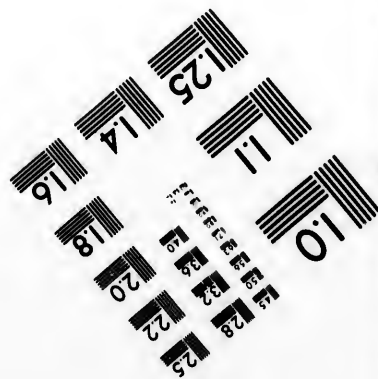
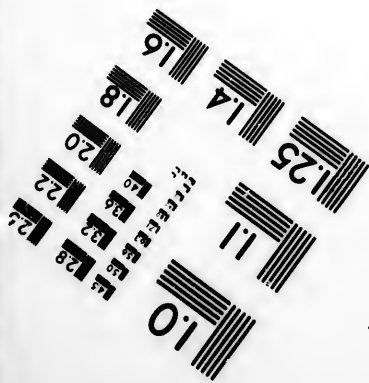
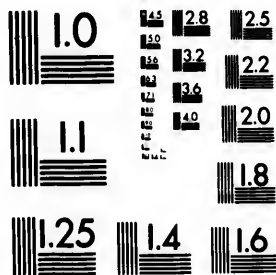


**IMAGE EVALUATION
TEST TARGET (MT-3)**



28
22
20

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**

01



Canadian Institute for Historical Microreproductions

Institut canadien de microreproductions historiques

1980

Technical Notes / Notes techniques

The Institute has attempted to obtain the best original copy available for filming. Physical features of this copy which may alter any of the images in the reproduction are checked below.

- Coloured covers/
Couvertures de couleur
- Coloured maps/
Cartes géographiques en couleur
- Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- Tight binding (may cause shadows or
distortion along interior margin)/
Reliure serré (peut causer de l'ombre ou
de la distortion le long de la marge
intérieure)
- Additional comments/
Commentaires supplémentaires

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Certains défauts susceptibles de nuire à la qualité de la reproduction sont notés ci-dessous.

- Coloured pages/
Pages de couleur
- Coloured plates/
Planches en couleur
- Show through/
Transparence
- Pages damaged/
Pages endommagées

Bibliographic Notes / Notes bibliographiques

- Only edition available/
Seule édition disponible
- Bound with other material/
Relié avec d'autres documents
- Cover title missing/
Le titre de couverture manque
- Plates missing/
Des planches manquent
- Additional comments/
Commentaires supplémentaires
- Pagination incorrect/
Erreurs de pagination
- Pages missing/
Des pages manquent
- Maps missing/
Des cartes géographiques manquent

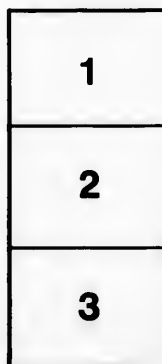
The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

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

The original copy was borrowed from, and filmed with, the kind consent of the following institution:

National Library of Canada

Maps or plates too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



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.

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

L'exemplaire filmé fut reproduit grâce à la générosité de l'établissement prêteur suivant :

Bibliothèque nationale du Canada

Les cartes ou les planches trop grandes pour être reproduites en un seul cliché sont filmées à partir de l'angle supérieure gauche, de gauche à droite et de haut en bas, en prenant le nombre d'images nécessaire. Le diagramme suivant illustre la méthode :

