

In spite of the unfavourable weather conditions we continued our journey to the next point in our itinerary, which was the summit of the divide between Mount Hopeless and Mount Snaas. After passing the uncomfortable stage of being half-wet—being thoroughly drenched while making our way through a luxuriant growth of herbage, largely composed of *Heracleum lanatum*, from 6 to 9 feet high—we found the flora of Canyon Creek Valley very interesting, and quite different from that in any other part of the region traversed. About half-way up the creek the valley widens out, becoming a characteristic sub-alpine valley with a covering of vegetation similar to that found in valleys farther north. It should be noted that Canyon Creek Valley has a rocky foundation, because the relation of the flora to the geological formation was clearly brought out during the exploration of other valleys to the south of this one.

For the purpose of comparing the flora of Canyon Creek Valley with that of the Skaist, Skagit, and Lightning Creek Valleys, it is necessary to mention only the characteristic species of each plant association in the order of dominance (altitude 3,385 feet.)

Where the soil was fairly good :—

Heracleum lanatum.
Epilobium angustifolium.
Aquilegia columbiana.
Senecio triangularis.
Veratrum viride.
Cnicus edulis.
Hydrophyllum capitatum.
Lilium parviflorum.
Castilleia angustifolia.
Pedicularis racemosa.
Thalictrum occidentale.

On rock-slides or by stony margins of creeks :—

Epilobium latifolium.
Oxyria digyna.
Saxifraga bronchialis.
Polystichum lonchites.
Luina hypoleuca.
Mimulus Lewisii.
Epilobium alpinum.
Polyonum viviparum.
Mitella pentandra.

The most interesting plant found in this locality was *Mitella trifida* a species not usually found in either of the above plant associations. It was evident from its erratic and local distribution that it was an intruder, and next day the source of supply was located on the western side of the watershed.

The summit of the divide is at an altitude of approximately 4,885 feet, and the above species was found near the summit (4,800 feet) on a rock-slide in the Canyon Creek Valley. Mr. Wattie found specimens at an altitude of approximately 3,500 feet in association with *Mitella pentandra.* It was observed that on the north-east side of the watershed these two species were associated together at an altitude of approximately 4,600 feet.

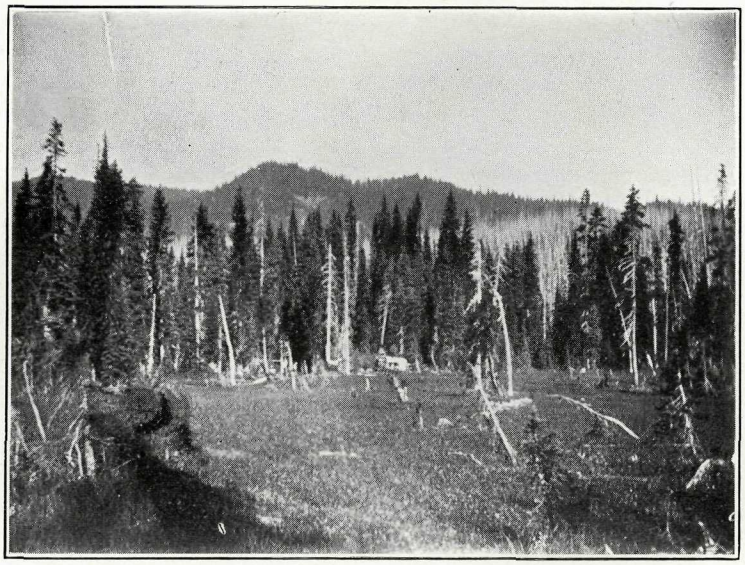

Fig. 68. Summit of the ridge between Mount Hopeless and Mount Snaas.
(Page 99.)

Fig. 69. *Picea Engelmannii.* (Looking north-east from headwaters of the Skaist.)
(Page 99.)

On the summit only the early spring flowers were in evidence, and, as the snow had not quite disappeared, most of the grasses and sedges had made no advance. A few willows, such as *S. commutata* and *S. Barclayi*, in flower constituted the brush; in the more marshy ground *Kalmia microphylla* and *Ledum glandulosum* were common.

Camp No. 3 was made on the Tulameen side of the watershed about 5.30 p.m. at an altitude of 4,810 feet. Most of the summit area is marshy, being flat or undulating, with a gentle slope towards the Tulameen. The principal plants associated here were: *Agrostis humilis*, *Erigeron salsuginosus*, *Caltha leptosepala*, *Tofieldia intermedia*, *Pedicularis grœnlandica*, and *Trientalis arctica*, etc. In some places the willows formed dense thickets varying from 3 to 8 feet in height, otherwise the country was comparatively open. (Fig. 68.)

On Wednesday, July 7th, we left camp at 8.30 with the intention of reaching the headwaters of the Skaist that night. On account of "windfalls" on the densely timbered slopes of Mount Snaas, our guide considered it advisable to follow a trail in the valley; consequently most of this day's collection is not included in our list as Skagit plants, being found outside the Skagit River basin; it so happened, however, that most of the species were found at some point inside the Skagit Valley.

Along the headwaters of the Tulameen the valley is at first fairly open, with good soil which supports a great variety of flowering plants. There seems to be several associations mixed together here, though on the whole they were characteristic of the higher altitudes. On a large stretch of country at the headwaters of the Tulameen, *Phlox Douglasii* in places carpeted the ground, while *Valeriana sitchensis*, *Potentilla flabellifolia*, *Mitella pentandra*, *Rubus pedatus*, and *Erigeron salsuginosus* combined together to form the dominant flora. *Lupinus arcticus*, *Delphinium bicolor*, *Pedicularis racemosus*, *Arnica latifolia*, *Trollius laxus*, *Senecio triangularis*, *Mitella trifida*, *Thalictrum occidentale*, *Phleum alpinum*, *Arenaria capillaris nardifolia*, *Antennaria rosea*, and *Sibbaldia procumbens* were common; a few specimens of *Polygonum viviparum* and *Listera cordata* were also found. The trees were mostly hemlock (*Tsuga Mertensiana*), with *Pyrus sitchensis* and *Pachystima myrinsites* forming the principal shrubs.

The base of Mount Snaas was skirted until the Skaist Valley was reached. The country in this region was of an arid character, principally due to the different geological formation. The country on the east side of the valley (altitude 5,010 feet) is formed of sandy benches supporting a lax growth of *Pinus contorta;* the vast majority of the plants associated with it were of the usual xerophytic type, and included the following: The surface vegetation consisted chiefly of *Vaccinium myrtillus microphyllum* with an association of *Phlox Douglasii*, *Sedum stenopetalum*, *Eriogonum subalpinum*, *Pentstemon confertus*, and *Fragaria platypetala.*

After this the trail ascended over the shoulder of a ridge at the headwaters of the Skaist; this ridge was comparatively bare, though the northern and eastern slopes were lightly timbered with *Picea Engelmannii* (Fig. 69). The underbrush was composed of *Rhododendron albiflorum*, *Vaccinium ovalifolium*, *Ribes viscosissimum*, *Pyrus occidentalis*, and *Pyrus sambucifolia.* The difference between the two latter species is very marked when seen growing together, *P. occidentalis* having glossy and serrate leaves, whereas *P. sambucifolia* has dull leaves and serrate only at the tips. Intermediate forms were frequently found, but it could not be ascertained whether these were hybrids or mere variations. This may be determined at some future date by experiments on specimens in the Botanical Garden collection.

The trail crosses the summit of the watershed at an altitude of 5,885 feet; here the country is very open, with occasional groups of *Picea Engelmannii* and *Abies lasiocarpa.* The soil, being a continuation of the same sandy bench land, supports a dwarf growth of vegetation chiefly composed of plants adapted to xerophytic conditions, except in the shallow valleys and

on the northern and eastern slopes, where the vegetation is taller. On the southern and western slopes the snow disappears early and the soil soon becomes dry and hot; the dominant plant on such ground in this locality was *Antennaria lanata*, which gave a white background to the other plants associated with it.

The undulating summit of this bench land (altitude 6,500 feet) between the headwaters of the Tulameen and the Skaist extends over several miles; the landscape in places is blue with lupine and larkspur; in others white with *Anemone occidentalis*, supplied with water from the slowly melting snow, which gets time to soak into the ground instead of running off the surface. The Coast winds must be considerably cooled off as they rise over the range of snow-capped peaks and glaciers (varying from 7,000 to 9,000 feet altitude) on the western boundary of the Skagit Valley, and this must be taken into account in explaining why on such an exposed area of plateau country large patches of snow were still to be found at that season of the year, supplying moisture to what would otherwise be hot, dry soil.

Camp No. 4 was made at 6.30 p.m. near the summit of the watershed of the Skagit River basin at a point, according to the map, close to Granite Mountain, and at an altitude of 6,510 feet. The flora in the immediate vicinity of the camp consisted of *Abies amabilis*, with underbrush of *Rhododendron albiflorum* and *Ribes Howellii*; the dominant herbaceous plants were *Lupinus arcticus*, *Claytonia lanceolata*, and the other usual members of this association (*Arnica*, *Valeriana*, *Veronica*, etc.), with the addition of *Antennaria lanata* apparently belonging to the association of plants which occupied that area before the *Abies-Rhododendron* association established itself.

A little to the north-east of our camp was a rocky peak forming the summit of the mountain (6,600 feet); during the evening we visited it and were delighted to find an abundant supply of a plant I had not previously seen, and which I assumed must be *Lewisia columbiana* (also known as *Calandrinia columbiana*). It was in full flower and will be a valuable addition to our collection of rock-garden plants. It grew in a comparatively shallow layer of soil formed by generations of decomposed moss (*Polytrichum*) on the smooth flat rock which constituted the surface. On the summit was an area of 3 or 4 acres, almost "table" like, with a few clumps of low-growing *Tsuga Mertensiana*, which also formed thickets around the edge. *Juniperus communis montana*, *Phlox Douglasii*, *Saxifraga bronchialis*, *Sedum divergens*, and *Erigeron aureus* were the dominant species found on the rocky ledges of the south and south-western sides.

Next morning, Thursday, June 8th, another visit was paid to the summit in order to secure specimens of *Lewisia* for the garden collection. It was noticed that where the soil was very shallow the plants could be pulled up easily; the roots often 3 feet long—clung to the moss, causing it to come up in thin sheets. Where the roots got into a vertical seam between two blocks of weathered rock, they were thicker, shorter, and less branched; from such situations it was almost impossible to dislodge them without serious injury to the plants. Good specimens, however, were secured and brought back to camp.

At 9.30 a.m. we commenced the descent into the Skaist Valley, following a southerly direction until we reached the Hope-Princeton Trail near the point where it crosses the watershed of the Skagit River basin. We followed this trail down the valley of the Skaist to Cedar Flats, which occupy the upper angle between the Skaist and the main Skagit.

The upper part of the Skaist Valley is comparatively open country formed of gravelly benches; the tributaries of the Skaist come through deep valleys the slopes of which, on account of their steepness and the loose nature of the soil, support but a light growth of shrubs and trees. At first the trees were chiefly *Picea Engelmannii* and *Pinus contorta*, with

Pachystima myrsinites, *Ribes viscossisimum*, and *Pyrus occidentalis* as the principal shrubs; the herbaceous vegetation was conspicuously characteristic of such an exposed gravelly region, and the flora here should be compared with that found lower down in the region where *Abies* becomes the dominant tree. The plant association at about 6,000 feet altitude consists of:—

On fully exposed places:—

Vaccinium myrtillus microphyllum.
Fragaria platypetala.
Sedum stenopetalum.
Phleum alpinum.
Trisetum spicatum.
Phlox Douglasii.
Pentstemon confertus cærulea-purpureus.
Rumex acetosella } probably both intro-
Achillea millefolium } duced.
Anaphalis margaritacea.
Arnica alpina and *A. cordifolia.*
Castilleia Bradburii.
Delphinum bicolor.
Antennaria rosea.
Pentstemon Menziesii.
Spiræa lucida.
Epilobium latifolium.
Epilobium angustifolium.
Troximon glaucum.

In slightly sheltered and moist places:—

Alnus sitchensis.
Rubus parviflorus.
Leptarrhena amplexifolia.
Lonicera involucrata.
Erigeron salsuginosus.
Lilium parviflorum.
Castilleia miniata.
Parnassia palustris.
Mitella pentandra.
Mitella trifidia.
Aster foliaceus.
Gentiana acuta.
Veronica serpyllifolia (probably intro-
Habenaria leucostachys. [duced).
Stenanthium occidentale.
Tofieldia intermedia.

Farther down the trail, at an altitude of about 5,400 feet, *Abies lasiocarpa* and *A. amabilis* replaces *Picea Engelmannii*, but *Pinus contorta* continues, though not so common, *Pseudotsuga taxifolia* and *Pinus monticola* became frequent, *Pyrus occidentalis* is very common, and *Prunus demissa* occasional.

On exposed situations are:—

Lupinus arcticus.
Lonicera involucrata.
Amelanchier alnifolia.
Ceanothus velutinus.
Arenaria capillaris nardifolia.
Pentstemon diffusus.
Claytonia parvifolia.
Arctostaphylos Uva-ursi.
Hieracium albiflorum.
Juniperus communis montana.
Rosa Woodsii.
Collinsia parviflora.

More sheltered and moist habitats:—

Aquilegia formosa.
Thalictrum occidentalis.
Pedicularis bracetosa.
Pedicularis racemosa.
Aruncus sylvester.
Heracleum lanatum.
Mimulus Lewisii.
Habenaria gracilis.
Arenaria lateriflora.
Epilobium alpinum.
Pyrola secunda.

An interesting study was made of *Abies lasiocarpa*, *A. amabilis*, and *A. grandis* during this part of the journey; though no specimens of *A. grandis* were found with green cones, the arrangement of the leaves and their structure on transverse section were relied on as distinctive characters. Trees were found with cones which when seen from the ground appeared green, even when viewed through the field-glass. The leaves showed the characters of *A. grandis*, but after climbing the trees and securing branches with cones they were found

to be distinctly purple, with no trace of green. The greenish appearance when seen from the ground was evidently due to the effect of a film of resin which covered the surface of the cone. (It may be mentioned that for over two years I have endeavoured to obtain *green* cones of *Abies grandis* because the colour is given in practically all books as the main distinction between this species and the two others, *A. amabilis* and *A. lasiocarpa*, which have purple cones. I am still hoping that some of our correspondents will be able to send in branches bearing both leaves and green cones. Hitherto all specimens received have shown the leaf-structure of *A. grandis*, but the cones were purple.)

At about 4,000 feet altitude the trail reaches the bottom of the valley and follows the river-bank for some distance. The aspect of the country is greatly changed here; instead of the exposed gravelly benches of the upper part of the valley, we find sparsely timbered rocky slopes, especially after the trail crosses to the left bank. The country at this point is bleak, rugged, and comparatively bare; soon, however, the trail rises high on the left bank and passes through densely timbered country, the trees being chiefly hemlock (*Tsuga heterophylla*) and Douglas fir (*Pseudotsuga taxifolia*), with a few of *Pinus monticola*. This lower part of the valley has a rocky foundation, and at many points the trail passes through some beautiful scenery; the banks along the trail are carpeted with an association of moisture and shade-loving plants, *Rubus pedatus*, *Chimaphila umbellata*, and *Tiarella unifoliata* being dominant.

After travelling through about five miles of this kind of country the trail gradually descends to the bottom of the valley, which is occasionally swampy, the trail being frequently made up with logs. In open areas alongside the trail one frequently found specimens of what appeard to be a white variety of *Castilleia miniata*.

At 6 p.m. we arrived at Cedar Flats (altitude 2,910 feet), where we made Camp No. 5, having travelled fourteen miles and descended 3,325 feet that day.

Next morning at 8 o'clock our party left camp at Cedar Flats to ascend the main Skagit Valley to its headwaters. A trail was cut along this valley several years ago, but as it is rarely used no information was available as to its condition. It was found, however, that in some places the trail was very well marked, while in others it was difficult to follow, becoming obscured by a luxuriant growth of underbrush which frequently attained a height of 10 or more feet. The trail for a short distance passes over rocky ground, with here and there a shallow covering of soil. The forest is open and lightly timbered with Douglas fir and a few trees of *Pinus monticola*. At one point *Shepherdia canadensis* (Sopolallie) forms the dominant underbrush, but throughout a great part of the valley it is replaced by *Pachystima myrsinites* (false box), with a fair proportion of *Berberis nervosa* (Oregon grape). It was interesting to note that in the characteristic plant association here ericaceous plants were dominant, viz.: *Chimaphila umbellata*, *Gaultheria ovatifolia*, *Pyrola bracteata*, and *P. chlorantha*.

By the time we had travelled two miles along the trail we had risen 500 feet, and at that altitude (3,410 feet) the trail crossed a small stretch of flat bench land at the base of comparatively steep, wooded slopes. The trees were chiefly Douglas fir and *Pinus monticola*, with a few *Tsuga heterophylla* (hemlock); the dominant underbrush was a tall growth of the evergreen *Rhododendron californicum*, with some *Vaccinium ovalifolium*; in this particular area rhododendron was very abundant. The surface of the ground was, as in the region near the Sumallo River, covered with angular rocks and sandy soil, but this habitat had a greater supply of water and shade than the one between Sumallo and Canyon Creeks. The surface vegetation consisted of mosses and lichens, with a few specimens of *Gaultheria ovatifolia*. (Fig. 70.)

Farther up the valley *Rhododendron californicum* was rare; only two or three isolated specimens were observed, although *Rhododendron albiflorum*, a deciduous species, became quite common.

