IMAGE EVALUATION TEST TARGET (MT-3)

Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

Ca

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**

Canadian Institute for Historical Microreproductions

Institut canadien de microreproductions historiques

1980

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

- ☒ Coloured covers/
Couverture de couleur
- ☐ Covers damaged/
Couverture endommagée
- ☐ Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/
Le titre de couverture manque
- ☐ Coloured maps/
Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- ☐ Bound with other material/
Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion
along interior margin/
La reliure serrée peut causer de l'ombre ou de la
distortion le long de la marge intérieure
- ☐ Blank leaves added during restoration may
appear within the text. Whenever possible, these
have been omitted from filming/
Il se peut que certaines pages blanches ajoutées
lors d'une restauration apparaissent dans le texte,
mais, lorsque cela était possible, ces pages n'ont
pas été filmées.
- ☐ Additional comments:/
Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages/
Pages de couleur
- ☐ Pages damaged/
Pages endommagées
- ☒ Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- ☒ Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- ☐ Pages detached/
Pages détachées
- ☐ Showthrough/
Transparence
- ☐ Quality of print varies/
Qualité inégale de l'impression
- ☐ Includes supplementary material/
Comprend du matériel supplémentaire
- ☐ Only edition available/
Seule édition disponible
- ☐ Pages wholly or partially obscured by errata
slips, tissues, etc., have been refilmed to
ensure the best possible image/
Les pages totalement ou partiellement
obscurcies par un feuillet d'errata, une pelure,
etc., ont été filmées à nouveau de façon à
obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
☐	☐	☐	☐	☒	☐
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

Library of the Public
Archives of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol → (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:

L'exemplaire filmé fut reproduit grâce à la générosité de:

La bibliothèque des Archives
publiques du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole → signifie "A SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

THI

*With the Compliments
of the writer*

THE FORESTS OF CANADA AND THEIR DISTRIBUTION,
WITH NOTES ON
THE MORE INTERESTING SPECIES.

JOHN MACOUN, M.A., F.L.S.

1895
(69)

GEOLOGICAL SURVEY OF CANADA,
George M. Dawson, C.M.G., LL.D., F.R.S.,

DEPUTY HEAD AND DIRECTOR,

MUSEUM AND OFFICES, SUSSEX STREET, OTTAWA.

Feb. 18th 1895

My dear Mr. Johnson,

I have your letter of yesterday. There is no conflict of opinion between me and the parties who say that the salmon rivers are drying up. I believe they are and I believe also that the land bordering on the sea is getting wetter.

The destruction of the forests in the interior causes an earlier melting of the snow and a quicker drying of the soil by letting in the rays of the sun hence the greater floods in spring and the lowered flow in late summer and autumn. On the other hand the cutting down of the forests near the coast lets in the sea fogs and the saturated atmosphere of the Bay of Fundy and the Atlantic and the moist atmosphere prevents the evaporation from the soil as you are aware a saturated atmosphere although the sun may be shining cannot dry the soil. As an example of this I may cite the case of the cornfields, that are changing *Sphagnum* into *Cattus*, near St. John New Brunswick. ^{They} ~~They~~ have found the air so saturated with moisture that they cannot evaporate the moisture in the *Sphagnum* without great difficulty. By the above you will see

M

GEOLOGICAL SURVEY OF CANADA,
George M. Dawson, C.M.G., LL.D., F.R.S.,
DEPUTY HEAD AND DIRECTOR,
MUSEUM AND OFFICES, SUSSEX STREET, OTTAWA.

2

189

my meaning more clearly than in the condensed statement in my article on forests.

I am quite sure that the cutting away of the forests is causing a drying up of all our rivers as there is more surface of open ground brought under the direct influence of the sun's rays. A time will come and that very soon when our rivers will wake up to the immense circulation that is taking place every where and is changing the climate of all our provinces and making them less fruitful.

Very sincerely yours

John Dawson

Mr. George Johnson
Statistician

Dept. of Agriculture
Ottawa

THE UNIVERSITY OF CHICAGO

THE DIVISION OF THE PHYSICAL SCIENCES

DEPARTMENT OF CHEMISTRY

RECEIVED

FROM THE LIBRARY OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

OF THE UNIVERSITY OF CHICAGO

LIBRARY

I.—*The Forests of Canada and their Distribution, with Notes on the more Interesting Species.*

By JOHN MACOUN, M. A. ; F. L. S.

(Read May 22, 1894.)

The forests of the Dominion of Canada are one of its chief assets and one that it seems the aim of governments and individuals to annihilate as quickly as possible. Instead of attempts being made to conserve these natural coverings of the land, means, both legitimate and illegal, have been taken to destroy them. In all the older provinces this has been done to such an extent that in many sections that were covered with unbroken forest fifty years ago there is to-day scarcely a tree to be seen. The great fertility of the land in former times is spoken of as if it pertained to the forest when in reality it was due to other causes.

On the sea coast, cutting away the forests has let in the sea air, and to-day the soil of Prince Edward Island and parts of Nova Scotia is wetter than when the timber was first cut off. As a proof of this, tamarack is now growing in pastures and meadows where hardwood once covered the land, and under-drainage has become an absolute necessity.

On the other hand the deforesting of Ontario has dried up springs, lessened the flow of rivers, caused sudden and early thaws in winter, and in summer droughts over large areas, and as a result lessened the products of the soil at least one-half. Year by year this state of things is becoming more intensified, yet the supineness of the authorities is so great that no sensible attempt is made to remedy this state of things. The forests of northern Ontario are being cut down to supply the increasing demand for pine and other woods, and in the wake of the cutting follows the annual fires which, besides burning over the districts from which the timber has been cut, extend in many instances through the untouched forests and destroy more timber than the woodman with his axe. Year after year this goes on, and now when a hundred miles or more intervenes between the settlements and the lumber camps, little attention is paid to the subject, but when the public awakes to the truth it will be appalled at the enormous waste and loss that has been going on for more than a generation.

Some years since a large area was set apart in northern Ontario as a park for the preservation of game and of the natural forest, but more especially as a covering to the soil at the sources of a number of streams falling into the Trent and Ottawa rivers. The public was not informed of one important fact, however, which was that the lumbermen had rights there that a venal government was going to uphold, and at present much of the park has been cut over, and in a few short years will be a blackened wilderness of naked rocks and dead trees.