Can. Pam

D

Drummond, Andrew T

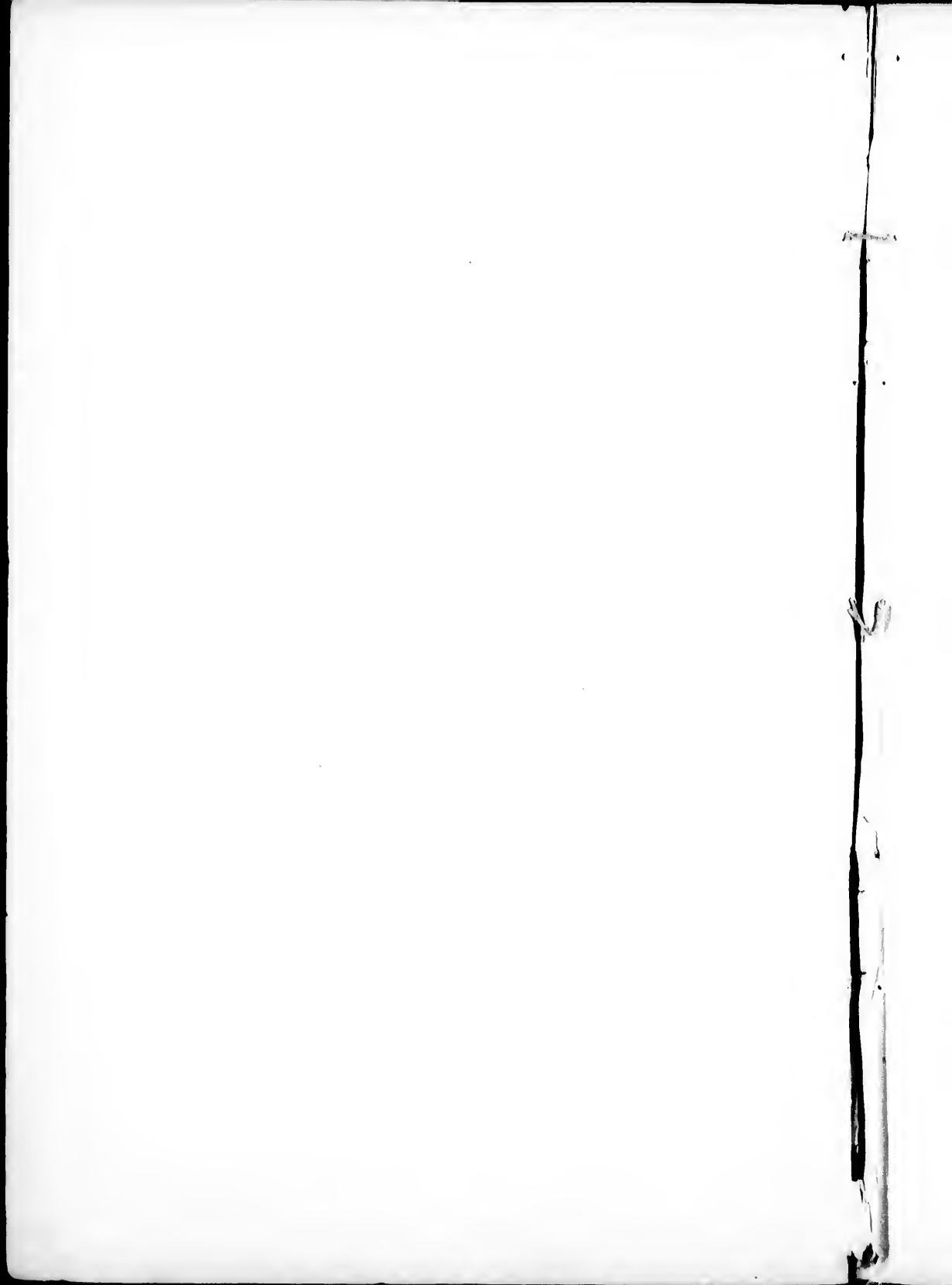
THE DISTRIBUTION
OF
CANADIAN FOREST TREES
IN ITS RELATION TO
CLIMATE AND OTHER CAUSES.

A PAPER READ BEFORE THE BRITISH ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE,
MONTREAL, SEPT. 2ND, 1884.

BY
A. T. DRUMMOND.

(Reprinted from Canadian Economics).

MONTREAL:
DAWSON BROTHERS, PUBLISHERS,
1885.



XI.