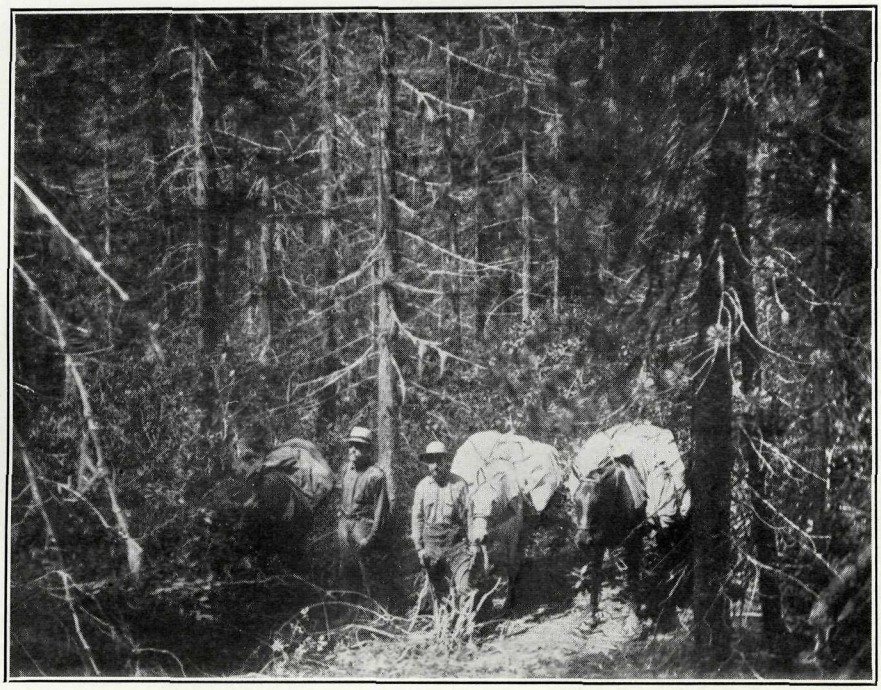

Fig. 70. Dense forest in Upper Skagit Valley; *Rhododendron californicum* as underbrush.
(Page 102.)

Soon after crossing the bench on which *R. californicum* was found the trail descended to the bottom of the valley, winding from side to side, crossing and recrossing the river several times at suitable fording places for the horses; we had either to wade or cross on fallen logs.

In this locality we experienced some difficulty in following the trail; though it was narrow on the higher slopes, the vegetation was never so dense as to obscure it, but in the bottom of the valley the forest was dense and the underbrush in places formed such a thick jungle of *Acer circinata* (vine-maple), *Alnus sitchensis* (alder), *Rubus parviflorus*, *Vaccinium macrophyllum* (blueberry), *Viburnum pauciflorum* (high-bush cranberry), and *Fatsia horrida* (devil's-club), while the abundance of fallen and decaying logs provided a habitat for a luxuriant growth of *Menziesia ferruginea* (false azalea), that we occasionally missed the trail and had to hunt around for blazes or any other marks which might suggest its location. It was noted that in this part of the valley *Thuja plicata* was conspicuously rare, though farther up it became quite common.

Several interesting examples were found of cedar and Douglas fir growing together, so close that they appeared to be growing from the same root, the stems growing like one stem, with one half of the bark Douglas fir the other half cedar. In each instance the cedar bark tended to envelop and overlap the Douglas fir. No doubt, had they been two firs or two cedars, they would have fused completely at an early stage, and we would find what is by no means rare—two trees surrounded by a common bark.

Farther up the valley the vegetation has an almost tropical aspect; the forest is moist and shady and the soil rich in decaying vegetable remains supporting a luxuriant growth of oak-ferns (*Phegopteris Dryopteris*), which carpeted the floor of the forest and was by far the most dominant species; other plants in association with it were *Clintonia uniflora* (queen-cup) and *Rubus pedatus*, a graceful little trailing plant with white flowers and clusters of red drupelets.

Throughout this part of the valley we walked through a miniature forest of devil's-club, with characteristic prickly stems 6 to 9 feet high, each surmounted by a spray of large palmate prickly leaves, varying in size up to 3 or 4 feet in diameter, forming a beautiful green canopy a few feet above our heads; then about 100 to 160 feet above that the tops of the monarchs of our British Columbia forests shut out the sunlight. Unfortunately the prevailing darkness made it absolutely impossible to obtain a photograph to illustrate the luxuriance of the vegetation in this region.

Gradually, as we ascended the valley, the oak-ferns became less abundant and other plants, such as *Claytonia sibirica*, *Aruncus sylvester*, *Lilium parviflorum*, and *Smilacina racemosa*, became more common. Finally, as the Skagit assumed the proportions of a small creek fed by several smaller ones, the trail left the main valley and rose rapidly over the shoulder of one of the mountains, leaving the characteristic vegetation of the Coast area below, and passing by a comparatively sudden change into lodge-pole or black pine country again. *Holodiscus discolor* (ocean-spray), *Spiræa lucida*, *Amelanchier alnifolia*, and *Ceanothus sanguineus* then became the common shrubs, and by the time we reached the divide we were completely into the *Pinus contorta* formation.

Camp No. 6 was made at 6 p.m. on the summit of the divide near the headwaters of Cambie Creek at an altitude of 4,610 feet. Here the ground was composed of sand and gravel and the trees practically all *Pinus contorta* (lodge-pole pine); the surface vegetation was largely composed of *Sedum Douglasii*, *Fragaria platypetala*, *Vaccinium myrtillus microphyllum*, *Eriogonum subalpinum*, and *Pentstemon confertus var. cæruleo-purpureus.*

On Saturday, July 10th, we left camp at 9.30, descending via Cambie Creek to near Lightning Lakes. The *Pinus contorta* association disappeared after we left the summit, and *Picea sitchensis* took its place, along with occasional specimens of *Pinus monticola.* The creek

had to be crossed once or twice during our descent, and at these crossing-points the trail is readily missed in the dense vegetation on both banks of the river.

Cambie Creek is a comparatively broad, shallow stream with a pebbly bottom and with occasional banks of sand along its margin. Many of these sand-banks were examined in the hope of finding specimens from the adjacent alpine summits, but nothing new was discovered; the species found were similar to those collected in the vicinity of our camp earlier in the day.

The creek descends with a gentle grade to a valley of considerable size; towards the upper end *Pinus contorta* and *Picea sitchensis* is found in about equal proportions; the main part of the valley is occupied by a good stand of spruce and cottonwood (*Picea sitchensis* and *Populus trichocarpa*), with a few comparatively young trees of Douglas fir (*Pseudotsuga taxifolia*) and a few giant cedar (*Thuja plicata*); *Lilium parviflorum* and *Aquilegia formosa* were conspicuously common in this region.

During our progress down the valley we came to a stretch of country (altitude 4,185 feet) with benches of sand and rounded boulders. At this point the change of flora was very abrupt; a comparatively sharp line separated the spruce forest from the almost characteristic Dry Belt vegetation, with black pine as the dominant tree. It was a magnificent illustration of the relation of plants to environment; within a few yards of the spruce forest we found the following species (given in the order of dominance):

Arctostaphylos Uva-ursi.
Sedum stenopetalum.
Spiræa lucida.
Gilia aggregata.
Shepherdia canadensis.
Lupinus arcticus.
Pentstemon Scouleri.
Ceanothus velutinus.

This was the first appearance of *Gilia aggregata* on the trip; a number of beautiful specimens were prepared for the herbarium, and fruits were secured for the garden collection.

The trail returns to the margin of the creek and follows it to the bridge by which the Princeton-Steamboat Trail crosses the Cambie. A little below the bridge we discovered a deserted cabin, apparently previously occupied by some prospectors of a resourceful and inventive turn of mind. They had contrived to make a kind of water-wheel entirely of wood, attached to a long thin tree which acted as a shaft, and from the number of wooden pulleys and wheels it was evident that they had made a successful device for sawing and turning. Fancy pedestal-like structures had been made for seats; a large trough made out of a solid tree had been used for a bath; and other little odds and ends lying around revealed considerable ingenuity on the part of the former occupants. From the names and dates carved on the door the cabin seemed to have been abandoned for many years.

The flats in this vicinity are composed of the same sand and gravel formation, and the flora is typical of such a geological environment. The principal herbaceous plants were *Vaccinium myrtillus microphyllum* and *Pachystima myrsinites*, with occasional plants of *Phlox Douglasii* and *Polemonium humile.*

We followed Steamboat Trail to a point near Lightning Lakes, and after crossing the divide camped near a trapper's cabin in that neighbourhood at an altitude of 4,310 feet.

The forest in this vicinity is composed of lodge-pole pine (*Pinus contorta*), with a few trees of *P. monticola;* the surface vegetation is reduced to a minimum, a low growth of *Vaccinium myrtillus microphyllum* being found in a few places; the only other traces of vegetation were occasional patches of dwarf *Polytrichum;* this gave to the open woods a bare and desolate appearance and emphasized the xerophytic nature of *Pinus contorta.*

On Sunday, July 11th, we left Camp No. 7 to return to Skagit Valley via Lightning Creek Trail. The maps of this vicinity are very unreliable. According to an Ottawa map

issued in 1913 a range of mountains is shown where in reality there exists a valley with a chain of lakes; other maps differ in the number of lakes, though they are all of approximately the same size and could not be readily missed by any one visiting the district to survey it. The 1913 map referred to shows what appears to be Lightning Creek arising near Mount Hosameen flowing east to the Similkameen River and finally draining into the Columbia via the Okanagan; whereas Lightning Creek starts from Lightning Lakes, flows west, and passes through a valley on the east side of Mount Hosameen; after crossing the International Boundary it drains into the Skagit. This makes a difference of approximately eight miles in the position of the Skagit watershed, agreeing with a blue-print of the Skagit District prepared by the Surveyor-General's Department at Victoria, and supplied after our return to Vancouver.

This made it necessary to have a special map prepared to illustrate with a greater degree of accuracy the district traversed, showing our route, camps, and altitudes (ascertained by aneroid with barometrical corrections). The altitudes of peaks adjacent to our route were obtained from various maps issued by the Dominion and Provincial Governments. (*See* map.)

The journey down Lightning Creek Valley was very interesting from a botanical point of view. Immediately after leaving camp at 8.30 a.m. we crossed between two of the lakes and found ourselves in an entirely different geological formation, with a correspondingly different flora. Instead of sand and gravel benches we found a mountainous country with a rocky formation.

One of the lakes had a large area of marshy ground around it, chiefly occupied by several species of *Carex*, *C. rostrata* being dominant. We botanized in this locality for some time, then set out to find the trail, but owing to the fact that it passes through the bush and is now seldom used, we missed it and found ourselves on Steamboat Trail heading for Nepopekum Valley. Seeing that this led round the wrong side of the mountains, we struck south through the bush towards Lightning Lakes and found Lightning Creek Trail, with indications that the horses had gone ahead.

We continued west along the margin of the lakes, finding various interesting habitats along the mountain-slopes on the north side of the valley. The flora was fairly characteristic of such a valley at an altitude of a little over 4,000 feet; the trees were largely alder, cottonwood, willow, and Douglas fir. Along the margin of the lakes we observed abundant evidence of the activity of beavers, there being many half-gnawed trees near the trail.

The underbrush was largely *Lonicera involucrata*, *Berberis aquifolium*, *Pachystima myrsinites*, and *Lonicera canadensis*. The herbaceous vegetation was of a sub-alpine character, similar to that found in Canyon Valley.

No creeks of any importance are found on the north side of this valley; it is bounded by a long ridge of mountains with steep sides, and occasional rock-slides bear such plants as *Saxifraga bronchialis*, *Phlox diffusa*, *Cryptogramma acrostichoides*, and *Woodsia scopulina*.

Near the last lake of the upper series there is another change in the geological conditions; we reach the end of the tree-clad slopes at a point adjacent to steep precipitous crags; a rock-slide extends from the base of these to the edge of the lake. From this point onwards the northern side of the valley is bounded by a ridge with sandy and gravelly slopes. This ridge rises approximately 2,000 feet above the valley; its slopes are very steep, and the trail climbs by a series of zigzags up to an altitude of over 6,000 feet. On account of its steep grade and the high altitude it reaches it is known as the "Sky Trail." (Figs. 71 and 72.)

It was proposed to have Camp No. 8 at an altitude of 6,110 feet near the top of the southern slope. From this locality one obtains a magnificent view of the mountainous country across Lightning Valley. In that region the valleys and lower slopes of the mountains were

heavily timbered, while slopes of the higher peaks were clothed with snow-fields and glaciers. By means of the field-glass one could see vast stretches of interesting botanical ground between timber-line and the perpetual-snow region. These slopes lay about six miles distant in a direct south line from where we stood, and in order to reach them a large tract of fallen timber and burned forest would have to be negotiated. In addition to the difficult access to that region, we could not definitely ascertain whether the area was north or south of the International Boundary. (Fig. 71.)

On account of the scarcity of water on this ridge, and also of the threatening aspect of the weather, it was decided to go a few miles farther on before camping, so we continued along the top of the ridge through a rich growth of herbaceous flowering plants almost waist-high, and largely composed of:—

Thalictrum occidentale.
Lupinus arcticus.
Aquilegia formosa.
Lilium parviflorum.
Heracleum lanatum.
Potentilla flabellifolia.

Farther west the vegetation thins out, becomes more dwarf, and is gradually replaced by an open growth of *Abies lasiocarpa*, with *Rhododendron albiflorum* as underbrush, *Phyllodoce empetriformis* forming the dominant surface vegetation; *Lupinus arcticus* was found in nearly every plant association throughout that region.

It was interesting to note the reappearance of *Abies* wherever rock formed the substratum and its almost total absence on gravelly ground.

This ridge is joined by a very narrow neck to another mountain situated near Mount Hosameen; the trail follows the top of what is commonly called a "Knife-edge" separating Lightning Valley from the headwaters of Napopekum Creek. On the left the slope is steep and precipitous, the ledges bearing a profusion of *Castilleia Bradburii*, *Sedum stenopetalum*, and *Eriogonum subalpinum*, while dwarf, stunted specimens of *Abies lasiocarpa* and clumps of *Juniperus communis montana* occupy cracks and crevices in the rock. (Fig. 72.)

On the right the slopes are lightly timbered with *Abies;* the underbrush consists of *Rhododendron albiflorum* and *Pyrus sambucifolia*, while *Phyllodoce empetriformis*, *Lupinus arcticus*, *Phyllodoce glanduliflorus*, and a few plants of *Phyllodoce intermedius* form the surface vegetation.

Finally the extreme western end of this ridge was reached; it is separated from Hosameen Ridge by a deep narrow valley in which flows a tributary of Lightning Creek. Near Mount Hosameen there is a small lake on Lightning Creek, and some distance below this lake the creek flows underground, the bottom of the valley being covered with rocks which have fallen down the steep sides of the adjacent slopes. The fact that the creek is not visible at this point may account for the mistake made in the 1913 map, where the creek is indicated as rising here and flowing east.

On the whole, the ridge forming the north side of Lightning Valley is composed of rock, with a thick deposit of sand and gravel on top. In certain areas the deposit has been washed off by rains or water from melting snow, and where the rock protrudes from the sand the flora differs markedly. Of course, where water has gouged out a valley in this deposit, other favourable conditions are created, such as shelter from cold winds or shade from the direct rays of the sun, and these, combined with an increased supply of moisture from surface drainage, easily explain the strong contrasts occasionally found in the plant associations.

The trail winds around the face of a particularly steep, loose, gravelly slope on which vegetation is comparatively sparse, though present in sufficient quantity to beautify the route

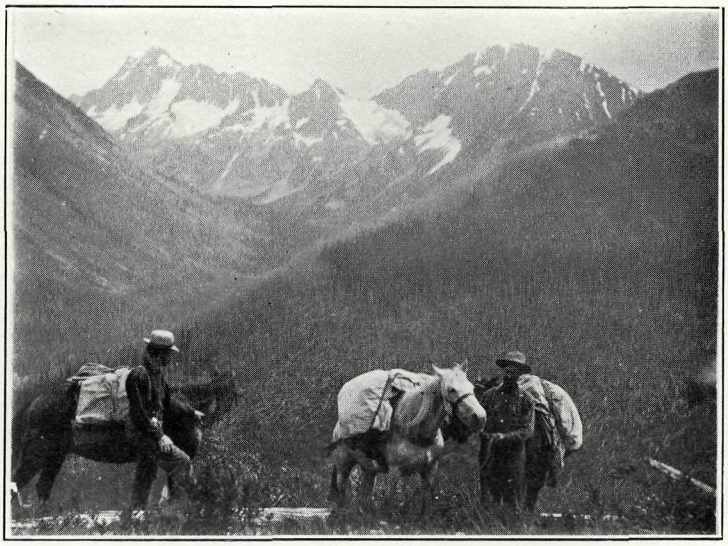

Fig. 71. Looking south across Lightning Valley. (Page 106.)