Twenty-five years ago the Algoma district, over 1,000 miles from east to west and we may say 200 miles from north to south, was a solid coniferous forest. To-day most of it

is so completely denuded of trees that even the dead and whitened trunks of some localities have disappeared and nothing is to be seen for miles but bushes and young trees growing in the crevices of the naked rocks, repeated fires having burned up every particle of the former covering which was the accumulation of ages.

Any traveller going west on the Canadian Pacific railway from Ottawa will pass through 1,200 miles of what was once continuous forest. At present, he will see little else but a dreary wilderness of bare rock, burned and bleaching trunks or young forests trying to cover up the nakedness of the land. I am not citing the line of the Canadian Pacific railway as the particular line but only as an illustration, for there is no disguising the fact that any line will do. In the summer of 1868 the first opening was made in the forest at Port Arthur. The summer of 1870 saw Wolseley's expedition pass on its way to Winnipeg and that summer the forest at Port Arthur was burned and since then the havoc has been continuous.

We are told that we have immense forests of white pine still untouched and that generations will pass before we can destroy it all. The same was said of the buffalo, but they are gone never to return. Sixteen years ago they darkened our interior plains in countless thousands, and two years later they had disappeared for ever. So will it be with the pine forests. The interested ones cry they are inexhaustible, but another decade will not elapse before they cease to be a public domain, and ever after the remnants will be the patrimony of the speculators who manipulated the sales.

There was a time when the prairie region was being deforested at an enormous rate and every year the fires rushing from the south and west forced their way into the still untouched woodlands and extended the burnt area still farther to the north. As soon as settlement took place attempts were made to stop the fires, and of late years destruction from that cause has almost ceased. It is a fact, nevertheless, that at the time of Palliser and Hynde's expeditions in 1857-59 there were districts south of the Qu'Appelle covered with heavy forests of aspen that twenty years after, in 1880, I found without even a twig to show that a tree ever grew there.

Passing westward to the Rocky and Selkirk Mountains, the same tale may be told. Forests of tall, graceful trees invaluable for railway and other purposes filling the valleys and climbing the mountain sides in 1885, nearly all gone in 1893. When the right of way was cut through the mountains, a lane was made through the forest and the brush and logs piled on either hand. The burning of this started the fires that prepared the material for succeeding years when the fires climbed the mountains so that at Hector and Stephen on the summit of the Rocky Mountains not a green tree was to be seen in 1890 where they had stood in myriads in 1885. This was not all, in 1885 quantities of permanent ice and snow that had completely disappeared in 1890, lay on the mountains to the north and south and instead of the cool mountain slopes of six years before the ascent had to be made through a blackened forest where the rustling of the dead bark and the tapping of the woodpecker took the place of the songs and twitterings of the small birds seen in 1885.

The same year the Columbia Valley from Golden down to Donald, and up Beaver Creek and down the Illicilliweat to Revelstoke was an unbroken forest of tall stately trees; to-day those that are left are ragged, torn and shrivelled, and the forest beauty has departed for ever. Year after year the lumberman is penetrating the valleys and the fire following in his wake finishes what he begins. In a few short years desolation will reign, and the

avalanche that descended in the form of snow will be replaced by rivers of mud, trees and rocks. The mountains will be disfigured, and travelling in spring will be both uncertain and dangerous.¹

Each succeeding summer on Vancouver Island the same destruction goes on. A great deal of the interior has been burned over repeatedly, and owing to the long summer droughts and the lack of brush amongst the tall trees the moss and logs become dry and the fire when once started never ceases until the September rains commence when the air clears of smoke, the fires die out and all things remain soaked until the following July when the same round of fires begins again. In July, 1887, I stood on the summit of Mount Arrowsmith, an isolated mountain about 100 miles north of Victoria, near the centre of the island, and almost 6,000 feet high. For some days the weather had been calm and the fires had made little progress so that the view from the summit was very extensive, taking in the Gulf of Georgia and the mountains of British Columbia on the one hand, and the Pacific for many miles on the other. The view on the evening of the 16th was indescribable and of vast extent. The 17th was windy and started up the fires and by sunset the smoke from scores of them had spread a pall over the scene and blotted out the whole landscape we had gazed upon with such delight the day before. The next day we descended the mountain and on our way to the coast passed through miles upon miles of burnt forest and three distinct forest fires, one of which, at least, was very dangerous. Standing in a safe place and gazing on scores of mighty trunks flaming like torches and rising 200 feet above you, impressions will be made that can never be effaced, and instinctively you will almost curse the hand that applied the match that caused the destruction of such noble trees. Owing to their immense height and the thickness of the bark few live trees succumb to the first fire, but yearly burnings soon kill the trees and in many instances they stand in thousands, dumb witnesses to man's terrible destruction.

Apparently there is little hope of a change, for viciousness, carelessness, cupidity and supineness of governments and people are responsible for this state of things which will continue until the trees are nearly all dead and the destruction of our noble forests all but completed; then when the end has come party parliamentarians will rise in their places and denounce all but themselves for having permitted such senseless and culpable destruction.

SUB-ARCTIC FOREST BELT.

Lying south of the watershed in Labrador and south of a line drawn northwesterly from Fort Churchill to near the mouth of the Mackenzie River in the Northwest Territories is a belt of forest that is continuous except where the surface becomes a peat bog too wet to support trees or the depressions are deeper and become lakes. This extensive belt at the base of the Rocky Mountains extends from lat. 53° to 67° in the valley of the Mackenzie. It trends to the south as it goes easterly so that in the meridian of Lake Winnipeg its limits are between 50 and 58; passing still eastward it gets narrower, so that when it reaches the Atlantic coast it is a mere fraction of what it was. In round numbers this immense region contains about 1,500,000 square miles, and its forest is made up of very few species of trees, the principal ones being pine, spruce, tamarack and aspen poplar. Indeed eight species of trees may be said to constitute the whole arborescent flora of the region in question. The

¹ What is here foretold actually happened a few days after this paper was read.

species are :—*Pinus Banksiana*, Lam., *Picea alba*, Link., *Picea nigra*, Link., *Larix Americana*, Michx., *Populus tremuloides*, Michx., *Populus balsamifera*, Linn., *Betula papyrifera*, Michx., and in less abundance and of more circumscribed range *Abies balsamea*, Marsh. On the southeastern margin *Thuja occidentalis*, Linn., and *Betula lutea*, Mx., are occasionally met with but may be excluded when speaking generally. Willows of many species are found throughout the whole region but seldom become trees.