*THE DISTRIBUTION OF CANADIAN FOREST TREES
IN ITS RELATIONS TO CLIMATE AND
OTHER CAUSES.*

BY A. T. DRUMMOND.

I. THE DISTRIBUTION OF TREES.

Excepting the great triangular prairie country east of the Rocky Mountains, lying between the United States boundary line and a line drawn from Red River to the Upper Peace River country, the whole of Canada up to the northern limit of the growth of trees presents one vast forest area, except where it has been cleared by the hand of man. Within this area there are ninety-five species of forest trees which are, however, so distributed as to present interesting peculiarities in range. There are sixty-five species in the Province of Ontario, of which sixty-one are found in the districts surrounding Lake Erie. Of these sixty-five species, fifty-two extend eastward to the Province of Quebec, thirty-five are found in greater or less abundance on the eastern and western sides of Lake Superior, while only fourteen range westward into the prairie country at and beyond Red River,—thus indicating at this point an almost abrupt barrier to westward extension. Again, in British Columbia there are thirty-five species of forest trees of which only seven, the Paper Birch (*Betula papyracea*), Balsam Poplar (*Populus balsamifera*), Aspen (*Populus tremuloides*), Black Spruce (*Abies nigra*), White

Spruce (*Abies alba*), Balsam Fir (*Abies balsamea*) and Red Cedar (*Juniperus Virginiana*) extend eastward beyond the influence of the Rocky Mountains, but these seven with the exception of the Red Cedar, are found somewhat generally throughout the whole Dominion, and, with *Larix Americana* form the vast northern forests which extend almost uninterruptedly over the whole country from James Bay, east to the Labrador Coast and north-west to Mackenzie River.

Taking a general view of the whole Dominion, four great forest areas or zones can be outlined and for convenience may be termed the zones (1) of the Douglas Fir, (2) of Poplars, (3) of Red and White Pine, and (4) of Beech and Maple. Along the shores of Lake Erie is what might almost be regarded as a fifth zone, circumscribed in area but having such characteristic trees as the Buttonwood (*Platanus occidentalis*), Black Walnut (*Juglans nigra*), Sassafras (*Sassafras officinale*), Tulip tree (*Liriodendron tulipifera*), Dogwood (*Cornus florida*), and Chestnut (*Castanea vesca*),—all of them outliers of the forests of the Middle and Western States.

(1.) DOUGLAS FIR.—The zone of the Douglas Fir (*Pseudotsuga Douglasii*) embraces the greater portion of central and southern British Columbia, and includes within its bounds a flora which is distinctive of the country west of the Rocky Mountains. The peculiar climate of the Province, so different from that of the prairie region to the east, and the physical features of the country, both largely tend to foster a flora of a distinctive type. The extensive coast line is indented everywhere with long and wide deep-water inlets and the effect of the low equable temperature of the sea coast is thus spread inland over a largely increased area. The mountains comprising the Coast Range lie very generally parallel to the inlets and thus aid in carrying far inland the moisture-laden sea air, and in affording an abundant rain-fall. For these reasons, the coast flora occupies a greater breadth of country parallel to the coast line than it otherwise would.

Among the most distinctive physical features of British Columbia are the successive ranges of high mountains which run the whole length of the southern half of the Province, and combine in most sections all the characteristics of high peaks, deep river

valleys, and somewhat level plateaus, which serve to distribute the flora somewhat generally over these sections,—the more northern plants finding their way southward on the mountain sides, and the more southern forms ranging northward through the valleys. These mountain ranges occur in almost parallel groups, and, with the principal rivers, lie in a general north-easterly and south-westerly direction, thus favouring the range northward into this region of the trees and other plants of Washington and Oregon. Speaking generally, the interior of the Province in its southern part has in some degree the characters of a plateau shut off by intervening mountains from the moist winds of the coast. This has resulted in a drier climate and in the occurrence of a representation of the plants of Nevada and Utah.