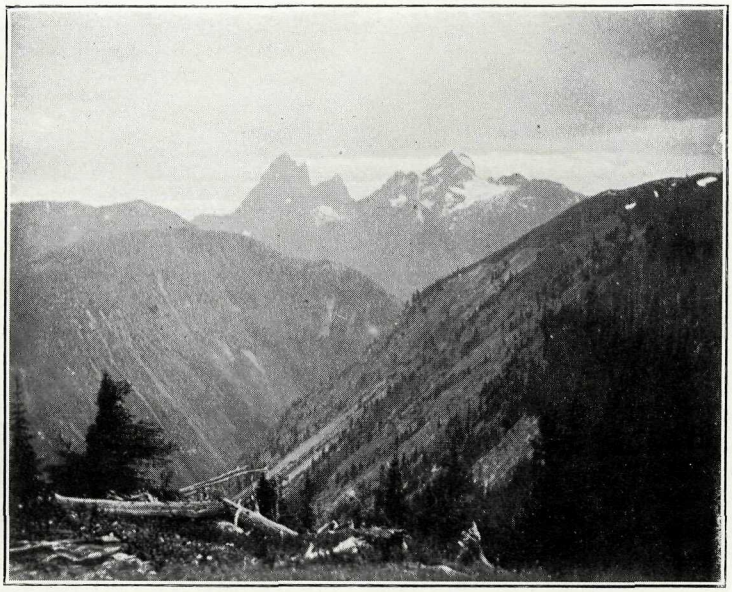

Fig. 72. Mount Hosameen, looking south-west. Sky Trail crosses the top of the mountain on the right. (Altitude 6,200 feet.) (Page 106.)

with many colours of flowers. There are no trees here, and the following plants give a good idea of the xerophytic conditions in close proximity to Mount Hosameen :—

Ceanothus velutinus.
Eriogonum umbellatum.
Lupinus arcticus.
Arenaria nardifolia capillaris.
Sedum stenopetalum.
Sedum divergens.
Gilia aggregata.
Phlox Douglasii.
Luina hypoleuca.
Delphinum bicolor.
Arnica alpina.

In the water-worn gullies :—

Thalictrum occidentale.
Lupinus arcticus.
Rhododendron albiflorum.
Lonicera canadensis.
Heracleum lanatum.
Symphoricarpos racemosus.

A close examination of many lupine flowers in this locality showed specimens with absolutely glabrous keels, and occasionally one found flowers on the same inflorescence, with a few cilia on the keel, similar to those found on some of our Garibaldi specimens, though none of the latter were found to be absolutely glabrous.

The finding of glabrous keels on lupines in this locality enabled me to definitely record them as *L. arcticus.* Specimens whose flowers had glabrous keels were carefully examined and compared with specimens whose keels were all ciliate, in order to see whether two species were growing together, but no other distinctive feature was found. The presence of glabrous and ciliated keels on the same plant compelled me to regard the ciliation as a variable character which cannot be relied on in distinguishing one species from another.

From this Dry Belt ridge we turned north for about one mile and reached the slopes at the head of the tributary of Lightning Creek. The flora here was typically sub-alpine, and consisted of an association similar to that found in the Garibaldi region. (*See* Report, page 53.)

The dominant trees were *Abies lasiocarpa;* the underbrush *Rhododendron albiflorum*, *Ribes Howellii*, and *Salix Barclayi.*

At 4.45 p.m. we made camp in this valley at an altitude of 4,310 feet, having for an hour previously been subjected to a torrential downpour of rain. The evening continued cold and wet, and the damp surroundings added to our difficulty in attending to the herbarium material; by this date our presses were well filled; this made it necessary to dry out some pressing-paper to receive part of the day's collection.

On Monday, July 12th, we left Camp No. 8 at 9.45 a.m., the herbage still laden with water on account of the previous day's rain and the dense clouds which hung around camp throughout the morning. By the time we left, the clouds began to lift, and glimpses of sunlight suggested the likelihood of the day clearing up.

The trail leads down into the valley of a tributary of Lightning Creek; here the vegetation is short and pasture-like, the dominant plant being *Eriogynia pectinata*, a low species resembling a mossy saxifrage. This vicinity is known to hunters as Mowitch Camp (*Mowitch* being the Chinook word for deer).

From Mowitch Camp the trail ascends to the summit of Hosameen Ridge at a point between two and three miles north of the boundary. During our ascent we found specimens of *Orobanche uniflora* (a parasitic flowering plant), and for the first time, *Rubus lasiococcus;* unfortunately we were unable to obtain fruits for propagation in the garden; at the time of our visit it was in full flower. *Viola glabella* was also noted here; this is the highest altitude I have found it, almost 6,000 feet above sea-level.

On reaching the summit of Hosameen Ridge we went north along the top for one or two miles. This is an extremely interesting locality; one could spend a whole week profitably studying the ecological conditions here, they are so varied.

At one point on the top of cliffs on the east side of the ridge (altitude 6,310 feet) we found an attractive display of *Erigeron compositus*, *Polemonium humile*, *Sedum stenopetalum*, *Saxifraga bronchialis*, *Potentilla dissecta*, *Eriogonum subalpinum*, and *Arenaria capillaris nardifolia*.

Along the ridge where the rock protrudes or lies near the surface *Abies lasiocarpa* and a short-leaved form of *Pinus monticola* occur. The latter closely resembled *Pinus albicaulis*, which, I am informed, is found in that region, but though we kept a sharp look-out for cones of the latter, none were found; such specimens as bore cones proved to be *Pinus monticola*.

We descended from Hosameen Ridge to the main Skagit Valley along a spur running west; on the top of this spur was found an unusual association. The soil was composed of crumbling rock which broke into small angular fragments; in some places one found a comparatively shallow deposit of sandy soil on which many young trees of *Pinus monticola* and *Pinus contorta* had made a start; a few had attained a height of 30 or 40 feet. The surface vegetation was sparse and scattered, there being frequent large areas bearing nothing but a sprinkling of withered pine-needles.

Owing to this side of the ridge being fully exposed to sun and south-western winds, only such plants as are able to resist drought can establish themselves here; even the lupine, which was common throughout other parts of this region, was rare in this particular locality.

The most noteworthy plants in this environment were *Lewisia columbiana*, *Balsamorhiza sagittata*, and *Potentilla fruticosa*, all growing at a little over 6,000 feet altitude. In an effort to secure garden specimens of these, it was found that the roots got away down between the cracks of the crumbling rock, and held the plants so firmly that it was impossible to get complete specimens. The *Potentilla*, which is a low shrubby species, formed very attractive bushes from 1 to 2 feet high, and after several attempts a few plants were secured for the garden. Associated with the above three species were such characteristic xerophytic plants as *Sedum divergens*, *Saxifraga bronchialis*, *Antennaria parvifolia*, *Eriogonum subalpinum*, and *Erigeron compositus discoidea*.

From the summit of this spur of Hosameen Ridge the trail makes a steep descent by a series of zigzags. On the upper slopes trees are rare; the exposed soil is of a rocky and sandy nature, on which the above xerophytic species are most common, while *Lupinus arcticus*, *Castilleia Bradburii*, and *Castilleia angustifolia* become plentiful; *Luina hypoleuca* is locally common and forms large conspicuous masses which suggest its value as a showy plant for rock-garden work.

The trail leads down through a zone of forest composed at first of *Pinus monticola* and *P. contorta*, with a few *Pseudotsuga taxifolia*; the latter gradually increases until it becomes dominant, and *Thuja plicata* enters into association with it, the pines becoming rare. Suddenly we emerge again on an open hillside clad with *Amelanchier alnifolia*, *Vicia americana*, *Holodiscus discolor*, *Aruncus sylvester*, and *Lupinus arcticus*. This continues until near the bottom of the valley, when we pass through another zone of Douglas fir and giant cedar, with an association of surface vegetation similar to that found in the Coast area. The soil here is fairly good, consisting of a sandy loam, in places rich in humus, according to the nature of the vegetation covering the ground.

Whitworth's Ranch (altitude 1,735 feet) was reached late in the afternoon, and we proceeded to attend to the herbarium material, having the greater part of two days' collection to press.

On Tuesday, July 13th, we had to make an early start; the presence of many thousands of sandflies—a minute species of midge—in our tent made us "clear out" soon after daybreak. Heavy clouds hung around the mountains; our guides predicted another wet day, and the change in the aneroid seemed to support this prediction.

The lower part of the Skagit Valley is fairly wide and flat, and there has been some attempt at agriculture; the soil varies from clayey sand to sandy gravel, corresponding to that frequently found along the Thompson River. In some localities, where the soil has sufficient humus to retain moisture, crops grow fairly well, but in less favourable localities the grass is sparse and tends to dry out.

By 7.45 a.m. we were about two miles north of Camp No. 9, again studying lupines. There seemed to be two varieties here, and, as the fruits were almost ripe, we secured a supply of both kinds to grow for observation in the Botanical Garden. At 1,785 feet altitude the vegetation was composed of the following. *Pinus contorta* and *Pseudotsuga taxifolia* were equally dominant; *Populus tremuloides* scarce.

The underbrush in the order of dominance consisted of:—

Amelanchier alnifolia.
Shepherdia canadensis.
Pachystima myrsinites.
Ceanothus velutinus.
Berberis aquifolium.
Berberis nervosa.
Rhododendron californicum (in some places very abundant).
Ceanothus sanguineus.

The herbaceous vegetation:—

Lupinus arcticus (profuse).
Pedicularis racemosa.
Spiræa lucida.
Apocynum androsæmifolium.
Actæa arguta.
Achillea millefolium (probably introduced).
Rumex acetosella.

At a point (altitude 1,860 feet) a few miles north of Steamboat Townsite we came into another belt of *Rhododendron californicum.* Here again the dominant tree was *Pinus contorta*, though *P. monticola* and *Pseudotsuga taxifolia* were quite common. The soil was a fine brown loam, and this supported an association of plants similar to those found at 1,785 feet altitude, with the addition of a few more characteristic plants of the Coast area, viz.: *Prunus emarginata*, *Alnus oregona*, *Thuja plicata*, *Vaccinium macrophyllum*, *Rubus parviflorus*, *Menziesia ferruginea*, *Chimaphila umbellata*, *Pyrola rotundifolia*, *Pyrola picta*, and a few plants of *Lilium parviflorum;* in places the surface of the ground was covered with *Peltigera* and *Cladonia.* A number of young rhododendron plants were secured for the garden, several well-rooted specimens being found in the vicinity of decomposed logs.

Soon after passing through this belt the valley again becomes narrow, and we enter a forest of tall Douglas fir and giant cedar, with a luxuriant growth of underbrush consisting largely of *Rubus parviflorus* (thimble-berry) and *Rubus spectabilis* (salmon-berry); while *Actæa spicata* (white baneberry) *Actæa arguta* (red baneberry), and an intermediate form with pale-pink berries occupied an important place amongst the herbaceous vegetation.

From 1 p.m. until we reached our next destination we were subjected to another downpour of rain, which continued throughout the night and most of next day.

At 6 p.m. after having travelled sixteen miles, we made Camp No. 10 at the Twenty-four-mile House (altitude 2,010 feet). This is an old cabin formerly occupied by prospectors, but now unoccupied except by travellers under such circumstances as we were; it was, however, sufficiently "water-tight" to enable us to get dried out.

On Wednesday, July 14th, at 6.45 a.m., we resumed our return journey in a drizzling rain. On reaching Twenty-two-mile House a prospector endeavoured to interest us in minerals, while we endeavoured to interest him in the flora. In the course of our conversation he spoke of a moss with a pink flower being found about 400 feet up the mountain on the west side of the valley. One could scarcely believe that the moss-campion was what he referred to, and he agreed to accompany us to the spot in spite of the rain and cloudy weather.

Instead of ascending 400 feet, however, we had to climb 1,115 feet, and our reward was a ledge covered with *Saxifraga oppositifolia*. This region should be thoroughly explored; there is a considerable amount of limestone and much mineral-bearing rock. It is a rather rugged country, precipices all around, but no doubt many other interesting species will be discovered in its inner recesses.

At the same altitude, on a small muddy slope, a few clumps were found of what at first sight appeared to be *Adiantum capillus-veneris* (a plant which we received from the Windermere District earlier in the summer). Specimens were secured for the garden, and specimens were also found of a form intermediate between it and *Adiantum pedatum*. On a close examination of the plants in the vicinity I was able to trace a gradual transition between the very dwarf form of the higher altitude and the typical tall form in the forest.

Further examination and comparison with the Windermere specimens showed that the Skagit Valley plant was merely a dwarf form of *A. pedatum*. It would have been difficult to prove this without the transition forms. The Windermere specimens were quite different and constituted a new record for Canada.

From this point to Hope our journey was along part of the trail we botanized over during the first two days of our expedition; we were thus enabled to make the return journey in less time. During our first two days we had noted certain species to be collected for the garden; these were secured, and Hope was reached about 7.30 p.m. after travelling twenty-four miles in the rain.

Summary.

During our eleven days' travel we covered, according to the map, approximately 135 miles, but if all the undulations, windings, and side-trips were taken into account, the actual distance travelled would be approximately double that number of miles.

Our expedition, for various reasons, was rather a hurried one, but it enabled us to obtain a general knowledge of the flora and to ascertain which regions required more thorough investigation.

As a result of our exploration of the east side of the Skagit River basin we have been able to supply a considerable amount of data concerning a region about which little has been published.

This is the first account of the flora, and owing to the varied geological features it has provided many excellent illustrations of the relation of plants to environment, and especially to soil conditions.

It has helped in a large measure to explain conditions found in the Dry Belt, conditions which are misinterpreted by casual observers. A great deal of information has been obtained to corroborate the researches made in the Lower Thompson Valley during 1914 and 1915, and when these are written up some of our observations in the Skagit Valley will be used to illustrate transition stages between the vegetation of typical Dry Belt areas and that of the humid Coast area. In the Skagit Valley these two types of vegetation may be seen side by side at the same altitude, whereas in the Dry Belt they are separated by an altitude of several thousand feet.

The appended list of plants is by no means complete; no one can pretend to supply this from a single visit, as the flora of each area differs according to the season; but the list will fill a great blank which previously existed in our knowledge of the native flora and help botanists to extend the distribution of several species. Ecological botanists will find much information regarding the various plant-associations observed during the expedition.

Apart from the collection of herbarium and garden specimens and the collection of data for our botanical survey records, the observations on the topography of the region will help the Dominion Government to issue corrected maps; we have been requested to send copies of our map to Ottawa for this purpose.

The exploration of the west side of the Skagit Valley will take more time; the geological formation is quite different. From the mountains on the east side of the valley one could see that it was a much more inaccessible region, abounding in rugged peaks, snow-fields, and glaciers. On account of the wild nature of the western side there are few trails; the information supplied in maps is very meagre, and we have yet to test our available information before we can know whether it is more reliable than that supplied of the eastern side.

There is no doubt, however, that when the western mountains have been botanically explored they will prove no less interesting than the area traversed this year.

LIST OF PLANTS FOUND DURING THE BOTANICAL EXPLORATION OF THE SKAGIT RIVER BASIN.

("(J. M. M.) 1905" indicates additions by Jas. M. Macoun, Esq., Ottawa.)

Polypodiaceæ.

**Woodsia scopulina*, Eaton.
Common on rock-slides throughout the valley.

**Phegopteris dryopteris* (L.), Fee.
Abundant in Sumallo and Upper Skagit Valleys.

Phegopteris polypodioides, Fee.
By side of trail in Nicolum Valley.

Phegopteris alpestris (Hoppe), Mett.
(J. M. M.) 1905.

**Polystichum lonchites* (L.), Roth.
Nicolum Valley; Upper Canyon Valley.

**Polystichum munitum* (Kaulf), Presl.
Common in Sumallo and Upper Skagit.

Asplenium cyclosorum, Rupr.
(J. M. M.) 1905.

**Asplenium trichomanes*, L.
Frequent in Sumallo, Canyon, Skaist, and Lightning Valleys.

Pellæa densa (Beack), Hook.
(J. M. M.) 1905.

**Cryptogramma acrostichoides*, R. Br.
Common on most rock-slides throughout the valley.

* Also recorded in Mr. Macoun's list.

Ophioglossaceæ.

**Botrychium virginianum* (L.), Sw.
Frequent in Canyon Valley, etc.

**Botrychium lunaria*, Sw.
Near Twenty-one-mile House, Sumallo Valley.

Equisetaceæ.

Equisetum fluviatile, L.
(J. M. M.) 1905.

Equisetum pratense, Ehrh.
(J. M. M.) 1905.

Equisetum arvense, L.
Near Mowitch Camp.

Lycopodiaceæ.

**Lycopodium complanatum*, L.
Sumallo Valley.

**Lycopodium clavatum*, L.
Sumallo Valley.

Lycopodium sitchense, Rupr.
Summit of Canyon Trail.

Pinaceæ.

Pinus contorta var. Murrayana, Engl.
Common in all the valleys.

Pinus monticola, Doutl.
Common on higher slopes of mountains.

Pinus albicaulis, Engl.
(J. M. M.) 1905.

Larix Lyallii, Parl.
(J. M. M.) 1905. (This is an interesting record. I saw no trace of larch on the east side of the valley; Mr. Macoun botanized largely on the west side.—J. D.)

Abies grandis, Lindl.
Frequent in Skaist Valley.

Abies amabilis, Forbes.
Frequent on summit of Canyon Trail, Upper Skaist.

Abies lasiocarpa, (Hook), Nutt.
Frequent at high altitudes near Mount Snaas, Granite Mountain, and Upper Skaist Valley.

Pseudotsuga taxifolia, Britt.
Common throughout Skagit Valley.

**Tsuga heterophylla*, Sarg.
Frequent throughout bottom of valleys.

**Tsuga Mertensiana*, Carr.
Common at high altitudes, near Mount Snaas, and Granite Mountain, etc.

Picea Engelmanni, Parry.
Near headwaters of Skaist. Fairly common.

Picea sitchensis, Carr.
Frequent throughout bottom of valleys. (Forms a forest on Cambie Valley.)

* Also recorded in Mr. Macoun's list.

Cupressineæ.

**Thuja plicata*, Dunn.
Common throughout the bottom of valleys.

**Chamæcyparis nutkænsis*, Spach.
Frequent on higher slopes; rare in bottom of valleys of Skaist.

**Juniperus communis montana*, Ait.
On high rocky places, near Granite Mountain and near Hosameen Ridge.

Graminaceæ.