Although the above trees occupy the area under discussion it must not be understood that they grow indiscriminately over the whole surface.

The tamarack or larch, as with us in the east, is still inclined to occupy the wet ground around muskegs, but as it nears its northern limit it leaves their vicinity and grows where the soil is drier and more heated in summer. The black spruce in the east prefers the boggy ground, but as it approaches its northern limit it too seems to enjoy the drier ground and vies with the white spruce in occupying the last oases before the forest ceases altogether and the continuous barren grounds commence. Wherever the ground is sandy or rocky, or both, the Banksian pine flourishes, and as it passes from east to west it loses its low and scrubby character as is the case along the St. Lawrence and Lake Superior, though it is a much finer tree in the latter district, and becomes a handsome tree west of Lake Winnipeg. On the Beaver, the English, the Athabasca and the Clearwater rivers, between lat. 53° and 58°, it attains its greatest dimensions, and is there a stately tree over 100 feet high and having a diameter from 12 to 20 inches.

The four trees mentioned above are the conifers of the northern forest and may be classed as forming the sub-arctic forest proper. They keep their tree form to their utmost limit, not dwindling to mere shrubs as they do on mountain summits but forming outliers, in the barren grounds, of fairly developed trees even at their extreme limit. This being the case some other cause than the absence of heat must be given to account for this. From the statements of Mr. J. B. Tyrrell, who traversed the barren grounds last season, I am led to believe that the true reason for this barrenness is too much humidity in the air, and consequently a wet cold soil that scarcely rises a few degrees above freezing under the very best conditions, and in which trees could not exist, much less grow.

The poplars and birch grow under altogether different conditions from the conifers. The aspen in the east seems to be a poor sickly tree, very seldom having a thrifty look and preferring gravelly hillsides and borders of swamps. Its habit and appearance change wonderfully as we come upon it on the Canadian Pacific railway after passing out of the spruce and tamarack before reaching the prairie on our way to Winnipeg. Lying between the tamarack and spruce, and the prairie is the belt of aspen which is only a few miles wide along the railway but which extends from the international boundary in lat. 49° all around the prairie regions, and may be said to constitute nearly the whole forest growth of the prairies outside of the river valleys. North of the prairie it penetrates the coniferous forest wherever there is good dry soil, and is the bulk of the forest in the Peace River country and on the plains lying along the Liard and the Mackenzie. It may be said with truth that aspen forest means agricultural land wherever found, and as it is in southern Manitoba so is it on the Peace River plains and farther north. In the Riding and Porcupine Mountains and westward through the forests to Prince Albert and Edmonton, a distance of 800 miles, this species is found to be a fine tall tree. In many cases the bark is quite white and the round smooth trunk, rising from fifty to one hundred feet, with a diameter ranging from six to

eighteen inches, is a remarkable object when seen in company with the brown barked gloomy looking spruce.

The aspen in its northwestern home keeps out of the flood plain of the river valleys and never appears on islands or indeed on alluvium at any time. On the other hand, balsam poplar makes its home there and is seldom found anywhere else. On the Saskatchewan and all its branches this tree grows to a large size, but these are but pigmies compared with those on the Peace, Athabasca, Liard, Slave and Mackenzie rivers. On the islands in these rivers it grows to an immense size and it is no uncommon thing to see a tree over six feet in diameter without bark stranded on a bar. It is this species and the white spruce that are found as drift wood on the shores of the Arctic Sea, as they constitute the trees of the islands and flood plains of the Mackenzie and its tributaries, which are constantly changing and being reformed by the spring freshets. All the islands and points are constantly changing except when there is a jam of logs at their upper end. In many cases a few hundred yards walk will take a person from trees four feet in diameter to the lower end of an island where the young seedlings are just emerging from the mud. If the island or point be quite large spruce will take possession of the upper end before the wasting takes place, the old poplars will be smothered and rot, and the spruce will live on their remains. Spruce are never found on a new island.

The Canada balsam (*Abies balsamea*) and the paper birch (*Betula papyrifera*) are not very common and may be passed over with a few words. The birch is the more plentiful tree and has a wide range but is never a striking object or very plentiful. Besides using its bark for canoes, the Indians in the English River and Chipewyan districts make, in spring, a very nice syrup from its juice, which before the advent of "canned goods" served in place of the dried and canned fruits now carried by travellers.

In another place I speak more in detail of the forests of British Columbia and the Rocky Mountains, but a few words may be necessary here to carry the sub-arctic forests to the Pacific coast. The only known change that takes place in the forest after reaching the mountains north of lat. 53° is the substitution of *Pinus Murrayana* for *Pinus Banksiana* and *Abies subalpina* for *Abies balsamea*, which was left far to the east. It may then be said that from lat. 53° west to the Coast Range and the tundra of Alaska, with the exceptions above stated, the same forest extends from Labrador to within a few miles of the Pacific coast.

Crossing the summit of the Coast Range and descending towards the west, we meet with a different forest composed chiefly of *Picea Sitchensis*, *Abies amabilis*, *Thuja excelsa* and *Tsuga Mertensiana*, and towards the south *Pseudotsuga Douglasii*, *Thuja gigantea* and *Alnus rubra*. The moist winds from the Pacific with the mildness of the winters combine to produce on this coast a most exuberant growth of every species, so that the forest is filled with a rank vegetation and the stately trees stand rank behind rank in serried phalanx forming a forest growth that is unequalled in America, and extending from southern Alaska to California.

THE FORESTS OF PRINCE EDWARD ISLAND.

The original forests of Prince Edward Island differ in no particular from those of Nova Scotia and New Brunswick as regards species except that their distribution is different. The species enumerated below are the only trees indigenous to the island.