The Conifere (or Pine Family) include nineteen out of the thirty-five British Columbia forest trees, and in the vast mass of individuals of the species as compared with other trees, form one of the characteristic features of various parts of the Province. In the near future, with the opening up of the country by railways and with the increased utilization of the navigable rivers, the lumber industries of British Columbia will rise to immense importance. Such timber as that obtained from the Douglas Fir (*Pseudotsuga Douglasii*), Yellow Pine (*Pinus ponderosa*) and White Pine (*Pinus monticola*) are already more or less known to commerce, but there are other coniferous trees, such as the Red Cedar (*Thuja gigantea*), Engelmann's Spruce (*Picea Engelmanni*), Menzies Spruce (*Picea Menziesii*), Western Hemlock (*Tsuga Mertensiana*), and Yellow Cypress (*Chamaecyparis Nutkaensis*), whose qualities are not so well known, but which may yet take an important place in the lumber trade of the country. Some of these trees, as the Douglas Fir, occur in great abundance, but often in localities which will be practically inaccessible to the lumberman, until cheap railways are constructed to the rivers or seaboard, and the waterways are improved or utilized. Everyone, however, who has the best interests of the country at heart, must hope that the government of British Columbia will profit by the results of the unwise policy of the Eastern Provinces of the Dominion, and will carefully conserve the forests so as to make them a continued source of revenue, instead of allowing fires and the lumberman's axe to have unrestrained sway among them. In

Ontario and Quebec it is almost too late to grapple effectually with a change of system in the leasing of timber lands, but British Columbia has the opportunity before it.

(2.) POPLARS.—The zone of the Poplars (*Populus tremuloides* and *Populus balsamifera*) may be said to include the whole country east of the Rocky Mountains from southern British Columbia to the mouth of Red River, Lake Nipigon and Anticosti in the Gulf of St. Lawrence, and thence northward to the limit of the growth of trees. The Poplars are found south of these limits, but not in that abundance which makes them here the characteristic species. The southern limits include a very considerable tract of prairie country, but even there, in the river valleys and among the scattered timber bluffs, the Poplar is often almost the only tree. South of the Assiniboine and Qu'Appelle Rivers, Cottonwood (*Populus monilifera*), Green Ash (*Fraxinus viridis*), Elm (*Ulmus Americana*), Maple (*Negundo aceroides*), Oaks and other trees begin to appear more frequently, but the country is almost entirely prairie, and these trees are not in such numbers as to give any character to the vegetation.

In the zone of Poplars, the number of species of forest trees is almost limited to the Aspen (*Populus tremuloides*), Balsam Poplar (*Populus balsamifera*), Paper Birch (*Betula papyracea*), Banksian Pine (*Pinus Banksiana*), White Spruce (*Abies alba*), Black Spruce (*Abies nigra*), Balsam Fir (*Abies balsamea*), and Tamarac (*Larix Americana*). These few species are, however, in such numbers individually as to constitute vast forests as far northward as the extreme limit of the growth of trees. From recent explorations we now know something of the range of these species in what has hitherto been an unknown land—the country surrounding the west coasts of Hudson Bay. The projected opening up of railway communication between Dakota, Minnesota and the Canadian Northwest on the one hand, and Churchill Harbour on Hudson Bay, on the other, has awakened an interest in the resources of this part of the country. At the outlet of Lake Winnipeg into Nelson River, the White Spruce has still sometimes a diameter of three feet, and even in the lower reaches of Nelson River is large enough for building purposes. The Balsam Fir does not here extend northward much beyond Lake Winnipeg and Oxford House on Hayes River. The Paper

Birch ranges as far as the country lying between the Hayes and Nelson Rivers. The Tamarac, in company with the Poplars, nearly reaches the entrance of Churchill River, whilst the Black Spruce is found as far beyond this on Hudson Bay as Seal River. The northern boundary of the forests of the Dominion may, in fact, be defined by an irregular line commencing on the Atlantic Coast, at the Strait of Belleisle, in latitude 52° , and crossing Hudson Bay on the east side at latitude 56° , and on the west at latitude 59° , and stretching thence by way of Mackenzie River, about latitude 67° , to the Alaska boundary. Beyond this line the vegetation consists of scrub and arctic plants. The general north-western direction of the irregular line is very marked.