**Phleum alpinum*, L.
Common in sub-alpine valleys of Canyon, Tulameen, Lightning, etc.

Agrostis exarata, Trin.
(J. M. M.) 1905.

Agrostis Rossæ? Vasey.
(Specimens of what appear to be this species were found on Hosameen Ridge, 6,100 feet, but they were not sufficiently mature to be absolutely certain.)

Agrostis hyemalis (Walt.), B. S. P.
Hope Trail.

Agrostis humilis, Vasey.
Summit of Canyon Trail.

Calamagrostis canadensis acuminata, Vasey.
(J. M. M.) 1905.

**Deschampsia elongata* (Hook), Munro.
Lightning Valley.

**Deschampsia atropurpurea* (Wahl.), Scheele.
Common at headwaters of Skaist, and Lightning Valley near Hosameen.

Trisetum canescens, Buckl.
Hope Trail.

**Trisetum subspicatum* (L.), Beauv.
Base of Mount Snaas (Tulameen River basin).

Melica Harfordii tenuior, Piper.
(J. M. M.) 1905.

**Poa Sandbergii*, Vasey.
Summit of Canyon Trail.

Poa gracillima, Vasey.
Hosameen Ridge.

Poa arctica, R. Br.
Northern slopes of Lightning Valley. (This is the same species as I found in the Garibaldi region, and which is referred to as *Poa laxa?* on p. 60 of my Report. It answered the description of *Poa laxa*, Haenke, as given in Howell's "Flora of Oregon," but I am informed that Howell drew up his description from a specimen of *Poa arctica*. One of the reasons for so much of the confusion one finds in Western Floras is this common habit of authors writing descriptions from wrongly identified species, instead of from type or authenticated specimens.)

Poa stenantha, Vasey.
Summit of Canyon Trail.

* Also recorded in Mr. Macoun's list.

Poa paddensis, Williams.
(J. M. M.) 1905.

Poa pratensis, L.
(J. M. M.) 1905.

Poa compressa, L.
(J. M. M.) 1905.

Glyceria pauciflora, Presl.
(J. M. M.) 1905.

Glyceria nervata, Trin.
(J. M. M.) 1905.

**Glyceria nervata elata*, Nash.
Summit of Hope Trail.

Festuca viridula, Vasey.
Sky Trail.

Festuca occidentalis, Hook.
(J. M. M.) 1905.

**Bromus vulgaris eximus*, Shear.
Canyon Trail.

Bromus marginatus seminudus, Shear.
Northern slopes of Lightning Valley.

Agropyron caninum, Beauv.
Summit of Canyon Trail.

Elymus sitanion, Schultes.
Main Skagit Valley.

Elymus glaucus, Buckl.
(J. M. M.) 1905.

Cyperaceæ.

Eriophorum Chamissonis, C. A. Meyer.
(J. M. M.) 1905.

Eriophorum angustifolium, Roth.
(J. M. M.) 1905.

Eriophorum gracile, Koch.
(J. M. M.) 1905.

Eleocharis palustris (L.), R. & S.
(J. M. M.) 1905.

Carex rostrata, Stokes.
Lightning Lakes.

**Carex canescens*, L.
Summit of Hope Trail.

Carex Goodenovii, Gay.
Cambie Creek.

Carex echinata, Murr.
Cambie Creek.

* Also recorded in Mr. Macoun's list.

Carex nardina, Fr.
(J. M. M.) 1905.

**Carex dives*, Holm.
Near Beaver Lake.

Carex interior, Bail.
(J. M. M.) 1905.

Carex ablata, Bail.
(J. M. M.) 1905.

Carex tenella, Schk.
(J. M. M.) 1905.

Carex Œderi var. Œdocarpa.
(J. M. M.) 1905.

Carex læviculmis, Meinsh.
(J. M. M.) 1905.

Carex Mertensii, Prescott.
(J. M. M.) 1905.

Carex diandra var. ramosa, Fernald.
(J. M. M.) 1905.

Carex gynocrates, Wormsk.
(J. M. M.) 1905.

Carex capillaris, L.
(J. M. M.) 1905.

Carex Halleri, Gunn.
(J. M. M.) 1905.

Carex Deweyana, Schwein.
(J. M. M.) 1905.

Carex vulgaris var. lipocarpa, Holm.
(J. M. M.) 1905.

Carex festiva, Dew.
(J. M. M.) 1905.

Carex Bonplandii, Kunth.
(J. M. M.) 1905.

Carex Bebbii (Bail.), Olney.
(J. M. M.) 1905.

Carex polytrichoides, Muehl.
(J. M. M.) 1905.

Carex multimoda, Bailey.
(J. M. M.) 1905.

Carex spectabilis, Dew.
(J. M. M.) 1905.

Carex nigricans, Meyer.
(J. M. M.) 1905.

Carex vitilis, Fries.
(J. M. M.) 1905.

* Also recorded in Mr. Macoun's list.

Araceæ.

**Lysichiton kamtschatcense*, Schott.
Frequent in Sumallo Valley and common near Beaver Lake.

Juncaceæ.

**Juncus subtriflorus* (Mey), Coville.
Near Mowitch Camp.

**Juncus Mertensianus*, Bong.
Near Mowitch Camp.

Juncus filiformis, L.
(J. M. M.) 1905.

Juncus Dudleyi, Wiegand.
(J. M. M.) 1905.

Juncus ensifolius, Wikstr.
(J. M. M.) 1905.

Juncus Parryi, Engl.
(J. M. M.) 1905.

**Luzula parviflora*, Desv.
Common throughout the valleys.

**Luzula spicata*, DC.
Common in Canyon Valley, etc.

Luzula Piperi, M. E. Jones.
(J. M. M.) 1905.

Luzula glabrata, Desv.
(J. M. M.) 1905.

Liliaceæ.

**Tofieldia intermedia*, Rydb.
Common in alpine marshes near Mount Snaas and near Hosameen Ridge.

**Stenanthium occidentale*, A. Gr.
Locally abundant on Upper Skaist.

**Veratrum viride*, Ait.
Common in sub-alpine valleys of Canyon, Upper Skagit, and Lightning Valleys.

Allium acuminatum, Hook.
West slopes of Hosameen Ridge.

**Lilium parviflorum* (Hook), Holz.
Common in sub-alpine valleys.

**Erythronium grandiflorum var. parviflorum*, Wats.
Near Granite Mountain.

Lloydia serotina (L.), Sweet.
(J. M. M.) 1905.

Clintonia uniflora, Kunth.
Abundant in Sumallo, Upper Skagit, etc.

**Smilacina sessilifolia*, Nutt.
Canyon Valley.

* Also recorded in Mr. Macoun's list.

**Smilacina amplexicaulis*, Nutt.
Sumallo and Canyon Valleys.

**Streptopus amplexifolius* (L.), DC.
Near base of Hosameen Ridge.

**Streptopus roseus*, Michx.
Common in Canyon Valley.

Orchidaceæ.

**Habenaria gracilis*, Wats.
Common in Canyon and Lightning Valleys.

Habenaria unalaschensis (Spreng), Wats.
Skaist Valley and Sky Trail.

Habenaria dilatata, Hook.
Summit of Canyon Trail.

Habenaria orbiculata, Hook.
Coquihalla Flats.

Habenaria hyperborea, R. Br.
(J. M. M.) 1905.

Habenaria borealis (C. & S.), Rydb.
(J. M. M.) 1905.

Spiranthes Romanzoffiana, Cham.
(J. M. M.) 1905.

Listera cordata, R. Br.
Tulameen headwaters.

**Goodyera Menziesii*, Lindl.
Common in Sumallo and Upper Skagit.

Salicaceæ.

Salix Barclayii, Anders.
Summit between Mount Snaas and Mount Hopeless, and near Hosameen Ridge.

**Salix commutata*, Bebb.
Same localities as *S. Barclayii*.

**Salix flavescens*, Nutt.
Common in Sumallo and Lower Skagit.

Salix Scouleriana, Hook.
Frequent in Upper Skaist

**Salix sitchensis*, Sanson.
Frequent in Sumallo and Lower Skagit, Canyon Trail, etc.

**Populus trichocarpa*, T. & G.
Common throughout valleys.

Populus tremuloides.
Lower Skagit.

Betulaceæ.

**Alnus tenuifolia*, Nutt.
Cambie Valley.

**Alnus rubra*, Bong.
Common in Sumallo and Lower Skagit, etc.

* Also recorded in Mr. Macoun's list.

Urticaceæ.

Urtica cardiophylla, Rydb.
(J. M. M.) 1905.

Aristolochiaceæ.

**Asarum caudatum*, Lindl.
Common in Sumallo Valley.

Polygonaceæ.

**Eriogonum subalpinum*, Greene.
Common in Upper Skaist, Cambie, and Lightning Valleys, and Hosameen Ridge. (This is probably only a pale-flowered form of *E. umbellatum*, Torr.)

**Oxyria digyna* (L.), Hill.
Common by sub-alpine creeks.

**Polygonum minimum*, S. Wats.
Canyon Trail.

Polygonum Douglasii, Green.
Northern slopes of Lightning Valley.

Polygonum viviparum, L.
Common in Canyon Valley and Tulameen Valley.

Portulaceæ.

**Claytonia lanceolata*, Pursh.
Common (6,000 feet) near Granite Mountain.

**Claytonia sibirica*, L.
Common in Sumallo and Canyon Valleys.

**Claytonia parvifolia*, Michx.
Upper Skaist.

Claytonia perfoliata.
Canyon Valley.

Lewisia columbiana (Howell), Rob.
On rocky summit near Granite Mountain and on Hosameen Ridge (6,000 feet).

Caryophyllaceæ.

Stellaria stricta, Rich.
(J. M. M.) 1905.

Stellaria longipes læta (Goldie), T. & G.
(J. M. M.) 1905.

Stellaria brachypetala, Bong.
(J. M. M.) 1905.

Stellaria obtusa, Engl.
(J. M. M.) 1905.

Cerastium effusum, Greene.
(J. M. M.) 1905.

Cerastium graminifolium, Rydb.
(J. M. M.) 1905.

* Also recorded in Mr. Macoun's list.

Cerastium campestre, Greene.
(J. M. M.) 1905.

Sagina crassicaulis, Wats.
(J. M. M.) 1905.

Sagina Linnæi, Presl.
(J. M. M.) 1905.

**Arenaria macrophylla*, Hook.
Northern slopes of Lightning Valley, etc.

**Arenaria serpyllifolia*, L.
Lower Skagit.

**Arenaria capillaris nardifolia* (Ledeb.), Regel.
Common near summit of Canyon Trail, headwaters of Skaist, Lightning Valley, Hosameen Ridge, and Tulameen Valley.

Arenaria propinqua, Rich.
(J. M. M.) 1905.

Silene Macounii, S. Wats.
Sky Trail, summit of Canyon Trail.

Silene acaulis, L.
(J. M. M.) 1905.

Silene multicaulis, Nutt.
(J. M. M.) 1905.

Ranunculaceæ.

**Caltha leptosepala*, DC.
Abundant on ridge between Mount Snaas and Mount Hopeless, also near Hosameen Ridge.

**Trollius albiflorus* (Gr.), Rbdb.
Along with *Caltha*, also near Tulameen headwaters.

Actæa spicata, Linn.
Common in Sumallo Valley.

**Actæa arguta*, Nutt.
Common in Sumallo and Canyon Valleys. (An intermediate form, possibly a hybrid, with beautiful pink berries was associated with the above two species in Sumallo Valley.)

**Aquilegia formosa*, Fischer.
Common in Nicolum, Sumallo, Canyon, Cambie, and Lightning Valleys.

**Delphinium bicolor*, Nutt.
Northern slopes of Lightning Creek.

**Anemone occidentalis*, Wats.
Northern slopes of Lightning Valley.

**Anemone Lyallii*, Britt.
Skaist Valley.

**Anemone multifida*, Poir.
Canyon Valley. Common.

Anemone Drummondii, Wats.
(J. M. M.) 1905.

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* Also recorded in Mr. Macoun's list.

Anemone (*sp. nov.*), Rydb.
(J. M. M.) 1905.

Clematis ligusticifolia, Nutt.
(J. M. M.) 1905.

**Ranunculus Eschscholtzii*, Schlecht.
Common in Canyon Valley.

**Ranunculus Bongardi*, Greene.
Common in Sumallo Valley, etc.

Ranunculus unalaschensis, Bess.
(J. M. M.) 1905.

Ranunculus Macounii, Britt.
(J. M. M.) 1905.

**Thalictrum occidentalis*, A. Gray.
Common in most of the valleys.

Berberidaceæ.

**Berberis nervosa*, Pursh.
Common in Sumallo and main Skagit Valleys.

Berberis aquifolium, Pursh.
Frequent in Sumallo Valley.

Achyls triphylla, DC.
Common in Coquihalla Flats and Nicolum Valley.

Fumariaceæ.

**Dicentra formosa*, DC.
Common in Sumallo Valley.

Cruciferæ.

Radicula pacifica, Howell.
(J. M. M.) 1905.

**Cardamine oligosperma*. Nutt.
Common in Sumallo and Nicolum Valleys.

Cardamine bellidifolia, L.
(J. M. M.) 1905.

Cardamine umbellata, Greene.
(J. M. M.) 1905.

Draba stellata nivalis, Regel.
Canyon Valley.

Draba præalta, Greene.
(J. M. M.) 1905.

Draba lonchocarpa, Rydb.
(J. M. M.) 1905.

Smelowskia ovalis, Jones.
(J. M. M.) 1905.

**Arabis Lyallii*, Wats.
Hosameen Ridge.

* Also recorded in Mr. Macoun's list.

**Arabis Drummondii*, Gray.
Canyon Valley.

Arabis divaricarpa, A. Nelson.
(J. M. M.) 1905.

Arabis ambigua, DC.
(J. M. M.) 1905.

Arabis glabra, (L.), Bernh.
(J. M. M.) 1905.

Arabis hirsuta, Scop.
(J. M. M.) 1905.

Droseraceæ.

**Drosera rotundifolia*, L.
Common on ridge between Mount Snaas and Mount Hopeless.

Crassulaceæ.

**Sedum divergens*, S. Wats.
Common on rock-slides, etc., Sumallo and Lightning Valleys and on Hosameen Ridge.

Sedum stenopetalum, Pursh.
Common at headwaters of Skaist, etc.

Saxifragaceæ.

**Leptarrhena amplexifolia* (Sternb.), Ser.
Common on sub-alpine regions of Canyon Valley and near Mowitch Camp, etc.

Suksdorfia ranunculifolia (Hook), Engler.
(Hemieva.) (J. M. M.) 1905.

Saxifraga oppositifolia, L.
West side of Sumallo Valley, near Twenty-one-mile House. Local.

**Saxifraga punctata*, Linn.
(This is the same species as was found in the Garibaldi region, and, as was pointed out on page 63 of Part II. of the Report, it agrees with the description of *S. æstivalis*, F. & M., the name supplied in Mr. Macoun's list. It is hoped that specimens of the European *S. punctata* will be grown in the Botanical Garden for future comparison with our native specimens, to ascertain whether ours are the same, as indicated by the Index Kewensis, or whether they are sufficiently distinct to deserve specific rank.)

**Saxifraga Bongardi*, Presl.
Frequent on Canyon Trail and Skaist Valley.

Saxifraga Lyallii, Engler.
(J. M. M.) 1905.

Saxifraga occidentalis, Wats.
(J. M. M.) 1905.

Saxifraga arguta, D. Don.
(J. M. M.) 1905.

Saxifraga Tolmiea, T. & G.
(J. M. M.) 1905.

Saxifraga delicatula, L.
(J. M. M.) 1905.

* Also recorded in Mr. Macoun's list.

Saxifraga adscendens, L.
(J. M. M.) 1905.

Saxifraga cernua, L.
(J. M. M.) 1905.

Saxifraga Mertensiana, Bong.
(J. M. M.) 1905.

Saxifraga austromontana, Wieg.
(J. M. M.) 1905.

**Tiarella unifoliata*, Hook.
Common in Sumallo and Upper Skagit Valleys.

Tiarella trifoliata, Linn.
Frequent in Sumallo Valley.

**Heuchera glabra*, Willd.
Sumallo, near Twenty-one-mile House.

Heuchera ovalifolia, Nutt.
Northern slopes of Lightning Valley.

Heuchera racemosa, S. Wats.
(J. M. M.) 1905.

Heuchera micrantha, Dougl.
(J. M. M.) 1905.

**Tolmiea Menziesii*, Pursh.
Common in Sumallo, Canyon, and Skaist Valleys.

**Tellima grandiflora*, R. Br.
Common in Sumallo Valley.

**Mitella pentandra*, Hook.
Common in most of the valleys.

**Mitella trifida*, Graham.
Locally common in Canyon and Upper Skaist Valleys. Abundant in Tulameen side of watershed.

Mitella Breweri, A. Gr.
(J. M. M.) 1905.

Mitella diversifolia, Greene.
(J. M. M.) 1905.

**Parnassia fimbriata*, Koenig.
Sumallo Valley.

**Ribes Howellii*, Greene.
Divide between Mount Snaas and Mount Hopeless, also near Granite Mountain and near Mowitch Camp.

Ribes viscosissimum, Pursh.
Skaist Valley.

**Ribes divaricatum*, Dougl.
Common in Upper Skagit.

**Ribes lacustre* (Pers.) Poir.
Canyon and Upper Skaist Valleys, etc.

* Also recorded in Mr. Macoun's list.