<i>Acer saccharinum</i> , Wang. (Sugar maple).	<i>Quercus rubra</i> , Linn. (Red oak).
" <i>rubrum</i> , Linn. (Red maple).	<i>Populus tremuloides</i> , Michx. (Aspen).
" <i>Pennsylvanicum</i> , Linn. (Striped maple).	" <i>balsamifera</i> , Linn. (Balsam poplar).
<i>Prunus serotina</i> , Ehrh. (Black cherry).	<i>Pinus Strobus</i> , Linn. (White pine).
" <i>Pennsylvanica</i> , L. f. (Bird cherry).	" <i>resinosa</i> , Ait. (Red pine).
<i>Fraxinus sambucifolia</i> , Lam. (Black ash).	<i>Picea alba</i> , Link. (White spruce).
" <i>Americana</i> , Linn. (White ash).	" <i>nigra</i> , Link. (Black spruce).
<i>Ulmus Americana</i> , Linn. (Common elm).	" <i>rubra</i> , Lcm. (Red spruce).
<i>Betula papyrifera</i> , Marsh. (Canoe birch).	<i>Abies balsamea</i> , Mill. (Balsam fir).
" <i>alba</i> , var. <i>populifolia</i> , Spach. (White birch).	<i>Taxus Canadensis</i> , Carr. (Hemlock).
" <i>lutea</i> , Michx. f. (Yellow birch).	<i>Larix Americana</i> , Michx. (Larch, tamarack).
<i>Fagus ferruginea</i> , Ait. (Beech).	<i>Thuja occidentalis</i> , Linn. (White cedar).

A few words may be said regarding the distribution of the twenty-four species enumerated above. While sugar maples and beeches grow on ridges and the more elevated parts on the mainland of Nova Scotia and New Brunswick they are found throughout Prince Edward Island on the general level only a few feet above the level of the sea. This one fact shows that the island has a better climate than the mainland and is much less subject to cold fogs. The sugar maple is more sensitive than most of our trees to a damp atmosphere and as it approaches its northern limit invariably occupies dry ridges, leaving the lower ground to birches and conifers.

Prince Edward Island produces finer specimens of balsam and the three spruces than are to be seen elsewhere in the Dominion. The air and soil seem to suit them perfectly, and a drive from Charlottetown to Brackley Point will show more beautiful specimens of these trees than can be seen anywhere else. The red spruce has been a puzzle to most botanists and may or may not be a good species, but seen on Prince Edward Island it is easily separated from either *P. alba* or *P. nigra*. It seems to be intermediate between the black and white species but more nearly related to the black. In the white spruce the cones are at the tips of the branches, and are from an inch to two inches long, drooping and deciduous. In the black spruce they are short and ovoid, clustered close to the stem and branches and persistent or very slightly deciduous. The cones of the red spruce are between the other two both in shape and position.

The occurrence of the white cedar in isolated patches near Tignish at the north end of Prince Edward Island and in Nova Scotia near Annapolis is somewhat remarkable, and this fact becomes more significant when it is known that its western outlier is found on Cedar Lake, an expansion of the Saskatchewan River, at least 200 miles west of any other point at which it is known to occur. I have no facts to offer in explanation of this peculiar distribution unless it be that the cedar is an old species that is gradually dying out.

NOVA SCOTIA AND NEW BRUNSWICK.

The forest floras of Nova Scotia and New Brunswick are practically identical and the climatic conditions are very similar in both provinces. On the side towards the Gulf of St. Lawrence the same conditions prevail as in Prince Edward Island, and the hardwood timber is found much nearer sea level than along the Atlantic coast and the Bay of Fundy. Northern New Brunswick has a more continental climate and may be compared with that of Quebec and northern Ontario. The following 29 species, with the exception of *Tilia Americana*, *Juglans cinerea* and *Quercus macrocarpa*, occur in both provinces.

<i>Tilia Americana</i> , Linn. (Basewood).	<i>Quercus macrocarpa</i> , Mx. (Mossy-cup oak).
<i>Acer saccharinum</i> , Wang. (Sugar maple).	<i>Fagus ferruginea</i> , Ait. (Beech).
" <i>rubrum</i> , Linn. (Red maple).	<i>Ostrya Virginica</i> , Willd. (Iron wood).
" <i>Pennsylvanicum</i> , Linn. (Striped maple).	<i>Salix nigra</i> , Marsh. (Black willow).
<i>Prunus serotina</i> , Ehrh. (Black cherry).	<i>Populus tremuloides</i> , Michx. (Aspen).
" <i>Pennsylvanica</i> , L. f. (Bird cherry).	" <i>balsamifera</i> , Linn. (Balsam poplar).
<i>Fraxinus sambucifolia</i> , Lam. (Black ash).	<i>Pinus Banksiana</i> , Lam. (Scrub pine).
" <i>Americana</i> , Linn. (White ash).	" <i>Strobus</i> , Linn. (White pine).
" <i>pubescens</i> , Lam. (Red ash).	" <i>resinosa</i> , Ait. (Red pine).
<i>Ulmus Americana</i> , Linn. (Elm).	<i>Picea alba</i> , Link. (White spruce).
<i>Juglans cinerea</i> , Linn. (Butternut).	" <i>nigra</i> , Link. (Black spruce).
<i>Betula alba</i> , var. <i>populifolia</i> , Spach. (White birch).	" <i>rubra</i> , Lam. (Red spruce).
" <i>papyrifera</i> , Marsh. (Canoe birch).	<i>Abies balsamea</i> , Mill. (Balsam fir).
" <i>lena</i> , Linn. (Cherry or black birch).	<i>Thuja Canadensis</i> , Carr. (Heinlock).
" <i>lutea</i> , Michx. f. (Yellow birch).	<i>Larix Americana</i> , Michx. (Larch, tamarack).
<i>Quercus rubra</i> , Linn. (Red oak).	<i>Thuja occidentalis</i> , Linn. (White cedar).

Owing to the influx of the cold winds from the Atlantic and the Bay of Fundy, the coast species are chiefly spruces and firs; but a few hundred feet of elevation above the river valleys bring us into a hardwood forest composed of maple, beech, ash and birch, with a sprinkling of spruce and pine, except in the western parts where spruce, fir and tamarack are the prevailing trees; in general terms this may be also said of Quebec, as the forests of northern New Brunswick are almost identical with those of that province. The American elm is, as usual, found most highly developed in the river valleys, birch and red maple growing with it here as elsewhere in the eastern provinces.

A study of the conditions under which the forests of Nova Scotia grow and occupy the ground shows that the sea air is not congenial to the native hardwood trees except the birch. An examination of the trees of the inner slope of North Mountain near Annapolis shows that the conditions necessary for the growth of hardwood trees are those required for the full development of the apple, and it would be well for fruit growers to preserve with care the forests on the Bay of Fundy side of the beautiful Annapolis valley. Since the forests were cut away in the neighbourhood of Kentville, Wolfville and Grand Pré, the soil has become much wetter and in many places where formerly the soil did not require drainage it is now necessary. The cutting away of the forests and letting in of the sea air has allowed tamarack to grow where formerly beech and maple occupied the soil.