(3.) WHITE AND RED PINE.—It is less difficult to indicate the northern limits of the zone of the White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*) than to say where its southern bounds should be placed. These two trees do not extend westward in Canada beyond the neighbourhood of the Lake of the Woods and the upper stretches of Winnipeg River in longitude 95° . From this general western boundary, the northern limits follow the height of land between the Great Lakes and James Bay eastward to Anticosti and Newfoundland. The southern limits of the zone may, in a general way, be said to stretch in Canada from the southern shores of the Georgian Bay across to the boundary line of New Hampshire, and further to include within them New Brunswick and Nova Scotia. With the exception of the Banksian Pine and the Cottonwood (*Populus monilifera*), all the trees in the zone of the Poplars are more or less associated with the White and Red Pine within these boundaries.

On the other hand, very many trees which obtain in Canada their maximum development in eastern, central and southern Ontario also extend to a greater or less extent into the zone of the Pines, but do not appear anywhere in sufficient numbers and size to form characteristic trees. Both the White and Red Pine themselves range southward throughout Ontario and along the mountainous districts of Vermont, New Hampshire, New York and Pennsylvania, but their best development and greatest numbers in Canada are found in the zone whose limits have been indicated. Although the area of this zone is extensive and the distribution of the Pines throughout it somewhat general, the

districts in which these trees attained their largest size and greatest numbers have already been well cut over; and lumbermen now derive their supplies chiefly from around the Georgian Bay, at the head-waters of Ottawa River and its tributaries, and at the sources of the St. Maurice and other rivers flowing from the north into the St. Lawrence. The timber obtained is also on the average fully one-third less in size than it was fifteen to twenty years ago. The area held still in the hands of the Government and available as Pine lands, is apparently extensive, but only apparently so,—the limits of the greatest development of these trees having been already passed, for as the northern boundaries of growth are approached, not only are the trees fewer in number but they are gradually smaller in size. Besides, immense tracts of these Government lands in northern Ontario and northern Quebec have already been completely denuded of their timber by forest fires.

In the same zone, the White Spruce (*Abies alba*) and Black Spruce (*Abies nigra*) also find their best development, although they range much farther northward and north-westward.

(4.) MAPLE AND BEECH.—This zone covers the country lying between Lakes Ontario, Erie and Huron to the southern shores of the Georgian Bay, and from this point eastward between Ottawa River and the St. Lawrence to the boundaries of New Hampshire. Within this limited area are found sixty-two out of the sixty-five species of forest trees occurring in Canada east of Manitoba. And so generally distributed throughout the limits indicated are nearly all these species that, especially in southwestern Ontario, the greater part of them may be frequently seen on a single farm.

The section of country bordering on Lake Erie lies in the latitude of western New York and southern Michigan, and is semi-insular in character. It is remarkable as including a vegetation much more southern in type than any other part of Canada. Certain forest trees of southern and western range, but peculiar in Canada to this section, have already been referred to. A large number of shrubs and herbaceous plants, more familiar in Ohio, Indiana and the Western States, have also found their way northward into the Lake Erie district. The tree in this section of most economic importance, apart from the Pines and the Spruces,

is the Black Walnut (*Juglans nigra*). At one time it was somewhat common and of good dimensions, but, during late years, a trunk of merchantable size has become somewhat rare. Fifty years ago it was not unusual to find, around London, White Pines varying from 13 ft. to 18 ft. in circumference, and averaging 160 ft. in height, and Oaks of 10 ft. to 15 ft. girth and with 45 ft. to 50 ft. of straight clear stems. This, however, is a thing of the past. Throughout the whole district lying between Niagara River and Lake St. Claire, there is little timber left of size sufficient to attract a lumberman.