Rosaceæ.

**Physocarpus opulifolius* (L.) Maxim.
Common at Coquihalla Flats.

**Spiræa lucida*, Dougl.
Common in Lower Skagit and Lightning Valleys, etc.

**Spiræa Douglasii*, Hook.
Common at Beaver Lake.

Spiræa densiflora, Nutt.
(J. M. M.) 1905.

Spiræa pyramidata, Greene.
(J. M. M.) 1905.

**Eriogynia (Lutkea) pectinata*, T. & G.
Common in Canyon Valley and Mowitch Camp.

Aruncus sylvester, Kost.
Common along Nicolum Valley.

**Pyrus occidentalis*, Wats.
Locally common in Upper Skaist.

**Pyrus sambucifolia*, Cham. & Schl.
Common on divide between Mount Snaas and Mount Hopeless, also near Granite Mountain, and associated with *Pyrus occidentalis* on Upper Skaist.

Pyrus diversifolia, Bong.
Near Beaver Lake and Lower Sumallo.

**Amelanchier alnifolia*, Nutt.
Skaist and main Skagit Valleys.

Cratægus Douglasii, Sarg.
(J. M. M.) 1905.

**Rubus leucodermis*, Dougl.
Common in vicinity of rock-slides.

**Rubus strigosus*, Michx.
Frequent in Sumallo and Lower Skaist Valleys.

**Rubus pedatus*, Smith.
Common in Lower Skaist, etc.

**Rubus ursinus*, Cham. & Schl.
Common in Sumallo Valley, etc.

**Rubus spectabilis*, Pursh.
Common in most of the valleys.

**Rubus parviflorus*, Nutt.
Common in Sumallo Valley, etc.

Rubus lasiococcus, Gray.
Locally common near Mowitch Camp.

**Fragaria bracteata*, Heller.
Common in Sumallo, Canyon, and other valleys.

**Fragaria platypetala*, Rydb.
Common throughout most of the valleys.

* Also recorded in Mr. Macoun's list.

Potentilla glandulosa, Lindl.
Skaist and Lightning Valleys.

Potentilla dissecta, Pursh.
Sky Trail near Hosameen Mountain.

Potentilla sp?
Intermediate between *P. rivale* and *millegrana*, near Lightning Lakes.

**Potentilla Drummondii*, Lehm.
Hope Trail.

**Potentilla fruticosa*, L.
Hosameen Ridge.

**Potentilla flabellifolia*, Hook.
Canyon, Tulameen, and Lightning Valleys.

Potentilla oregana, Nutt.
(J. M. M.) 1905.

Potentilla nana, Willd.
(J. M. M.) 1905.

Potentilla glaucophylla, Lehm.
(J. M. M.) 1905.

Potentilla cascadensis, Rydb.
(J. M. M.) 1905.

Potentilla emarginata, Pursh.
(J. M. M.) 1905.

Comarum palustre, L.
(J. M. M.) 1905.

**Sibbaldia procumbens*, L.
Common in Canyon Valley, etc.

Geum oregonense (Scheutz), Rydb.
(J. M. M.) 1905.

**Geum macrophyllum*, Willd.
Canyon Valley.

Dryas octopetala, L.
(J. M. M.) 1905.

Rosa Woodsii, Lindl.
Skaist Valley.

Rosa gymnocarpa, Nutt.
Sumallo Valley.

**Rosa nutkana*, Moc.
Lower Skagit, etc.

Rosa leucopsis, Rydb.
(J. M. M.) 1905.

**Prunus emarginata* (Dougl.), Walp.
Sumallo Valley, etc.

**Prunus demissa* (Nutt), Dietr.
Upper Skaist.

* Also recorded in Mr. Macoun's list.

Leguminosæ.

**Lupinus arcticus*, Wats.
Common in most of the valleys.

Vicia americana, Muhl.
West slopes of Hosameen Ridge.

Empetraceæ.

Empetrum nigrum, L.
(J. M. M.) 1905.

Celastraceæ.

**Pachistima Myrsinites*, Raf.
Common in Upper Skaist and Lightning Valley, etc.

Aceraceæ.

**Acer circinatum*, Pursh.
Common in Sumallo, Canyon, and Skagit Valleys.

**Acer glabrum*, Torr.
Canyon Valley and Upper Skaist. (Great variation was found in both leaves and fruits; one found typical fruits and fruits with wings at 180 degrees on the same plant.)

Rhamnaceæ.

**Ceanothus velutinus*, Dougl.
Locally common in Skaist, Lightning, and Lower Skagit Valleys.

Ceanothus sanguineus, Pursh.
Hope Trail near Canyon Creek, west slopes of Hosameen Ridge, and Skagit Valley.

Violaceæ.

Viola glabella, Nutt.
Near Mowitch Camp and Canyon Valley.

Viola canadensis, L.
Sumallo Valley.

Viola adunca, Smith.
Headwaters of Tulameen.

Viola palustris, L.
(J. M. M.) 1905.

Elæagnaceæ.

Shepherdia canadensis, Nutt.
Common in certain areas in Skagit Valley.

Onagraceæ.

**Epilobium angustifolium*, L.
Common in most valleys.

**Epilobium latifolium*, L.
Common in Canyon and Lightning Valleys, etc.

Epilobium Hornemannii, Reich.
Canyon Valley.

* Also recorded in Mr. Macoun's list.

**Epilobium adenocaulon*, Hauss.
Common in Sumallo, Skaist, and Skagit Valleys.

Epilobium alpinum, L.
Canyon Valley and near Mowitch Camp.

**Epilobium luteum*, Pursh.
Canyon Valley.

Epilobium paniculatum, Nutt.
(J. M. M.) 1905.

Epilobium glaberrimum, Barb.
(J. M. M.) 1905.

Epilobium minutum, Lind. var.
(J. M. M.) 1905.

Araliaceæ.

Fatsia horrida (Sm.), B. & H.
Common in Upper Skagit, etc.

Umbelliferæ.

**Osmorhiza divaricata*, Nutt.
Canyon Valley, etc.

Osmorhiza purpurea, C. & R.
(J. M. M.) 1905.

Cicuta occidentalis, Greene.
(J. M. M.) 1905.

Cicuta vagans (Greene).
(J. M. M.) 1905.

Cicuta Douglasii (DC.), C. & R.
(J. M. M.) 1905.

Lomatium nudicaule (Pursh.), C. & R.
Cambie Valley.

Lomatium ambiguum (Nutt.), C. & R.
Sky Trail near Hosameen.

Pastinaca sativa, L.
(J. M. M.) 1905.

**Heracleum lanatum*, Michx.
Common in most of the valleys.

Cornaceæ.

Cornus canadensis, L.
Common in most of the valleys.

Cornus stolonifera var. riparia, Visher.
(J. M. M.) 1905.

Pyrolaceæ.

**Chimaphila umbellata* (L.), Nutt.
Common in Sumallo, Canyon, and Upper Skagit Valleys, etc.

* Also recorded in Mr. Macoun's list.

**Pyrola minor*, Linn.
Upper Skaist.

**Pyrola secunda*, L.
Common in most of the valleys.

**Pyrola bracteata*, Hook.
Common in Sumallo Valley, etc.

**Pyrola chlorantha*, Sw.
Common in Upper Skagit.

**Pyrola rotundifolia*, L.
Common in Sumallo Valley, etc.

Pyrola picta, Smith.
(J. M. M.) 1905.

Moneses uniflora (L.), Gray.
North-eastern slopes of Mount Snaas.

Monotropaceæ.

Monotropa uniflora, L.
(J. M. M.) 1905.

Ericaceæ.

Ledum glandulosum, Nutt.
On summit between Mount Snaas and Mount Hopeless.

**Rhododendron albiflorum*, Hook.
Common on Mount Snaas, Skaist, Upper Skagit, and Lightning Valleys.

**Rhododendron californicum*, Hook.
Locally common near junction of Sumallo and Skagit, Upper and Lower Skagit Valleys. Rare in Skaist Valley.

**Menziesia ferruginea*, Sm.
Common in most valleys.

**Phyllodoce empetriformis* (Sm.), D. Don.
Common in the high regions of most of the valleys.

**Phyllodoce glanduliflorus* (Hook), Coville.
Summit of ridge in Lightning Valley.

**Phyllodoce empetriformis intermedius* (Hook), Rydb.
Associated with *P. glanduliflorus*.

**Kalmia microphylla* (Hook), Heller.
Common on Summit of Canyon Trail.

Kalmia polifolia, Ait.
(J. M. M.) 1905.

**Cassiope Mertensiana* (Bong), D. Don.
On ridge on north side of Lightning Valley.

Cassiope stelleriana, DC.
(J. M. M.) 1905.

**Gaultheria shallon*, Pursh.
Common in most of the valleys.

* Also recorded in Mr. Macoun's list.

**Gaultheria ovatifolia*, Gray.
Upper Skagit Valley, etc.

Arctostaphylos Uva-ursi, Spreng.
Common in Sumallo and Lightning Valleys, etc.

**Vaccinium myrtillus microphyllum*, Hook.
Common in Upper Skaist and Lightning Valleys.

Vaccinium ovalifolium, Sm.
Common in Sumallo and Upper Skagit Valleys, etc.

Vaccinium parvifolium, Sm.
In most of the valleys.

**Vaccinium macrophyllum* (Hook), Piper.
Main Skagit and Canyon Valleys, etc.

Vaccinium alaskensis, Howell.
(J. M. M.) 1905.

Vaccinium deliciosum, Piper.
(J. M. M.) 1905.

Oxyococcus vulgaris var. intermedia, Gr.
(J. M. M.) 1905.

Primulaceæ.

Trientalis latifolia, Hook.
Sumallo Valley, etc.

Trientalis arctica, Fisch.
Divide between Mount Snaas and Mount Hopeless.

Gentianaceæ.

**Gentiana acuta*, Michx.
Upper Skaist.

Menyanthes trifoliata, L.
(J. M. M.) 1905.

Apocynaceæ.

Apocynum androsæmifolium, L.
Lower Skagit.

Polemoniaceæ.

**Phlox diffusa*, Benth.
Northern slopes of Lightning Creek.

**Collomia linearis*, Nutt.
Skaist Valley.

Collomia heterophylla, Hook.
(J. M. M.) 1905.

**Gilia gracilis* (Dougl.), Greene.
Northern slopes of Lightning Creek.

**Polemonium humile*, R. & S.
Common in Skaist, Lightning, and Cambie Valleys.

* Also recorded in Mr. Macoun's list.

Hydrophyllaceæ.

**Hydrophyllum capitatum*, Dougl.
Common in Canyon Valley, etc.

Hydrophyllum albifrons, Heller.
(J. M. M.) 1905.

**Phacelia circinata*, Jacq.
Common in Sumallo Valley, etc. (This is the ochroleucus or whitish-flowered form *P. heterophylla*, Pursh., is described by him as having blue flowers.)

Phacelia sericea (Graham), A. Gray.
(J. M. M.) 1905.

Romanzoffia sitchensis, Bong.
(J. M. M.) 1905.

Boraginaceæ.

**Lappula diffusa* (Lehm), Greene.
Common on northern slopes of Lightning Valley.

Myosotis laxa, Lehm.
(J. M. M.) 1905.

Labiatæ.

**Prunella vulgaris*, L.
Common along the trails.

Scrophulariaceæ.

Collinsia parviflora, Dougl.
Common near Beaver Lake and in Upper Skaist.

**Pentstemon diffusus*, Dougl.
Common in Sumallo, Canyon, and Lower Skagit Valleys.

**Pentstemon confertus*, Dougl.
Upper Skaist.

**Pentstemon procerus*, Dougl.
Head of Canyon Valley.

Pentstemon Menziesii, Hook.
Skaist Valley.

Pentstemon Scouleri, Dougl.
Cambie Valley.

Pentstemon fruticosus (Pursh.), Greene.
(J. M. M.) 1905.

Pentstemon ovatus, Dougl.
(J. M. M.) 1905.

**Mimulus moschatus*, Dougl.
Sumallo and Canyon Valley.

**Mimulus Lewisii*, Pursh.
Common in Canyon Valley and near Mowitch Camp.

**Mimulus alpinus* (Gray), Piper.
Common near Mowitch Camp.

* Also recorded in Mr. Macoun's list.

Mimulus Langsdorfii, Donn.
(J. M. M.) 1905.

**Veronica americana*, Schewein.
Sumallo Valley, etc.

**Veronica alpina*, L.
Common near Mowitch Camp and north-eastern slopes of Mount Snaas.

Veronica serpyllifolia, L.
Common in Sumallo Valley, etc.

Veronica humifusa, Dicks.
(J. M. M.) 1905.

Veronica arvensis, L.
(J. M. M.) 1905.

Castilleia angustifolia, Nutt.
Ridge of Hosameen.

**Castilleia Bradburii* (Nutt.), Don.
Hosameen Ridge.

Castilleia lancifolia, Rydb.
(J. M. M.) 1905.

Castilleia oreopola, Greenman.
(J. M. M.) 1905.

Castilleia rupicola, Piper.
(J. M. M.) 1905.

Castilleia pallida, Kunth.
Headwaters of the Skaist.

**Pedicularis bracteosa*, Benth.
Common in Upper Skaist and near Mowitch Camp.

**Pedicularis racemosa*, Dougl.
Common in Canyon and Lower Skagit Valleys, etc.

Pedicularis grœnlandica, Retz.
Locally common on summit of ridge between Mount Snaas and Mount Hopeless.

Orobanchaceæ.

Orobanche uniflora, L.
Rare, near Mowitch Camp.

Lentibulariaceæ.

Pinguicula vulgaris, L.
On summit of ridge between Mount Snaas and Mount Hopeless.

Rubiaceæ.

**Galium triflorum*, Mx.
Common in Sumallo and Canyon Valleys.

Galium trifidum subbiflorum, Wieg.
(J. M. M.) 1905.

* Also recorded in Mr. Macoun's list.

Caprifoliaceæ.

**Sambucus racemosa*, L.
Sumallo and Canyon Valleys.

**Viburnum pauciflorum*, Rylaie.
Canyon and Upper Skagit Valleys, etc.

**Symphoricarpos racemosus*, Michx.
Common in most valleys.

**Linnæa borealis var. americana* (Forbes), Rehder.
Common in most valleys.

Lonicera canadensis, Marsh.
Skaist and Lightning Valleys.

**Lonicera involucrata*, Banks.
Common in most valleys.

Lonicera ciliosa (Pursh.), Poir.
(J. M. M.) 1905.

Valerianaceæ.

**Valeriana sitchensis*, Bong.
Common in Canyon and Lightning Valleys, etc.

Valeriana septentrionalis, Rydb.
(J. M. M.) 1905.

Campanulaceæ.

Campanula rotundifolia, L.
Sumallo, near Beaver Lake.

Compositæ.

Brickellia oblongifolia, Nutt.
(J. M. M.) 1905.

Chrysopsis villosa, Nutt.
(J. M. M.) 1905.

Solidago elongata, Nutt.
(J. M. M.) 1905.

Solidago ciliosa, Greene.
(J. M. M.) 1905.

Solidago scopulorum, Nelson.
(J. M. M.) 1905.

Aplopappus Lyallii, Gray.
(J. M. M.) 1905.

**Aster Englemanii*, Gray.
Skaist Valley.

Aster apricus, Rydb.
(J. M. M.) 1905.

**Erigeron salsuginosus* (Rich.), A. Gray.
Canyon and Lightning Valleys.

**Erigeron aureus*, Greene.
Near Hosameen and near Granite Mountain. Locally common.

* Also recorded in Mr. Macoun's list.

Erigeron acris, Linn.
Canyon Trail.

**Erigeron philadelphicus*, L.
Sumallo, Canyon, and Lower Skagit Valleys.

**Erigeron compositus*, Pursh.
Hosameen Ridge. (These specimens closely approach the so-called *E. multifidus*, Rydb. The latter species is based on very unreliable points, the cutting and pubescence of the leaves being too variable a character to be of value in the segregation of a new species. We have herbarium specimens of typical *E. compositus* from the perpetual-snow regions of the Garibaldi Mountain District, showing bi-ternate and tri-ternate leaves on the same plant. Others show a variation from linear, through ternate to bi-ternate leaves. The pubescence varies from densely hirsute to almost glabrous. The specimens found on Hosameen Ridge have glabrate leaves with petioles sparsely hirsute. It is interesting to note that most of our herbarium specimens from dry sandy benches in the Interior are less compact and taller than those from the summit of Coast Mountains, but I am of the opinion that the difference is a purely environmental one and unworthy of more than varietal rank.)

Erigeron speciosus (Lindl.), DC.
(J. M. M.) 1905.

Erigeron angustifolius (A. Gray), Rydb.
(J. M. M.) 1905.

Erigeron juncundus, Greene.
(J. M. M.) 1905.

Antennaria racemosa, Hook.
Skaist and Lightning Valleys, near Hosameen.

**Antennaria lanata* (Hook), Greene.
Headwaters of Skaist.

**Antennaria parvifolia*, Nutt.
Upper Skaist.

Antennaria rosea, Greene.
Headwaters of Skaist. Common.

Antennaria inamœna, Greene.
(J. M. M.) 1905.

Antennaria modesta, Greene.
(J. M. M.) 1905.

Antennaria eximia, Greene.
(J. M. M.) 1905.

Antennaria flavescens, Rydb.
(J. M. M.) 1905.

Antennaria erigeroides, Greene.
(J. M. M.) 1905.

Antennaria chlorantha, Greene.
(J. M. M.) 1905.

Antennaria media, Greene.
(J. M. M.) 1905.

* Also recorded in Mr. Macoun's list.