The tendency in Nova Scotia and New Brunswick is for the forest to re-clothe the soil, but when the hardwood trees of the original forests disappear, spruce, balsam, birch and tamarack take their place and everything shows that in that region the cutting away of the forests does not lessen the rainfall, but rather increases the deposition or brings the general air nearer to the point of saturation. The change in climate is causing a decline in grain-raising and increasing the area of drained soil devoted to fruit-growing and stock-farming.

In southern New Brunswick, *Juglans cinerea*, *Tilia Americana* and *Quercus macrocarpa* are found in some abundance, but they cannot be said to be common anywhere and they indicate a higher temperature as we pass from the conditions peculiar to the coast.

QUEBEC.

The forests of Quebec are still very valuable and very extensive and approach those of northern and central Ontario in the number and distribution of species. The conditions

found on the New Brunswick border extend into Quebec and south of the St. Lawrence to Montreal. The same conditions obtain in the valley of the St. John River and up the Ottawa to its source. Except in the more southern districts, the elms, maples and beeches occupy restricted areas as they do further east, but the general distribution is the same and the trees of Quebec with few exceptions are the trees of the maritime provinces. The following additional species enter Quebec but only along the Ottawa and St. Lawrence valleys.

Acer dasycarpum, Ehrh. (Broad-fruited maple).

Crataegus coccinea, Linn. (Red-fruited thorn).

Ulmus fulva, Michx. (Slippery elm).

" *racemosa*, Thomas. (Rock elm).

Celtis occidentalis, Linn. (Nettle tree).

Carya amara, Nutt. (Bitternut).

Carya alba, Nutt. (Shell-bark hickory).

Carpinus Caroliniana, Walt. (Beech).

Quercus alba, Linn. (White oak).

Populus monilifera, Ait. (Cotton-wood).

Juniperus Virginiana, Linn. (Red cedar).

None of the above trees are very abundant and the elms and bitternut are the only species that could be called common anywhere in Quebec. The hickory and nettle-tree cling to the St. Lawrence and are seldom seen elsewhere in the province.

The northern forests of Quebec are a part of the sub-arctic forests and are composed of only a few species of trees. The more valuable woods of commerce are found south of the watershed of the northern tributaries of the St. Lawrence and the Ottawa, and these constitute the present lumber regions of the province. Still further south on both sides of the St. Lawrence and the lower Ottawa lie the fertile lands of the province that in the past had a mixed forest of hardwood trees where the ash, maple, birch, beech and elm gave character to the landscape and natural beauty to river, lake and shore. Many areas of mixed forest remain almost untouched in Quebec, and when these forests are cleared away hundreds of smiling farms will take their place. The two most important areas are the Lake St. John district, north of Quebec, and the very valuable and large tract of country towards the sources of the Ottawa.

ONTARIO.

Owing to the position and extent of Ontario its forests are not all of the same character and while in the north and northwest the species are identical with those found in Quebec, those in the south and southwestern peninsula are quite distinct and may be said to be a reproduction of the northern Ohio and Pennsylvania forests. A few words will suffice for the north and northwest. What was said of Quebec north and south of the St. Lawrence watershed is applicable here. Only the species of the sub-arctic forest find a congenial home in this region and at the head of the streams flowing southward into the Ottawa and the great lakes are to be found the remnants of the noble forests that supplied material for the devastation of the last half century. It is truly appalling when the magnitude of the national interests at stake are considered, to view the spoliation which has been carried on quite recklessly under the protection of permits and licenses. When one is soberly told that this destruction was necessary in the interests of trade and for the development of the country, one is forced to deny the truth of such statements and to enter a protest against the fallacy concealed in them. If there had been any just or proportionate return to the fisc from such operations the objections might have less force, but when it is realized that for this splendid heritage the people of Canada have directly received only a nominal return in dues and bonuses, the responsibility for such a waste of resources, which should be guarded

for the present and future generations of Canadians, is indeed grave. It is hardly a forcible argument to advance, that the money placed in circulation as wages to labourers employed in lumbering and the consequent local stimulation to trade or the enormous increase of private capital are a sufficient indirect gain. The cash paid as wages for such labour, labour which should have been used in the protection and development of these very forests, could never represent if multiplied many hundred times, the loss which has occurred owing to its misdirection; and the capital represents only a fraction of the use and value of the forests which should have been guarded for the public benefit. It is not yet too late to formulate a policy which will protect the sparse remains of this once dense forest and control them for the best interests of the whole country; it is a policy which the present generation demands and the neglect of such a plain duty on the part of our legislators will only be an evidence of short-sightedness, of the triumph of party over patriotism, for which they will be visited with the just reprobation of those who will have to suffer from the present ill-considered action.

That part of the southwestern peninsula of Ontario which lies west of Toronto has a flora quite distinct in many respects from any other part of Canada. Its position between Lakes Ontario and Erie and along the latter lake accounts for this, and to this also is due its value as a fruit garden. The trees peculiar to this district are:

<i>Asimina triloba</i> , Duval. (Cucumber-tree).	<i>Sassafras officinale</i> , Nees. (Sassafras).
<i>Liriodendron Tulipifera</i> , Linn. (Tulip-tree).	<i>Platanus occidentalis</i> , Linn. (Button-wood).
<i>Gymnocladus Canadensis</i> , Lam. (Kentucky coffee-tree),	<i>Carya porcina</i> , Nutt. (Hog-nut hickory).
<i>Cercis Canadensis</i> , Linn. (Judas-tree).	" <i>tomentosa</i> , Nutt. (White-heart hickory).
<i>Gleditsia triacanthos</i> , Linn. (Honey locust).	" <i>microcarpa</i> , Nutt. (Small-fruited hickory).
<i>Pirus coronaria</i> , Linn. (Crab apple).	<i>Juglans nigra</i> , Linn. (Black walnut).
<i>Crataegus Crus-galli</i> , Linn. (Cock-spur thorn).	<i>Castanea sativa</i> , Mill. var. <i>Americana</i> . Gray. (Chestnut).
" <i>tomentosa</i> , Linn. (Downy-leaved thorn).	<i>Quercus bicolor</i> , Willd. (Swamp white oak).
<i>Amelanchier Canadensis</i> , T. & G. (June-berry).	" <i>coccinea</i> , Willd. (Scarlet oak).
<i>Cornus florida</i> , Linn. (Flowering dogwood).	" <i>palustris</i> , Du Roi. (Swamp oak).
<i>Nyssa multiflora</i> , Wang. (Sour gum).	" <i>tinctoria</i> , Bart. (Black oak).
<i>Fraxinus quadrangulata</i> , Michx. (Blue ash).	