II. CAUSES DETERMINING THE RANGE OF TREES.

The causes to which we must ascribe the frequent peculiarities in range of forest trees and other plants in Canada are very varied, but consist chiefly of physical conditions, and changes in climate resulting from these conditions.

The eastern portion of the northern half of the American continent has in its midst immense areas of water, and has widely and deeply indented shores,—Labrador and the great section of country lying between Hudson Bay and the Great Lakes being virtually one vast peninsula. The double effect of a northern latitude and of the presence of these great bodies of water is very marked in the lower general temperature and in the shorter summers and more severe winters. The result of these conditions is to give a much milder climate and a much higher range of trees on the western side of the continent than on the east. Thus Anticosti, whose flora indicates a sub-arctic climate and whose coasts are only used for fishing and lighthouse stations, is in the same latitude as Winnipeg and Vancouver Island, and lies even south of most of the best agricultural land in Manitoba and the Northwest. Again, semi-arctic plants are found on the projecting headlands of Lake Superior, and the combined effects of the broad deep waters of the St. Lawrence estuary and of the cold Labrador current, which sends a branch up this river, are seen in semi-arctic plants even beyond the Saguenay. There is no question that the lower resulting temperature and the short summers have their influence in checking the northern range of many forest trees beyond the outlet of Lake Superior and pre-

venting similarly their extension down the St. Lawrence below Quebec.

In the United States and Canada the mountain ranges are somewhat continuous, and have a general northern and southern trend, and this affords an opportunity to the northern trees to extend southward on the mountain flanks, and to the southern trees to range northward in the valleys. The existence of these mountain ranges has in this way given rise to a more extended distribution than could otherwise occur. Thus the White Pine (*Pinus strobus*), Red Pine (*Pinus resinosa*), Tamarac (*Larix Americana*), Hemlock (*Abies Canadensis*), Paper Birch (*Betula papyracea*), and Aspen (*Populus grandidentata*), among others, extend along the Green Mountains, Adirondacks and Alleghanies as far south as Virginia, and one or two range further. Allusion has already been made to similar features in British Columbia.

An important element in the distribution of forest trees, more particularly in the Ontario peninsula, is the chain of great lakes which forms a barrier to the free northward extension into Canada of southern forms common in Ohio, Indiana, Pennsylvania and western New York, and which should otherwise be expected in the counties of Ontario bordering on Lake Erie. Here we should find such trees as the Cucumber Tree (*Magnolia acuminata*), Red-bud (*Cercis Canadensis*), Coffee Tree (*Gymnocladus Canadensis*), Honey Locust (*Gleditschia triacanthos*), Chestnut Oak (*Quercus Prinus*), Black Oak (*Quercus nigra*), and others whose occurrence at present is doubtful. Whilst, however, the Great Lakes form in this way a barrier, the currents of the lakes have been the means of distributing seeds on the jutting headlands of the northern coasts, and though these headlands have not yet been explored with any special care, not a few southern forms have been observed. At the same time, the effect of such large and deep bodies of water, as the Great Lakes, is to lower the general temperature of the immediately surrounding country, and on the one hand to prevent the range to their shores of numerous plants requiring a higher temperature, on the other to afford a climate suitable for more northern species. Thus, as already mentioned, around the coasts of Lake Superior the flora includes some semi-arctic plants, though inland these all disappear and the vegetation is more of a northern temperate type.

Most trees have some area of country where the climatic and other conditions are most favorable to their development, and where the greatest masses of the individuals of their species are found and their greatest size is attained. As these conditions become less favorable, each tree shows less development. There are thus trees which show a greater growth in the northern part of their range and others which have the reverse. *Arbutus Menziesii* is a tree in British Columbia and a shrub in California. The Banksian Pine (*Pinus Banksiana*) has been found near James Bay of sufficient size to be merchantable, while in the Ottawa valley it is a shrub. *Taxus brevifolia* attains in Oregon to a height of from fifty to sixty feet, and yet in California it rarely exceeds from twenty to thirty feet. On the other hand, there is of course a general tendency in all trees which extend far north to become stunted as they approach their extreme northern limits of growth.