Anaphalis margaritacea, L.
Upper Skaist.

Anaphalis margaritacea subalpina, A. Gray.
(J. M. M.) 1905.

Gnaphalium Macounii, Greene.
(J. M. M.) 1905.

Balsamorhiza sagittata, Nutt.
Hosameen Ridge.

Helianthella Douglasii, Torr. & Gray.
Skaist Valley.

**Eriophyllum lanatum* (Pursh.), Forbes.
Upper Sumallo and near Mount Hosameen.

**Achillea lanulosa*, Nutt.
Upper Skaist, etc.

**Artemisia discolor*, Dougl.
Northern slopes of Lightning Valley.

Petasites frigida (L.), Fries.
(J. M. M.) 1905.

**Arnica cordifolia*, Hook.
Northern slopes of Lightning Valley.

Arnica alpina, Linn.
Lightning Valley and north-east of Mount Snaas.

Arnica Parryi, Gray.
Sumallo and Canyon Valleys, etc.

Arnica amplexicaulis, Nutt.
Summit of Canyon Valley and Skaist Valley.

**Arnica latifolia*, Bong.
Canyon Valley, etc.

Arnica sp. ?
Skaist Valley.

Arnica eradiata (Gr.), Heller.
(J. M. M.) 1905.

Arnica Macounii, Greene.
(J. M. M.), 1905.

Arnica gracilis, Rydb.
(J. M. M.) 1905.

**Luina hypoleuca*, Benth.
Canyon Valley. Common on Hosameen Ridge.

**Senecio triangularis*, Hook.
Canyon Valley, etc. Common.

**Senecio discoideus*, Britton.
Sumallo Valley, etc. Frequent.

Senecio pauciflorus, Pursh.
Common in Canyon Valley and near Mowitch Camp.

* Also recorded in Mr. Macoun's list.

Senecio Fremonti, Torr. & Gr.
(J. M. M.) 1905.

Senecio cymbalarioides, Nutt.
(J. M. M.) 1905.

Senecio exaltatus, Nutt.
(J. M. M.) 1905.

Senecio Elmeri, Piper.
(J. M. M.) 1905.

Senecio Burkei.
(J. M. M.) 1905.

**Cnicus edulis*, Gray.
Common in sub-alpine regions in most of the valleys.

Taraxacum latilobum, DC.
Upper Skagit; headwaters of Cambie Creek.

Taraxacum alaskanum, Rydb.
(J. M. M.) 1905.

Troximon glaucum, Nutt.
Summit of Skagit. Common near headwaters of Tulameen and Cambie Creeks.

Troximon gracilens, Gray.
(J. M. M.) 1905.

**Hieracium albiflorum*, Hook.
Common in Sumallo and Canyon Valleys, etc.

**Hieracium gracile*, Hook.
Frequent in most of the valleys.

Hieracium columbianum.
(J. M. M.) 1905.

Species on Mr. Macoun's list and not on mine	171
Species on my list and not on Mr. Macoun's	100
Species common to both lists	185
Total number of species recorded	456

It will be observed that Mr. Macoun's additions to my list are mostly species characteristic of alpine and marshy habitats; while most of my additions to his list are characteristic of a drier environment, thus emphasizing the different geological conditions of the east and west watersheds of the Skagit River basin.

(9*b*.) BOTANICAL EXPLORATION OF THE BITTER-ROOT GROUNDS AND "THREE SISTERS" VALLEY, BETWEEN SPENCES BRIDGE AND ASHCROFT.

In continuation of last year's botanical exploration of the Lower Thompson a visit was made to the region of the Thompson River between Spences Bridge and Ashcroft.

Early in May information was received to the effect that large numbers of Indians had gone to the bitter-root grounds, and that bitter-root (*Lewisia rediviva*) was very abundant this season. (Frontispiece, Fig. 61.)

*Also recorded in Mr. Macoun's list.

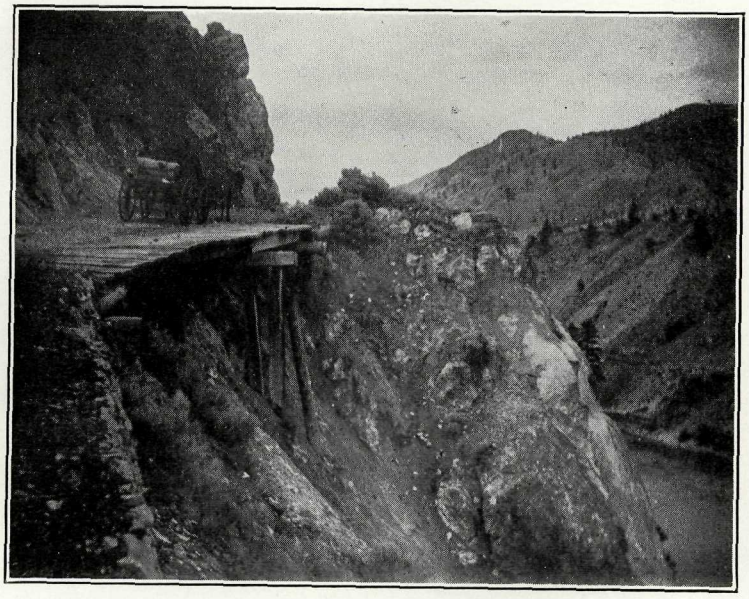

Fig. 73. Scene on the old Cariboo Road between Spences Bridge and Ashcroft. (Page 135.)

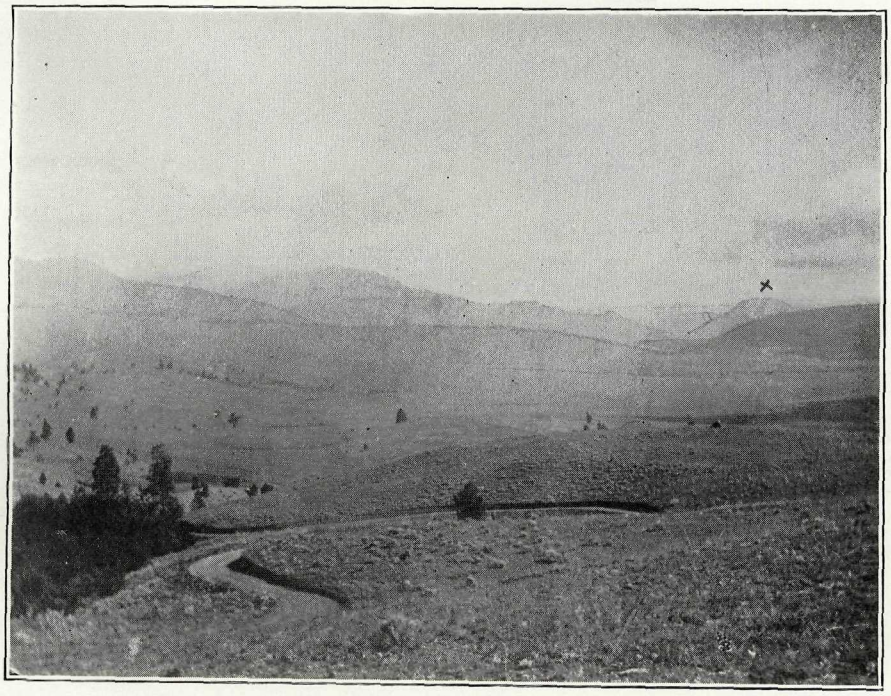

Fig. 74. "100-Mile Flats." The heart of the bitter-root country. Rattlesnake Mountain marked X. (Page 135.)

Fig. 75. Bitter-root on "100-Mile Flats." (Page 135.)

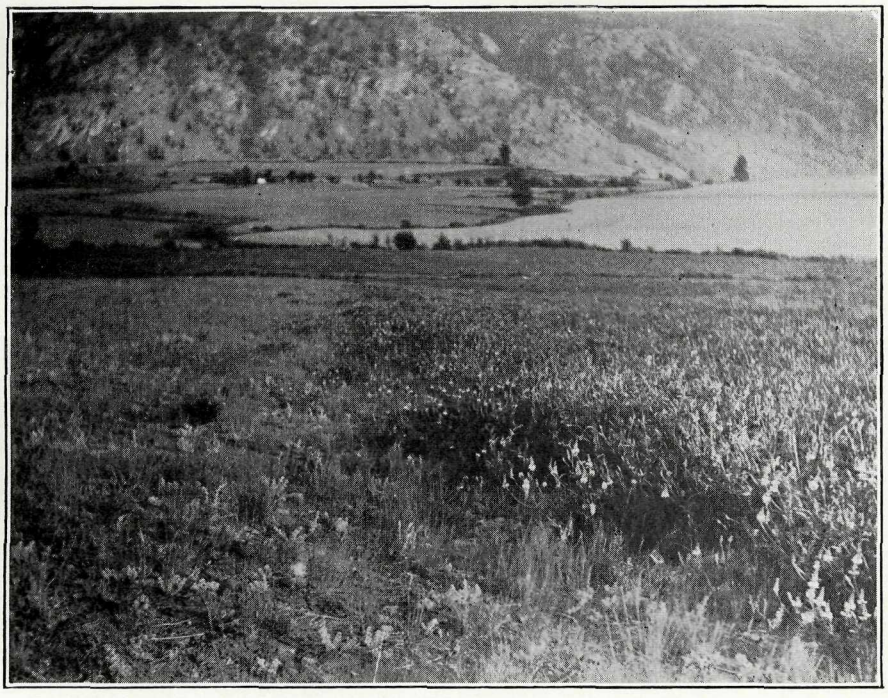

Fig. 76. Showing the effect of irrigating a bitter-root habitat in Thompson Valley. On the left, sage-brush, bunch-grass, and cactus; on the right, a field of sanfoin (*Onobrychis viciæfolia*) irrigated. (Page 135.)

Fig. 77. Bitter-root (*Lewisia rediviva*), one-half natural size. (Page 135.)

Arrangements were made by Mr. J. A. Teit, botanical correspondent at Spences Bridge, to enable me to visit that region and "Three Sisters" Valley, which I was informed had quite a different flora from that of the valleys explored last year.

On May 12th I arrived at Spences Bridge and, after ascertaining the nature of the country, arranged for a rig and two horses to convey our equipment, tent, and provisions along the old Yale-Cariboo Road to the bitter-root grounds at "100-Mile Flats," known to Indians as "Schuchem-elch," which means "Root-digging house." (Figs. 73 and 74.)

The road follows the Thompson River to a point a little above Spatsum, where it leaves the river and goes north-west. Up to this point the country is typical Dry Belt, the dominant vegetation being sage-brush (*Artemisia tridentata* and *A. frigida*) and such grasses as Indian-rice (*Oryzopsis membranacea*), brome-grass (*Bromus tectorum*), and bunch-grass (*Agropyron glaucum occidentale*), with few trees except in the vicinity of creeks and on the upper slopes of the valley. (Fig. 76.)

From the river the road leads up to high bench land at about 1,225 feet altitude, where *Pinus contorta* and *Pinus ponderosa* become frequent. At this elevation there is a large stretch of comparatively flat or slightly undulating country constituting the principal bitter-root region. At first large patches of bitter-root occur on ground composed of clayey sand and gravel, but in localities where rock appears it is practically absent, trees occupying such habitats. It was noted that in this region a ridge of limestone runs from the south-east across the Thompson to the head of "Three Sisters" Valley. This suggested a possible relationship between the geological formation and the presence of *Lewisia rediviva* and *Clematis columbiana*, the latter being found in shady places in "Three Sisters" Valley. (Since my return I have made inquiries and find that in one locality in Okanagan Valley where these two species are found limestone also occurs in the vicinity. Whether this is more than a coincidence remains to be ascertained by future observation, and correspondents are requested to note this point.)

The bitter-root region covers several square miles of open undulating country. The plants are present in millions; at one point twenty-two plants were counted on one square foot of ground. Over large areas one finds an average of twelve plants per square foot, and one can imagine how beautiful the country is during the flowering season, with flowers about the size and colour of a wild rose lying close to the soil. (Figs. 75 and 77.)

The plant develops its linear fleshy leaves in autumn and early spring, and is one of the earliest flowering plants; the leaves wither up and the plant goes to rest during the hot, dry period.

The principal plants associated with it are *Phacelia Menziesii*, *Triticum glaucum occidentale*, *Erigeron peucophyllus*, *Opuntia polyacantha borealis*, *Artemisia tridentata* (fairly large plants), and *Artemisia frigida* (low scraggy plants).

The distribution of bitter-root in the Lower Thompson extends from a point about five miles north of Spences Bridge, where it is rare, to near Rattlesnake Mountain west of Ashcroft, a distance of approximately eighteen miles. It is also reported from certain benches on the opposite side of the river. (Fig. 74.)

Bitter-root—known also as "Spatlum"—is collected in large quantities by Indians, who travel many miles on horseback to the bitter-root grounds. This work is done by the women, and during our outward journey we met several root-digging parties returning.

The plant is collected for food, being dug up by the aid of wooden or iron root-diggers. The roots vary from 3 to 5 inches long and are usually bifurcated; the cortical tissue separates readily and is stripped off from the crown to the tip, displaying a beautifully clean flesh-coloured root.

From an examination of several Indian camping-places it was seen that the women evidently collect a supply of roots and return to camp to strip them. One can picture half a dozen Indian women, squatted before the camp-fire at the close of a day's digging, busy peeling the roots preparatory to packing them. The small heaps of skins left at most of the camps indicated that each party returned with many hundreds—perhaps thousands—of roots.

Our main camp was in the centre of the bitter-root region near an Indian's house, and before returning to Spences Bridge the camp cook prepared some roots in true Indian fashion for my benefit. Specimens were sampled raw, but were not quite so palatable as when cooked. When boiled they form a pinkish starchy jelly which tastes slightly bitter, like quinine. I should think that after one acquired a taste for them they would be a good appetizer; they are said to be very nutritious.

While partaking of this meal the Indian paid a visit to our camp and was somewhat interested to see us "enjoying" bitter-root. After a conversation with my guide (Mr. Teit) he returned to his house and brought out an Indian delicacy for me to sample. I was asked to identify this, but failed; it most resembled a piece of black rubber about 1 inch thick, and did not appear to be edible. This was a cake of jelly prepared from what is called "black moss"; in reality a lichen (*Alectoria jubata*) which had been boiled and afterwards poured into a shallow vessel to set.

The cake is eaten by cutting off thin slices and chewing it, or soup may be made by adding a little to hot water. After partaking of a very small portion I felt no desire to deprive the Indian of his "delicacy." (One could imagine glue and soot having a similar taste.) I was informed that if too much was eaten at one time it was liable to produce sickness; I have no reason to doubt this.

During my visit I had a splendid opportunity of studying the variation of the cactus, and several clumps were collected for the Botanical Garden. Amongst the most interesting specimens found were forms of *Opuntia polyacantha borealis*, with purplish or reddish joints instead of the usual bluish-green. The purplish forms contrasted greatly with the green ones with which they were surrounded, and were conspicuous at a distance.

It was noted at Boston Flats that the large-jointed specimens were frequently attacked by the larvæ of one of the Lepidoptera. Comparatively large green masses of caterpillar's dung on the clumps of cactus drew attention to the work of the insect. It was found that the soft cellular tissue of the joints was eaten clean out, leaving only the green tough rind or shell of the joint. In a few instances the caterpillar ate his way from one joint to another, but in most cases entrance was made by a hole near the base. No specimens of the smaller variety were found to be attacked.

At Boston Flats, near Rattlesnake Mountain, specimens of the typical large flat-jointed *Opuntia polyacantha* were found growing along with the smaller less-flattened variety, and this supplied good reason for retaining the varietal name *borealis*, especially when one takes into account the difference in the size of the seeds. It was observed, however, that, in so far as the vegetative characters are concerned, gradual transitions between the two extreme forms are found. It will now be possible to study the different variations in the Botanical Garden, where they are being propagated.

A visit was made to the head of "Three Sisters" Valley, which is reached from "100-Mile Flats" by a wagon-road constructed for the convenience of a few settlers there.

It is proposed to deal with the flora of this region when the details of last season's work in Skoonkon and adjacent valleys are written up. (*See* Vol. I., Part 2, page 44.)

(10.) A STUDY OF THE FLORA OF DRYAS ISLAND, HOPE, B.C., SHOWING SOME CHANGES BROUGHT ABOUT BY THE CREATION OF A DIFFERENT ENVIRONMENT.

By T. L. Thacker, J.P., and J. Davidson, F.L.S.

Dryas Island is a small island or bar on the Fraser River near Hope, situated about a mile and three-quarters above that town, and a quarter of a mile west of Union Bar.

The Island before 1894.

The site had, according to information supplied by Indians and "old-timers," supported a flora similar in every respect to that of the adjacent bottom lands in this district.

These bottom lands are composed of a layer of gravelly sand and clay, several feet deep, overlying a deposit of boulders and clay. The surface is covered with a comparatively shallow deposit of humus, which varies according to the nature of the vegetation.

The dominant trees are: *Pseudotsuga taxifolia* (Douglas fir), *Thuja plicata* (giant cedar), *Acer macrophyllum* (large-leaved maple), *Acer circinatum* (vine maple), *Rhamnus Purshiana* (cascara tree), *Corylus rostrata* (hazel), *Cornus Nuttallii* (Nuttall's dogwood), *Alnus rubra* (red alder), and *Populus trichocarpa* (cottonwood). The underbrush: *Ribes divaricatum* and *R. lacustre* (wild gooseberries), *Aruncus sylvester* (goat's-beard), *Gaultheria shallon* (salal), and *Symphoricarpos racemosus* (snowberry), associated with such herbaceous plants as *Tolmiea Menziesii*, *Claytonia sibirica*, *Trillium ovatum*, *Tiarella unifoliata*, *Asarum caudatum*, *Actæa arguta* and *Achyls triphylla*.