In the above list there are 23 species which represent a flora that has its affinities in the south and gives an entirely different aspect to the forests of the western peninsula when compared with those of the east. One leading feature is the almost total absence of coniferous trees and the great development of the hickories, the oaks, the button-wood, the chestnut and the tulip-tree. The shrubs and herbaceous plants change with the forests, and scores of species not found in other parts of Canada grow here in profusion. The cucumber-tree was once common around Niagara and Queenston, now it is so rare that only the older people can tell one of its existence. In June, 1892, I searched for days before I found a clump fit to photograph. These were on the Niagara escarpment near Merritton. I have also found it fruiting at Leamington, in Essex Co. Although the sassafras is scattered through the old forest and is quite a large tree, it is becoming scarce around clearings, and is seldom planted. There are many fine specimens about two or three miles from Niagara Falls on the high road to Merritton and St. Catharines. The Kentucky coffee-tree, honey locust and Judas-tree are confined to Pelee Island and were not observed on any part of the mainland except when cultivated, yet the two former are quite hardy at Ottawa, and two fine specimens of the first species are now growing in front of Rideau hall.

Another peculiarity of the peninsula is that species which in other parts of the province are only large shrubs or very small trees are here well developed, and have become fair-sized

trees. Included in this group are four species of *Crataegus* and the June berry (*Amelanchier*), which in the vicinity of Niagara-on-the-Lake are very noticeable. Even the wild grape, *Vitis astivalis*, has often a stem over four inches in diameter, and *Cornus alterniflora*, *Sambucus racemosa* and *Viburnum Lentago* become trees, and in fence corners make a fine shade for cattle and sheep.

Were my paper intended to illustrate climatic conditions or the many lessons to be learned from the natural distribution of the forest, I might show from the wild grape, the plum, the wild apple and the wild cherry the economic importance of this district as a fruit producer. Only a few years since our own people believed that peaches and certain varieties of the grape could be grown only in favoured localities, yet the forest growth if read aright would have told them that with proper local shelter all the finer fruits of temperate climates were suited to the district under consideration, and not alone to this district but to the whole of Ontario along the St. Lawrence and Lake Ontario. With the exception of the peach, every other species can be profitably raised as far east as Ottawa, if proper shelter be forthcoming, for it is not a low temperature so much as unsuitable conditions that prevents the successful culture of fruits in Ontario. A lesson hard to learn is that shelter from nipping winds is just as necessary for vegetation as it is for the shorn lamb, and when horticulturists and others realize this to its full extent there will be fewer failures in fruit growing.

Lying between the west end of Lake Superior and the Lake of the Woods on the south and Hudson's Bay on the north is a tract of country that is indeed a province in itself. It is a land of lakes and rivers which discharge their waters to the north, and although its trees are those of the sub-arctic forest, they are as a rule well developed and indicate a climate well suited for the growth of vegetables and the coarser grains at least, and there is no climatic reason why the greater part of this region should not produce wheat. I wish, however, to draw attention to the forests. Mr. A. P. Low's report on his exploration of a part of this region in 1886 shows that both soil and climate are good, and that black and white spruce, and aspen, and balsam poplar grow to a large size and will produce in the future much merchantable timber. I am speaking more particularly of the country near Trout Lake, but the district along the upper Severn River is of the same character. A railway from Rat Portage by way of Lake Seul to penetrate this region can be built at small cost and would open it up for settlement and bring its timber within reach.

MANITOBA AND THE NORTHWEST TERRITORIES.

The trees of the forests of this immense region are few in number and nearly all belong to the sub-arctic forest, and as a whole have been treated under that head. Two trees which we have had with us from Nova Scotia appear in Manitoba, but they are never found in much abundance and seldom out of the river valleys. These are the elm and the balsam poplar. The green ash (*Fraxinus viridis*) and red ash (*Fraxinus racemosus*) are found in the valleys of the Red, Assiniboine and Souris rivers but do not leave their valleys. On the other hand the over-cup oak (*Quercus macrocarpa*) forms thickets and open forests in many parts of Manitoba, becoming a fine tree at times, but dies out west of the Assiniboine above Fort Ellice. The elm disappears on the Red Deer River—not far west of Lake Winnipegosis, and at its extreme limit is still a well-developed and large tree. The last

sugar maple was left at McKny's Mountain, near Lake Superior, and the red or swamp maple disappeared at Rainy Lake, but a few basswood manage to reach nearly as far west as Brandon in the Assiniboine valley, and from thence westward all trees, apart from the species belonging to the sub-arctic forest, are of western origin, except *Populus monilifera* (cotton-wood) and *Negundo aceroides* (ash-leaved maple). These trees extend, in the river valleys, far out towards the Rocky Mountains, but do not reach them.

In the Cypress Hills west of long. 110° west, at an elevation of over 3,000 feet, the Rocky Mountain scrub pine (*Pinus Murrayana*) is found in abundance, and from this tree the hills take their name, the scrub pine of the east (*Pinus Banksiana*) being the cypress of the French voyageurs. In the valleys of the rivers forming the South Saskatchewan two species of poplar (*Populus angustifolia* and *P. trichocarpa*) are found. These are a part of the more southern forest and are not known north of Medicine Hat.

ROCKY MOUNTAINS AND BRITISH COLUMBIA.

The trees of the Rocky Mountains may with few exceptions be classed with the western flora, and those that have not that origin belong to the sub-arctic forest, and have descended from the north along the mountains. The following list includes all the trees of the Rocky Mountains, a few of them occurring only on the western slopes facing the valley of the Columbia River.

ROCKY MOUNTAINS.