Unlike the herbaceous plants, there are very few trees which can be regarded as rovers—trees suiting themselves readily and naturally to almost every condition, and thus having a wide range. Among those which might be classed as, more or less, rovers are the Aspen (*Populus tremuloides*), Balsam Poplar (*Populus balsamifera*), Paper Birch (*Betula papyracea*), Balsam Fir (*Abies balsamea*) and Black Spruce (*Abies nigra*). They are found from British Columbia to Labrador, and from almost the Arctic Circle to the Southern United States; among the Rocky Mountains, the Laurentian Hills and the Alleghanies, and near the moist coast lines of Nova Scotia and Newfoundland, as well as in, or in the neighbourhood of, the drier climate of the western prairies. Again, in America we have many herbaceous plants which are not only widely distributed there, but are common to Europe. There are, however, only three trees having this feature—the Chestnut (*Castanea vesca*), White Birch (*Betula alba*), and the Yew (*Taxus baccata*), and even these appear to be varieties of the European forms. One reason for this difference between herbaceous plants and trees clearly is that the seeds of trees, on account of their greater size and weight, are less readily distributed. Even those trees, like the Poplars, Birches, Ash, Elms and Maples, whose seeds are of smaller size and have natural attachments to aid in their dissemination, have, for that reason

alone, a wider distribution and are more common everywhere than the Oaks, Walnuts, Butternuts and Hickories, with large heavy nuts whose weight naturally carries them, when ripe, directly under their parent tree.

As already referred to, a remarkable break in the westward extension of quite a number of our Canadian forest trees occurs beyond Lake Superior. The White Pine (*Pinus strobus*), Red Pine (*Pinus resinosa*), Red Oak (*Quercus rubra*), Ironwood (*Ostrya Virginica*), Sugar Maple (*Acer sacharrinum*), Red Maple, (*Acer rubrum*), Beech (*Fagus ferruginea*), Yellow Birch (*Betula lutea*), White Ash (*Fraxinus Americana*), and others range beyond the lake, some of them as far as Lake of the Woods, but, between these two points, lines drawn to represent the extreme limits of distribution of these trees in that section of country would bend southward through Minnesota. The causes which have given rise to this abrupt break may be traced largely to climatic influences. It is just probable that at one time the prairies were covered everywhere, more or less, with forests, and that fires have been gradually widening the area which is now exclusively prairie. The removal of the trees over such a vast space has had its effect in creating a very dry climate, in making it colder in winter than amidst the forest areas, and in subjecting every part of the country to the influence of sweeping winds. These atmospheric conditions, all of which would result from the absence of trees, are probably not favourable to the free growth of most forest trees. Even the trees which do occur—if the cosmopolitan poplars be excepted—prefer the immediate vicinity of the rivers and streams as giving them the moisture unattainable upon the prairie. The effect of this dryness of the climate, of the cool nights and the longer daylight during summer in the Northwest, is seen in the higher grade of wheat produced there, and to the same causes is no doubt to be attributed the alleged superior quality of the wood of the Aspen and Spruce there.

Too much moisture in the atmosphere has equally its results in determining the range of trees. To the frequent fogs which spread over the coasts of New Brunswick and Nova Scotia, and to the moisture-laden air general there at all times, is probably to be largely attributed the absence of the Butternut (*Juglans cinerea*), White Cedar (*Thuja occidentalis*), Red Cedar (*Juniperus*

Virginiana), and White Oak (*Quercus alba*) in the principal portions of these provinces.