The conditions which prevailed on the island previous to the flood of 1894 were, therefore, according to the information supplied, very different from those existing at the present time. Instead of a wind-swept sandy area, it was a well-timbered island with abundance of clay and sand; and, being well timbered, it afforded shade and protection to many species of the characteristic plants of the Coast area, such as those noted above on the adjacent bottom land. It should also be borne in mind that, on account of the island being several feet higher, the vegetation was not then liable to occasional submersion.

The Flood of 1894.

The year 1894 is remembered by inhabitants of the Interior as one in which there was a late, cold spring. The snow of the previous winter was retained on the mountains and plateaux of the Upper Country until early summer; then a sudden heat-wave followed, during which, through the rapidly melting snow, every little creek became a rushing torrent, leaping and bounding from ledge to ledge until it reached the valleys, where the soil is composed largely of clay and gravel. Here they joined with the other swollen creeks, and in some places gouged out deep beds for themselves; in others they overflowed their banks, washing away houses and acres of land, tearing up huge trees and other vegetation, all of which were carried to swell the already overswollen Thompson and Fraser Rivers.

Conditions here were no better; those great rivers flowed at an alarming velocity, carrying everything before them; the trees, leaping and plunging, tore boats from their moorings, and bridge after bridge went down the river like matchwood until, for many miles of country, scarcely a bridge was left across the Thompson and Fraser or their main tributaries.

At Lytton the two rivers join, and for about sixty miles through the Fraser Canyon there was a turbulent, boiling cauldron of white muddy water, with trees and other debris appearing and disappearing as they were swiftly carried towards the Coast.

Soon after emerging from the canyon a comparatively small island—the subject of our study—sought to impede the onrushing waters, but only for a short time, and one more tract of bare country was added to the devastation caused by the flood of 1894.

We are not at present concerned with what took place in the remaining ninety miles from there to the sea, but when the water subsided the island was represented by a desolate waste of sand and boulders, with roots and trees heaped and scattered over the higher part, and with no trace of the original vegetation, save perhaps the broken rootlets of *Populus trichocarpa*, the cottonwood, or so-called balsam poplar.

Dryas Island is at present of practically no economic value, being little more than a large sand-bar, but to the ecological botanist it affords an excellent illustration of the relation of plants to environment. It illustrates, also, the value of vegetation as a factor in rebuilding an island by the accumulation and retention of sand and other deposits brought down by the river.

Present Conditions.

The area which appears to have remained entirely above water since that date (or, if submerged, to have been so only very slightly and for a very brief period), is of a triangular shape and contains roughly about $2\frac{1}{2}$ acres.

It is almost surrounded by a wide zone of bare gravel, sand, and rounded boulders; this zone is covered at high water in May or June by a swiftly flowing turbid current, which at its highest defines the area of the island itself. These boulders, etc., fulfil an important function in helping to collect silt carried down by the river during high water, and this silt, from August to April, is blown towards the area now covered with vegetation, leaving the boulders free to accumulate more when the river rises again.

A considerable log-jam had formed on its highest point as the water fell, and this would tend to collect whole plants, twigs, roots, rhizomes, corms, bulbs, or seeds which may have been brought down the river. It is of interest to note that several trees of the yellow pine (*Pinus ponderosa*) from the Dry Belt are found in these piles of driftwood.

The upper end of the island is composed of rather large boulders from 6 to 18 inches in diameter, with little sand between them, but this condition gradually improves westward where vegetation is enabled to hold its own behind a rampart of drift-logs in all stages of decay.

These log-jams accumulate, on the lee side, a plant-supporting silt during the season from August to April, when the prevaling and strongest winds carry sand and clay and deposit them in miniature dunes. It is on soil of this nature that most of the new vegetation has established itself.

At the west end of the island there is a steep bank some 8 to 10 feet high, which once was the edge of a channel of the Coquihalla River; this channel, till recently, helped to isolate the island, though now of little service, being nearly full of drift-sand from a bar to the west.

Meteorological Conditions.

The island is open to the full sweep of the wind up and down the valley, wind at times of considerable velocity. In dry weather the wind drives the sand with great force, and this must be a serious deterrent to the growth of seedlings and to any plants of a delicate or tender nature.

In the winter, if snow falls on frozen sand or stones, the wind rapidly blows it away, thus depriving the plants of protection, which in the Interior and on the high mountain-slopes they naturally secure.

Being situated in the Coast area—sometimes called the "Wet Belt"—there is a liberal rainfall, the proximity of high mountains and densely wooded country being conducive to frequent precipitation.

Drought and flood are features by no means to be ignored in discussing conditions on the island. Periodically every plant has to meet extremes in both directions. Scarcity of water threatens from late summer to early spring as the river falls, and the reverse, even to total submergence, is possible during May or June.

The Flora To-day.

Specimens of the flora of the island were collected by Mr. T. L. Thacker, and his collection was forwarded to the Provincial Herbarium to have his determinations verified. He also supplied all the data necessary to enable one to make an analysis of the flora.

The outstanding feature of the new flora is the abundance of certain species not found in any other locality in that region. The dominant plants are: *Oryzopsis membranacea*, *Salix argophylla*, *Populus trichocarpa*, *Anemone multifida*, *Astragalus serotinus*, *Hedysarum Mackenzii*, *Melilotus alba*, *Dryas Drummondii*, *Achillea millefolium*, *Artemisia dracunculoides*, and *Gaillardia aristata*. Most of these are undoubted Dry Belt species, *Populus* being probably the only species left of the original flora. *Salix* and *Achillea* are both common in the vicinity of Hope, the former on adjacent sand-bars, the latter as an introduced weed.

The only common plant of doubtful origin is *Dryas*, which, being alpine, is not usually associated with characteristic Dry Belt species. It is common on the mountain-tops of the Interior as well as on those of the Coast area, and it is just possible that fruits may have been carried from mountains in the Coast area by some of the strong winds already referred to.

On the other hand, fruits may have blown from the mountains of the Interior to the sandy benches of the Dry Belt, and when creeks overflowed or washed away portions of the benches, these fruits would come down the river along with the fruits or seeds of occupants of such bench lands.

In either case, whether the fruits came to the island by wind or water, it is apparent from its abundance that *Dryas* has been established there for many years. It grows in dense colonies over the greater part of the unflooded area of the island, and there is no doubt that its success is due to the thorough preparation which the island received in 1894 by the removal of all plants likely to compete with it and crush it out. Had the fruits landed in any other part of the adjacent densely wooded country, it is unlikely that it could have maintained an existence in competition with the Coast-area flora.

The same applies to other species of Dry Belt plants which may have come to the island since 1894. Seeds are liable to be deposited with silt on the strand of boulders during the high-water season, and when the water subsides may be blown to a higher and more sheltered part of the island, the occasional rain favouring their chances of germination in the sandy silt. Several species of leguminous plants have firmly established themselves, the beautiful *Hedysarum Mackenzii* growing abundantly and flowering profusely below high-water mark.

The following Dry Belt species may have come to the island in recent years, thus accounting for their comparative rarity:—

Chrysopsis villosa.
Cnicus undulatus.
Phacelia circinata.
Oxytropis villosa.
Elymus canadensis.
Allium cernuum.
Clematis ligusticifolia.
Aralia nudicaule.

The abundance of certain Dry Belt species is strongly contrasted with the rarity or total absence of many characteristic Coast-area species common on both sides of the river. This is entirely due to the changed environment; the exposure and soil conditions combine to make it almost impossible for these plants to obtain a foothold.

One has had many opportunities of studying the revegetation of areas which have been artificially cleared, but in such cases the soil conditions remain unaltered, and these areas are quickly repopulated by an association of native and introduced plants whose seeds are carried by wind; this is followed by an association of native plants whose seeds are carried by birds. These plants ultimately crush out the first association, and create conditions which favour the growth of shrubs and trees; so that in a comparatively short time there is a young growth of the original plant-formation. This, however, has not taken place on Dryas Island. Twenty-one years have elapsed since the environment was changed, and the Coast vegetation has made little progress.

When we consider the many thousands of seeds which must have been carried to the island by wind, birds, or other agencies during these years, the present flora must be looked on as providing a magnificent illustration of the survival of the fittest.

The following Coast-area species, common on the adjacent bottom lands, may have inhabited the island before 1894, but to-day they are very rare, being each represented by one or two specimens, and these, in some instances, mere seedlings which may not survive:—

Thuja plicata (giant cedar).
Abies grandis (grand fir).
Alnus rubra (red alder).
Acer glabrum (mountain-maple).
Pseudotsuga taxifolia (Douglas fir).
Symphoricarpos racemosus (snowberry).
Amelanchier alnifolia (June-berry).

The shelter afforded by *Populus trichocarpa* has no doubt enabled several of the above to maintain an existence, by preventing the young plants from becoming buried in sand. When once these trees and shrubs get firmly established, they will afford the necessary shade, protection, and humus for the invasion of Coast-area plants which will finally crush out the present dominant flora.

Recently, through the silting-up of the channel which formerly separated Dryas Island from the south bank of the Fraser, horses gain access to the island when the water is low; this will almost certainly result in the introduction of more weeds and fodder-plants. There are comparatively few introduced weeds at present, and when we compare the weed-list of the island with the weeds usually found on pack-trails (attributed to seeds contained in the food and dung of horses) it is reasonable to suspect that some of these weeds may have become established through this agency.

At present the introduced plants are:—

Phleum pratense (timothy-grass).
Lolium perenne (perennial rye-grass).
Sisymbrium altissimum (tumbling mustard).
Trifolium repens (white clover).
Trifolium pratense (red clover).
Prunella vulgaris (self-heal).
Achillea millefolium (milfoil).

THE FLORA OF DRYAS ISLAND, HOPE, B.C.

Polypodiaceæ.

Polypodium vulgare var. occidentale, Hook. (Western Polypody Fern).
One clump on a large fir-stump.

Equisetaceæ.

Equisetum lævigatum, A. Br. (Smooth Scouring-rush).

Pinaceæ.

Pinus monticola, Douglas (Western White Pine).
One dwarfed seedling.

Pseudotsuga taxifolia (Lambert), Britton (Douglas Fir).
A few seedlings up to 5 feet.

Abies grandis, Lindley (Grand Fir).
One small plant.

Thuja plicata, Donn. (Giant Cedar).
A few up to 5 feet.

Graminaceæ.

Oryzopsis membranacea, Vasey (Mountain-rice).
Fairly common.

Phleum pratense, Linn. (Timothy-grass).
A few plants.

Poa pratensis, Linn. (Timothy-grass).
Not common.

Lolium perenne, Linn. (Perennial Rye-grass).
Fairly common.

Agropyron tenerum, Vasey (Slender Wheat-grass).

Elymus canadensis, Linn. (Lyme-grass).
Frequent.

Liliaceæ.

Allium cernuum, Roth. (Wild Onion).
Very few.

Salicaceæ.

Salix argophylla, Nutt. (Sand-bar Willow).
Very common; a valuable sand-binder on river-bars.

Salix sitchensis, Sanson (Sitka Willow).
Not common.

Populus tremuloides, Michx. (Aspen).
Two or three young trees.

Populus trichocarpa, Torr. & Gray (Cottonwood).
Very common. Being one of the few genera which give rise to buds from their roots, it is likely they originated from rootlets left on the island in 1894.

Betulaceæ.

Betula occidentalis, Hook. (Western Birch).
One dwarfted plant.

Alnus rubra, Nutt. (Red Alder).
One or two small trees.

Chenopodiaceæ.

Corispermum hyssopifolium, Linn. (Bugseed).
Very common.

Caryophyllaceæ.

Arenaria serpyllifolia Linn. (Thyme-leaved Sandwort).
Fairly common.

Ranunculaceæ.

Anemone multifida, Poir. (Cut-leaved Anemone).
Plentiful above high-water mark.

Clematis ligusticifolia, Nutt. (Virgin's bower).
About ten plants.

Cruciferæ.

Sisymbrium altissimum, Linn. (Tumbling Mustard).
Two plants only.

Saxifragaceæ.

Ribes sp.?
One small specimen with foliage only.

Rosaceæ.

Pyrus diversifolia, Bong. (Crab-apple).
Two or three young trees.

Rubus strigosus, Michx. (Red Raspberry).
One plant on root of upturned stump.

Fragaria bracteata, Heller (Strawberry).
A few plants amongst log-piles.

Dryas Drummondii, Richards (Drummond's Dryas).
In dense colonies over most of the unflooded part of the island.

Rosa pisocarpa, A. Gray.
A few dwarfed specimens.

Amelanchier alnifolia, Nuttall (June-berry).
A few specimens.

Leguminosæ.

Melilotus alba, Desv. (Sweet Clover).
Abundant.

Medicago sativa, Linn. (Alfalfa).
One plant.

Trifolium pratense, Linn. (Red Clover).
Not common.

Trifolium repens, Linn. (White Clover).
Two or three clumps.

Astragalus tenellus, Pursh.
One plant only.

Astragalus serotinus, Blank.
Frequent.

Oxtropis villosus, Rydb. (Oxytrope).
One plant.

Hedysarum Mackenzii, Richards (Sweet-broom).
Very plentiful below high-water mark, flowering profusely.

Aceraceæ.

Acer glabrum, Torr. (Mountain-maple).
A few small bush-like plants.

Violaceæ.

Viola adunca, Smith (Western Dog-violet).

Onagraceæ.

Epilobium angustifolium, Linn. (Spiked Willow-herb).
One or two plants. In the West this species is called "fireweed" because it grows in profusion on ground which has been cleared by fire, or cleared by man and left undisturbed.

Araliaceæ.

Aralia nudicaulis, Linn. (Wild Sarsaparilla).
One clump in upturned root of birch log.

Cornaceæ.

Cornus stolonifera, Michx. (Red-stemmed Dogwood).
A few plants.

Hydrophyllaceæ.

Phacelia circinata, Jacq. (Phacelia).
One or two plants.

Labiatæ.

Prunella vulgaris, Linn. (Self-heal).
Not common.

Scrophulariaceæ.

Pentstemon Scouleri, Lindley (Scouler's Pentstemon).
One or two plants.

Caprifoliaceæ.

Symphoricarpos racemosus, Michx (Snowberry).
One small bush.

Compositæ.

Chrysopsis villosa (Pursh.), Nutt. (Hairy Golden Aster).
Common. In addition to the typical *C. villosa*, specimens were found which answer the description of *C. villosa stenophylla*, Gray. Found mostly on parts submerged by high water.

Solidago canadensis, Linn. (Goldenrod).
Not common.

Solidago caurina ?, Piper (Goldenrod). (Immature.)

Erigeron philadephicus, Linn.

Antennaria Howellii, Greene.
A few plants.

Anaphalis margaritacea, Benth & Hook. (Pearly Everlasting).
Very few.

Gaillardia aristata, Pursh.
Fairly common.

Achillea millefolium, Linn. (Milfoil).
Plentiful and growing well.

Artemisia ludoviciana, Nutt.
Scarce.

Artemisia dracunculoides, Pursh.
Fairly common.

Cnicus undulatus, A. Gray.
About six plants.

Taraxacum officinale, Weber.
Very scarce.

Hieracium canadensis, Michx.
Not common.

(11.) CONTRIBUTION TO THE FLORA OF WINDERMERE, B.C.

(*Plants collected by Miss A. B. Mackenzie.*)

Marchantia polymorpha (Liverwort).

Adiantum capillus-veneris, L. (True Maidenhair Fern).
By creek near Fairmont Springs. New record for Canada.

Equisetum arvense, L. (Field Horsetail).

Equisetum hyemale, L. (Scouring-rush).

Juniperus scopulorum, Sargent (Rocky Mountain Juniper).
Common.

Polypogon monspeliensis (L.), Desf. (Annual Beard-grass).

Tofieldia intermedia, Rydb. (False Asphodel).

Zygadenus venenosus, S. Wats. (Poison-camas).

Veratrum viride, Ait. (False Hellebore).
Toby Creek.

Allium cernuum, Roth. (Nodding Garlic).

Lilium philadelphicum, L. (Philadelphia Lily).
Common in open woody places.

Fritillaria pudica (Pursh.), Spreng (Yellow Fritillary).

Calochortus macrocarpus, Dougl. (Mariposa Lily).

Smilacina stellata, Desf. (False Solomon's-seal).

Disporum trachycarpum (S. Watson), B. & H. (Fairy-bells).

Streptopus amplexifolius (L.), DC. (Twisted-stalk).
Toby Creek.

Sisyrinchium angustifolium, Meed (Blue-eyed Grass).
Common.

Cypripedium passerinum, Richards (Northern Lady's-slipper).
Fairly common; associated with *C. parviflorum*.

Orchis rotundifolia, Pursh. (Small Round-leaved Orchis).
Abundant near mouth of creek.

Habenaria obtusata, Richards (Northern Bog-orchis).

Habenaria gracilis, Wats. (Slender Rein-orchid).

Cora'lorhiza innata, R. Br. (Early Coral-root Orchid).
Calypso bulbosa (L.), Oakes (Purple Lady's-slipper).
Rare, one specimen; woods.

Comandra pallida, DC. (Pale Bastard Toad-flax).
Po'ygonum lapathifolium, L. (Pale Persicaria).
Chenopodium capitatum, Aschers. (Strawberry-blite).
Cerastium arvense, L. (Meadow-chickweed).
Arenaria lateriflora, L. (Blunt-leaved Sandwort).
Actæa arguta (Nutt.), Torr. (Red Baneberry).
Toby Creek.