<i>Populus tremuloides</i> , Michx. (Aspen).	<i>Pseudotsuga Douglasii</i> , Carr. (Douglas fir).
" <i>balsamifera</i> , Linn. (Balsam poplar).	<i>Pinus flexilis</i> , James, (Rocky mountain pine).
<i>Picea alba</i> , Link. (White spruce).	" <i>Murrayana</i> , Balfour. (Black pine).
" <i>Engelmanni</i> , Engelm. (Engelmann's spruce).	" <i>albicaulis</i> , Engelm. (White-barked pine).
<i>Abies subalpina</i> , Engelm. (Mountain balsam).	<i>Larix Lyallii</i> , Parl. (Mountain larch)

Other species in the Columbia Valley and Selkirk Mountains.

<i>Populus trichocarpa</i> , Torr & Gray.	<i>Pinus ponderosa</i> var. <i>scopulorum</i> , Engelm. (Yellow pine)
<i>Juniperus Virginiana</i> , Linn. (Red cedar).	<i>Thuja Pattoniana</i> , Engelm. (Mountain hemlock).
<i>Thuja gigantea</i> , Nutt. (Western white cedar).	" <i>Mertensiana</i> , Carr. (Western hemlock).
<i>Pinus monticola</i> , Dougl. (Western white pine).	<i>Larix occidentalis</i> , Nutt. (Western larch).

ADDITIONAL PACIFIC COAST SPECIES.

<i>Acer circinatum</i> , Pursh. (Vine maple).	<i>Salix Scouleriana</i> , Barratt. (Western willow).
" <i>macrophyllum</i> , Pursh. (Broad-leaved maple).	<i>Thuja excelsa</i> , Bong. (Yellow cypress).
<i>Rhamnus Purshiana</i> , DC. ("Barberry").	<i>Taxus brevifolia</i> , Nutt. (Western yew).
<i>Prunus emarginata</i> , Walp. (Western bird cherry).	<i>Pinus contorta</i> , Dougl. (Western scrub pine).
<i>Pinus rivularis</i> , Dougl. (Western crab apple).	<i>Picea Sitchenis</i> , Carr. (Menzies spruce).
<i>Cornus Nuttallii</i> , And. (Western flowering dogwood).	<i>Abies grandis</i> , Lindley. (Mountain fir).
<i>Arbutus Menziesii</i> , Pursh. (Madrona).	" <i>amabilis</i> , Forbes. (White fir).

The bulk of the forest in the Rocky Mountains south of lat. 53° is made up of white spruce, Engelmann's spruce, black pine, Douglas fir and balsam fir. These five species include at least 90 per cent of the forest growth, the remaining 10 per cent being made up of the other five species. Of these *Pinus flexilis* is found only on the margins of the rivers issuing from the mountains, and the poplars in the valleys and open spaces where the original forest has been burnt off. On the other hand *Pinus albicaulis* and *Larix Lyallii* form a zone

more or less pronounced at the extreme limit of trees, about 7,000 to 7,500 feet altitude, and in September the latter tree stands out very distinctly owing to the changing of its leaves from green to yellow.

All the valleys are filled with white spruce, and the mountain slopes, where gravel or sand predominates, are covered with pine. As we ascend above 5,000 feet, the pines are left behind and spruce and fir with Douglas fir take their place.

Descending from the Rocky mountain summit by the Kicking Horse Pass, we meet the western cedar as a mere shrub, but in the Columbia Valley it becomes a gigantic tree, often having a diameter of ten feet, in the valley of Beaver Creek. Ascending the slope on the west side of the valley we come at once into a belt of the western hemlock and white pine, which is characteristic of all the mountains from here to the Coast Range. Above these trees, but often intermixed with them, as at the Glacier hotel, Selkirk Mountains, Patton's hemlock is found capping the mountains or forming the last groves on their sides. On the Coast Range a change takes place, and the upper slopes are clothed with this tree and the white fir (*Abies amabilis*). Fine groves of this shapely tree are to be seen here, and the difference between it and the Rocky mountain species (*Abies subalpina*) is very apparent, as the former has green cones and the latter bright purple ones. Descending the Columbia River, groves of the western larch are seen below the Upper Arrow Lake, and this fine tree is not uncommon on the lower slopes of the mountains on both the east and west sides of the Gold Range.

Generally speaking, all the valleys throughout both the Gold and Selkirk ranges are filled with cedar and spruce, and the mountain slopes are covered with Douglas fir and hemlock. The trees are in all cases well-developed, and from their size are suited for any purpose. This is the character of all the timber from the Columbia valley to the western slopes of the Gold Range. The valleys of the streams discharging westward from the latter range into the Eagle and Spullamacheen rivers and Shuswap Lake are also filled with fine timber of the same species. Passing westward from these mountains we come gradually into a drier region, and the country becomes open, with only scattered groves or single trees on the lower slopes and plateaus, and the yellow pine (*Pinus ponderosa*) so characteristic of the dry interior of British Columbia is the chief feature in the landscape.

The light rainfall east of the Coast Range in British Columbia prevents the growth of a continuous forest outside the flood-plains of the rivers so that yellow pine and Douglas fir are scattered over the Okanagan and Kamloops country until we reach an altitude of about 3,500 feet. Above this is a belt of dense forest composed chiefly of spruce and black pine (*Pinus Murrayana*) with which is mixed, in places, a considerable quantity of Douglas fir. This forms a zone of from 2,000 to 3,000 feet above which the forest thins out and grassy meadows, with beautiful groves of fir, cap the mountains.

The transition from the arid region of British Columbia to the humid coast district is a sudden one. As soon as the summit of the range is passed a change occurs, and descending by the valley of the Fraser, this is noted a few miles above Boston Bar where the mountain barrier closes the valley to the moisture-laden winds from the Pacific. Descending into the lower valley of the Fraser causes little change in the trees outside the flood-plains, but they at once increase in size and more than double their height. It is in the lower Fraser valley that we first see the Pacific coast forest and are lost in wonder at the height of the Douglas fir, Menzies spruce and the western cedar. Trees of Douglas fir 300 feet high and ten or

twelve feet in diameter were formerly common, and many fine specimens still remain. A visit to Stanley park at Vancouver will satisfy the most skeptical, and the remnants of the former forests seen there give full assurance that the size and number of trees in the old forests was not exaggerated. The samples seen on this peninsula between New Westminster and Vancouver City will exemplify the forests of some parts of Vancouver Island and the coves and deep inlets of the mainland.