Delphinium bicolor, Nutt. (Larkspur).
Anemone multifida, Poir. (Cut-leaved Anemone).
Very common; woods, roadsides.

Anemone parviflora, Michx. (Small-flowered Anemone).
Anemone patens Nuttalliana, Gray (Pasque Flower).
Clematis columbiana (Nutt.) T. & G. (Blue Clematis).
Rare; woods by margin of lake.

Ranunculus cymbalaria, Pursh. (Seaside Crowfoot).
Ranunculus sceleratus, L. (Cursed Crowfoot).
Thalictrum occidentale, A. Gray (Western Meadow-rue).
Berberis aquifolium, Pursh. (Oregon Grape).
Corydalis aurea, Willd. (Golden Cordyalis).
Sisymbrium incisum, Engelm. (Cut-leaved Mustard).
Sisymbrium Thalianum (L.), Gray (Mouse-ear Cress).
Sisymbrium altissimum, L. (Tumbling Mustard).
Toby Creek.

Cardamine pennsylvanica, Muhl. (Bitter Cress).
Lesquerella Douglasii, S. Wats. (Bladder-pod).
Common; dry hillsides.

Capsella bursa-pastoris (L.), Medic. (Shepherd's-purse).
Arabis Nuttallii, Robinson (Nuttall's Rock-cress).
Arabis Holbœllii, Hornemann (Holbœll's Rock-cress).
Erysimum parviflorum (Nutt.), T. & G. (Small-flowered Prairie-rocket).
Erysimum Cheiranthoides, L. (Wormseed).
Toby Creek.

Saxifraga oppositifolia, L. (Opposite-leaved Saxifrage).
Toby Creek.

Saxifraga aizoides, L. (Yellow Mountain-saxifrage).
Toby Creek.

Tiarella unifoliata, Hook. (False Mitrewort).
Toby Creek.

Heuchera ovalifolia, Nutt. (Alum-root).
Tellima parviflora, Hook.
Mitella nuda, L. (Naked Mitrewort).

Parnassia fimbriata, Koenig (Grass of Parnassus).
Frequent; side of irrigation-ditches.

Parnassia palustris, L. (Marsh-grass of Parnassus).

Ribes lacustre (Pers.) Poir. (Swamp-gooseberry).
Toby Creek.

Spiræa lucida, Dougl. (Corymbed Spiræa).

Pyrus occidentalis, S. Wats. (Western Rowan, Mountain-ash).
Toby Creek.

Amelanchier alnifolia, Nutt. (June-berry).

Cratægus Douglasii, Lindl. (Douglas' Hawthorn).
One specimen.

Rubus triflorus, Richards (Dwarf Blackberry).

Fragaria glauca (Wats.), Rydb. (Wild Strawberry).
Toby Creek.

Potentilla anserina, L. (Silverweed).

Potentilla fruticosa, L. (Shrubby Cinquefoil).

Potentilla pennsylvanica strigosa, Pursh. (Prairie-cinquefoil).

Geum triflorum, Pursh. (Three-flowered Avens).

Dryas Drummondii, Richards (Drummond's Mountain-avens).
Common; thick woods around lake.

Rosa blanda, Ait. (Meadow-rose).

Rosa acicularis, Lindl. (Prickly Rose).
Toby Creek.

Prunus demissa, Nutt. (Choke-cherry).

Oxtropis albiflora, Bunge (White-flowered Oxytrope).

Vicia sativa, L. (Common Vetch).

Lathyrus ochroleucus, Hook. (Cream-coloured Vetchling).

Geranium Bicknellii, Britton (Bicknell's Crane's-bill).
Common.

Linum Lewisii, Pursh. (Flax).

Ceanothus velutinus, Dougl. (Velvety Snow-brush).
Toby Creek.

Malvastrum coccineum (Pursh.), Gray (Red False Mallow).
Frequent; dry gravelly slopes; collected from only one locality.

Viola nephrophylla, Greene (Northern Bog-violet).
Common by lake, creek at Windermere.

Viola blanda ?, Willd. (Sweet White Violet).

Viola adunca, Smith (Hooked Violet).
Common.

Viola retroscabra, Greene.

Shepherdia canadensis, Nutt. (Buffalo-berry).

Elæagnus argentea, Pursh. (Silverberry).

Epilobium angustifolium, L. (Fireweed, Spiked Willow-herb).

Epilobium adenocaulon, Hausk (Willow-herb).

Œnothera biennis, L. (Evening Primrose).

Aralia nudicaulis, L. (Wild Sarsaparilla).

Leptotænia dissecta, Nutt.

Cornus canadensis, L. (Bunchberry).

Cornus stolonifera, Michx. (Red-stemmed Dogwood).

Pyrola chlorantha, S. W. (Wintergreen).
Pyrola rotundifolia, L. (Round-leaved Wintergreen).
Typical. Common, woods.
Pyrola bracteata, A. Gray.
Pyrola secunda, L. (Secund Wintergreen).
Moneses uniflora (L.), Gray (One-flowered Wintergreen).
Abundant, woods.
Ledum grœnlandicum, Oedes. (Labrador Tea).
Rhododendron albiflorum, Hook. (White Rhododendron).
Toby Creek.
Arctostaphylos Uva-ursi, Spreng. (Bearberry or Kinnikinnick).
Common.
Androsace occidentalis, Pursh. (Western Androsace).
Dodecatheon Meadia pauciflorum, Durand. (Shooting-star).
Abundant.
Gentiana acuta, Michx. (Northern Gentian).
In hay-field.
Polemonium micranthum, Benth. (Small-flowered Polemonium).
Common.
Phacelia Menziesii, Torr. (Menzies' Phacelia).
Lappula echinata, Gilib. (Blue-burr Stickweed).
Lithospermum angustifolium, Michx. (Narrow-leaved Puccoon).
Lithospermum pilosum, Nutt. (Woolly Gromwell).
Dracocephalum parviflorum, Nutt. (American Dragon-head).
Apparently introduced.
Prunella vulgaris, L. (Self-heal).
Pentstemon Scouleri, Lindl. (Scouler's Beard-tongue).
Pentstemon erianthera, Pursh. (Crested Beard-tongue).
Common; dry hills, associated with *P. Scouleri* and *Phacelia Menziesii*.
Pentstemon confertus, Dougl. (Creamy Beard-tongue).
Veronica americana, Schwein (American Brooklime).
One specimen, moss-covered log in water.
Castilleia miniata, Dougl. (Indian Paint-brush).
Abundant; by creeks and irrigation ditches.
Castilleia camporum (Greenman), Howell.
Orobanche fasiculata, Nutt. (Clustered Cancer-root).
Pinguicula vulgaris (Common Butterwort).
Local; woods around creek and lake.
Plantago lanceolata, L. (Common Plantain).
Galium triflorum, Michx. (Sweet-scented Bedstraw).
Galium boreale, L. (Northern Bedstraw).
Toby Creek.
Sambucus melanocarpa, Gray (Black-berried Elder).
Toby Creek.
Viburnum pauciflorum, Pylaie (High-bush Cranberry).
Symphoricarpos racemosus, Michx. (Snowberry).

Linnæa borealis americana (Forbes), Rehder (Twin Flower).
Common; damp woods.

Lonicera glaucescens, Rydb. (Red Honeysuckle).
Toby Creek.

Lonicera canadensis, Marsh. (Canadian Fly-honeysuckle).

Campanula rotundifolia, L. (Bluebell).

Lobelia Kalmii, L. (Kalm's Lobelia).
Rare; only a few specimens at margin of creek.

Chrysopsis villosa (Pursh.), Nutt. (Hairy Golden Aster).

Solidago elongata, Nutt. (Golden-rod).

Solidago multiradiata, Ait. (Northern Golden-rod).

Bigelovia graveolens, Gray (Fœtid Rayless Golden-rod).

Townsendia sericea, Hook. (Silky Townsendia).
Abundant on bare hills. (New record for British Columbia.)

Aster multiflorus, Ait. (Dense-flowered Aster).

Aster Lindleyanus, T. & G. (Lindley's Aster).

Aster conspicuus, Lindl. (Showy Aster).

Erigeron pumilus, Nutt. (Low Erigeron).

Erigeron compositus discoideus, Gray (Rayless Erigeron).

Erigeron acris, L. (Bitter Fleabane).

Erigeron glabellus asper, T. & G. (Rough Erigeron).
Abundant, but local; dry hillsides.

Antennaria rosea, Green (Rosy Everlasting).
Common.

Antennaria dimorpha (Nutt.), T. & G. (Low Everlasting).
Common.

Balsamorhiza sagittata (Pursh.), Nutt. (Balsam-root).

Helianthella uniflora, T. & G.
Toby Creek.

Gaillardia aristata, Pursh. (Great-flowered Gaillardia).
Common.

Achillea millefolium, L. (Yarrow, or Millfoil).
Common.

Chrysanthmeum leucanthemum pinnatifidum, Lecoq. & Lamott. (Ox-eye Daisy).

Artemisia frigida, Willd. (Pasture Sage-brush).

Artemisia canadensis, Michx. (Canada Wormwood).

Arnica cordifolia, Hook. (Heart-leaved Arnica).

Arnica alpina (L.), Olin & Laden (Mountain-arnica).
Common.

Cnicus undulatus, A. Gray (Woolly Thistle).

Taraxacum officinale, Weber (Common Dandelion).

Lygodesmia juncea (Pursh.), Don. (Rush-like Lygodesmia).
One plant amongst *Chenopodium*. (New record for British Columbia.)

Troximon glaucum Pursh. (Goat-chicory).

Hieracium canadense, Michx. (Canada Hawkweed).

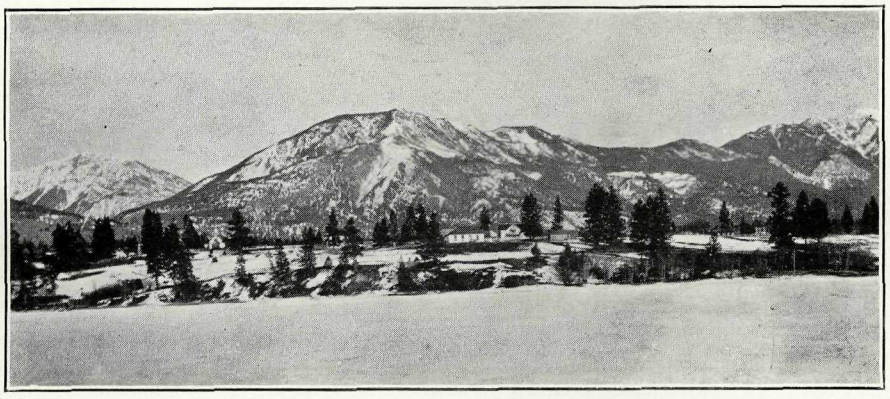

Fig. 78. Windermere and foot-hills of the Rockies, from Lake Windermere, B.C. (Photo by Mrs. Bell.)

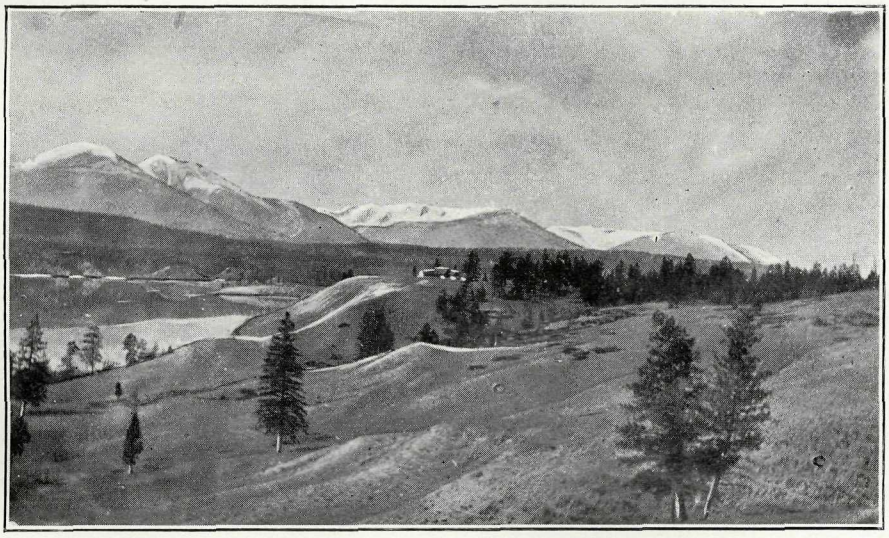

Fig. 79. Near Lake Windermere, looking towards the Selkirk Range. The benches in the foreground constitute the habitat of *Townsendia sericea*. (Photo by Mrs. Kimpton.) (*See* page 148.)

(12.) PUBLICATIONS.

So many requests have been received for our Annual Report that our supply of 500 copies of Part I. was exhausted during the year, and our supply of Part II. is rapidly decreasing, while the number of libraries and botanical institutions on our mailing and exchange list is increasing. In return for the supply of information on the British Columbia flora to other countries, we are informed as to what is being done elsewhere.

The *Journal of Ecology*, which deals with plant ecology in all parts of the world, and is edited by Professor F. Caver, of the University of London, devoted considerable space to an attractive review of our reports; this was illustrated by thirteen photos from our First Report It was gratifying to see that our first efforts received such prominence, as this journal reaches botanical investigators in most parts of the globe.

Since the issue of our last report a Botanical Office leaflet entitled "Instructions on the Collection and Preservation of Plants for Private or School Herbaria" (illustrated) has been prepared and issued to all Botanical Office correspondents. Copies were supplied through Mr. J. W. Gibson, Director of Elementary Agricultural Education, to the teachers attending the summer classes in Victoria, and a copy has been supplied to each school in British Columbia.

Since its issue there has been a considerable demand for it from many parts of the Mainland and Vancouver Island, and it has resulted in bringing additional enthusiasts into touch with this office, besides being the means of improving the quality and condition of specimens received for identification.

A considerable amount of correspondence during the past year related to queries on medicinal and poisonous plants found in the Province, and it is intended to issue a leaflet giving information to the public concerning this important side of botany.

From the nature of inquiries addressed to this office we have an opportunity of ascertaining what branches of botany the public desire information on, and it is our aim to supply this according to the demands.

Several other leaflets are projected, and we are accumulating information and material to deal with these at some future date. It is not our intention to issue mere compilations, but rather to supply as much authentic and local information as possible, supplemented by the experience of correspondents in British Columbia; this we think will make them of greater value to people at home as well as abroad.

(13.) ACKNOWLEDGMENTS.

In concluding the Third Report of the Botanical Office, I beg to acknowledge the valued assistance received from those of our correspondents who have contributed large collections of specimens to enable us to ascertain the flora of their district. This is not only a great help to us in supplying abundant material for the Provincial Herbarium, but the data accompanying the specimens is of considerable value in connection with our botanical survey of the Province.

Our thanks are also due to: Ira W. Clokey, Esq., Denver, Col., for specimens of Western Carices; Professor A. S. Hitchcock, Washington, D.C., for assistance in verifying and determining grasses; J. H. Maiden, Esq., F.L.S., Sydney, N.S.W., for collection of seeds for experiments in connection with the prevention of erosion; Dr. M. O. Malte, Ottawa, for information on species of *Elymus;* Professor John Macoun, Sidney, B.C., for information relating to the reported *Allium vancouverensis;* James M. Macoun, Esq., F.L.S., Ottawa, for a list of the plants found by him in Skagit Valley in 1905; enabling us to include many species not found in the region covered in our botanical survey; W. W. Price, Esq., Lake

Tahoe, California, for further variations of *Amelanchier* in connection with our investigations on the Western species of this genus; Dr. P. A. Rydberg, New York, for information on the genus *Lupinus*; and Professor C. S. Sargent, Arnold Arboretum, Mass., for information on genus *Amelanchier*.

Respectfully submitted,

JOHN DAVIDSON,
Provincial Botanist.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1916.

SKETCH MAP TO ILLUSTRATE
BOTANICAL SURVEY OF THE
Skagit River Basin.

Compiled by J.A. WATTIE. M.A., from Gov.t maps. supplemented and corrected from field notes by J. DAVIDSON. F.L.S. JULY. 1915.

·····: ROUTE OF EXPEDITION. | Nos 1-10 = CAMPS.
——: TRAILS. | 2360 etc. = ALTITUDES.

SCALE.
1 2 3 4 5 MILES

FRASER RIVER
PACK TRAIL TO NICOLA
COQUIHALLA RIVER
HOPE
NICOLUM RIVER
SILVER CREEK
BEAVER MT
MT HOPELESS
7050
1 2360
SUMALLO RIVER
2 2610
3185
2070
2310
10
SILVER TIP MT
8400
28 MILE CK.
KLESILKWA CK.
STEAMBOAT MT
7000
TEN MILE CK.
MASELPANIK CK.
MT ALICE
6000
MINAUGHT CK.
GALENA CK.
NEPOPEKUM CREEK
BOUNDARY TRAIL
CHILLIWACK LAKE
INTERNATIONAL BOUNDARY.
HOZAMEEN MT
9 1735
6580
6300
8 5960
SKY TRAIL
5118
LIGHTNING LAKES
7 4310
STEAMBOAT – PRINCETON TRAIL
CAMBIE CREEK
THREE BROTHERS
ALLISON PASS
6 4450
5 2910
CEDAR FLATS
UPPER SKAGIT
SKAIST CREEK
6000
CANYON CREEK
3 4810
MT SNAAS
TULAMEEN
TULAMEEN
PRINCETON
CRANITE MT.
4 6660
SKAIST MT.
6000
PRINCETON