The broad-leaved maple is a coast species, but ascends the Fraser almost as far as its junction with the Thompson, and before it disappears dwindles to little more than a shrub. The arbutus is seldom seen on the mainland except on rocky points jutting into the sea, but it ascends the north arm of Burrard Inlet for a mile or two. From Burrard Inlet northward the coast forests of the mainland change gradually so that the sequence of trees on a mountain near Vancouver City will illustrate the gradual change on the coast, with one exception—Menzie's spruce. This species is a very fine tree on Burrard Inlet and continues so, far into Alaska, while the Douglas fir seems to be at its best here, and begins to diminish in size and numbers towards the north end of Vancouver Island. It gradually becomes intermixed with hemlock (*Tsuga Mertensiana*) and yellow cedar (*Thuja excelsa*) to the north and eventually disappears, and the coast forests are then composed of spruce, hemlock and yellow cedar only.

The species on the mountain summits of the mainland are little known, but reasoning from what we know of Vancouver Island we can safely say that *Tsuga Pattoniana* and *Abies amabilis* are the principal trees. These are intermixed on the upper slopes with *Thuja excelsa* and *Tsuga Mertensiana*, while on the middle slopes *Pinus monticola* is well developed.

VANCOUVER ISLAND.

There are no trees on Vancouver island that are peculiar to it, and only one which is not found on the mainland—the western white oak (*Quercus Garayana*). This tree covers a considerable area of rocky ground around Victoria, and is found at Departure Bay and in some quantity at Comox, but in the latter locality it is of little value. Douglas fir is the chief forest tree throughout Vancouver Island. On the south it is mixed with white cedar and balsam fir. On the mountain slopes this tree with white pine, yellow cedar and hemlock constitute the forest, and at an altitude of 5,500 feet it holds its own with *Abies amabilis* and *Tsuga Pattoniana*. As we pass to the north the forest changes and the mountain trees descend so that the yellow cedar, first seen on Mount Benson, near Nanaimo, at an elevation of 2,000 feet, reaches the coast some distance south of the north end of the island.

The trees which give character to the Vancouver Island vegetation are the arbutus, flowering dogwood and broad-leaved maple. The former with its large laurel-like evergreen leaves is a living proof of the mildness of the climate, and its red inner bark and green leaves as it is seen standing on a rocky point or jutting rock along the coast relieves the sombre aspect of the thick forests of Douglas fir. The dogwood may often be seen in company with it, its white involucre, over three inches across, covering the tree with a mantle of white, broken here and there by protruding leaves.

CONCLUSION.

The examination of the Canadian forests brings out some noteworthy points relative to the distribution of species. Without referring to the origin of our flora, which it is not intended to discuss in this paper, it may be interesting to note the sequence of species in some genera as they pass from east to west.

Pinus Banksiana, *P. Murrayana* and *P. contorta* form a natural group of scrub pines that under one form or another pass, without intermixing, from the Atlantic to the Pacific. The first extends without a break from the Atlantic coast of Nova Scotia to the Athabasca River at Fort Assiniboine. Here at its western limit and as far east as Prince Albert on the Saskatchewan it is a fine tree. Scarcely a day's journey west of Fort Assiniboine the writer found the second species in great profusion, but never more than three inches in diameter. Mr. McConnell found both species on the Liard River, *P. Murrayana* being near the mountains and *P. Banksiana* lower down the stream towards the Mackenzie. Throughout the Rocky Mountains *P. Murrayana* is the principal tree, between 4,000 and 5,000 feet, and in British Columbia on the plateau between lat. 51° and 55°, at an altitude of from 2,000 to 4,000 feet. Passing from the Coast Range to the valley of the Fraser the third species comes in, but except on the coast it prefers swamps to dry ground.

Picea alba, *P. Engelmanni* and *P. Sitkensis* form another natural group and are distributed in nearly the same way. In this case, however, our knowledge is not so definite, and there may be four species instead of three. *Picea alba* is found in abundance from Nova Scotia westward to the prairie region, and even there occasionally on river banks. It is plentiful, too, in the Cypress Hills. This species enters the Rocky Mountains, and is found in river valleys as far west as the valley of Eagle River, west of the Gold Range. In the higher mountain valleys *Picea Engelmanni* takes its place, and is the spruce found on nearly all mountains from the Rockies to the Coast Range. Crossing the Coast Range *Picea Sitkensis* comes in and is the only coast species.

The firs have the same distribution and pass from east to west in the same way, the Rocky Mountains and west coast having their own species, the sequence being *Abies balsamea*, *A. subalpina* and *A. grandis*.

The habitat of *Juniperus Virginiana* changes as it passes from east to west. In the east it grows on the rocky banks of streams or on shallow soil on limestone. In the west, on the other hand, it grows in peat bogs or by lakeshores, and although so distinct in habit there seems to be no clear character by which it may be separated into two species.

The only trees that pass from east to west without apparent change are the aspen and the canoe birch. The latter, however, never becomes the fine tree on the west coast that it does in the east. On Vancouver Island there are two forms of the aspen, one of which may be the European *P. tremula*. Both forms grow in clumps, but the leaves of the one supposed to be *P. tremula* were quite brown in character when I saw them in 1893, while those of the other form which grew near it were the usual light green colour. The old leaves of the former were quite round and seldom pointed, the teeth were sinuate and appressed and not erect and regular as they are in the common aspen.

In conclusion I may say that including Vancouver Island a coniferous forest may be said to extend from the Pacific to the Atlantic, bounded on the north by the tundra of

Alaska and the Barren Grounds of the Dominion, and southerly with a varying border until it meets and intermingles with the poplar forests of the Northwest Territories. Passing still eastward the poplar mixes with it to the south until after passing Lake Superior it gradually merges into the deciduous forests of Ontario, southern Quebec and the elevated and interior region of New Brunswick, Nova Scotia and Prince Edward Island.

After all has been said about our waste both by myself and others it is evident that we have woodland enough in the north to supply every demand that may be made upon it for many generations, but like everything that is valuable, it is hard to get at. When it will be wanted none can say, but that it is there in incalculable quantities is absolutely certain. A belt 200 miles deep and 3,000 miles wide gives us an area of 600,000 square miles, but we are quite safe in estimating it at 1,000,000. The poplar forest and the mixed growth to the north of it extends from Edmonton to Winnipeg, a distance of about 900 miles, and averages over 50 miles in width, which gives an area of 45,000 square miles of aspen forest for the use of the settlers who will by degrees occupy this region, for the aspen districts have, as a rule, good soil.

19

7.1

[illegible]