The same causes, which prevent the range westward beyond Red River of many of the eastern trees, equally prevail in restricting the eastward range of the British Columbia trees beyond the influence of the Rocky Mountains. Allusion has already been made to the peculiar physical features of that Province, its somewhat generally moist climate and its distinctive forest flora. The barriers to eastward distribution are not merely the great mountain ranges and the climatic effects which they produce, for the Douglas Fir (*Pseudotsuga Douglasii*) and the Western Scrub Pine (*Pinus contorta*), for instance, both cross the Rocky Mountains and are found beyond their flanks on the eastern side. The different atmosphere met with, when the clear open prairie is reached, and the continued exposure there to dry sweeping winds, form further obstacles to the spread to these trees. It does not appear probable that the prairie soil has much to do with the question, as, so far as limited experiments afford any proof, eastern trees at least will readily grow on our prairies when properly cared for and protected from fires and winds. In fact, to make Manitoba and the land westward a successful country for the growth of many fruits, it will only be necessary to create effective wind-breaks around the orchards.

III. THE CREATION OF FORESTS.

The comparative absence of trees upon the prairies has such marked results in the rapidity with which the water is both evaporated and drained from the surface of the whole country, that the creation and preservation of forests, at least around the sources of the larger streams, has become a matter of national concern. These forests would form reservoirs, in which the water would become more frequently accumulated, and more gradually drawn off by rivulets and brooks into the main stream, and thus maintain a more constant and uniform supply. Trees should also be planted not only along the brooks and rivulets, but even along the larger streams. These fringing the banks would limit evaporation, by protecting the streams from drying winds, as well as by shading them in part from the sun. The sources of every

large river should be examined, and, if forests already exist there, an extensive area of them should be reserved from public sale and retained for the nation, as a source of supply for the waters of the river; while where forests do not exist, as at the headwaters of the Qu'Appelle and some tributaries of that and other important streams, an immediate effort should be made to create these by encouraging the planting of trees.

As cities and towns spring up over the whole country, the question of water supply increases in importance. The sites of the future towns will naturally be on the borders of the rivers; but, where these rivers run dry practically during two or three months' out of the year, there never can be more than mere hamlets on their banks. While the land in the Northwest is still, in chief part, in the hands of the Crown and the Canadian Pacific Railway Company, the policy of the Department of the Interior and of the railway company can be so moulded as to encourage tree-planting and forest-preservation in the districts specially requiring it: later on, when the land passes into the hands of settlers and speculators, and so many different interests have to be considered and dealt with, it will be very difficult to carry out such a policy. By an amendment made this year to the Dominion Lands Act, the Government is authorized to reserve from sale, lease or license, sections of country at the Rocky Mountains for such purposes as are here indicated. This, if properly carried out on an extensive scale, is so far well, but it is only covering the ground in one section of the country.

The vast prairie country lying between the Rocky Mountains and Red River on either side of the Canadian Pacific Railway, though possessing such rivers as the Bow, Red Deer, South Saskatchewan, Qu'Appelle and Assiniboine, is, for such an extensive tract, greatly deficient in the small but permanent streams which, in a wooded country like Ontario, are found in every township throughout the province, and are invaluable for agricultural purposes, and which go to make up the volume of water in the larger rivers. In post-tertiary times, the Assiniboine, above Brandon, and the Qu'Appelle, as shown by their widely separated high banks, have been enormous rivers, varying from half a mile to a mile in width, which have gradually cut their way through clays to a depth of 200 to 250 feet below the present prairie level.

Whatever were the original sources from which their supply of water was derived, and which are now cut off, it can be readily believed that, as the country through which the rivers and their tributaries ran became prairie, the volume of water flowing into the rivers would gradually lessen, and that this forms an important reason why they are reduced to their present low level. Were the country wooded instead of prairie, these two rivers would be navigable at all times in summer throughout almost their entire course.

Reverting to tree-planting, it is proper, before closing this paper, to mention that to make it a success, it will be necessary not merely to select trees of hardy species, but to see that the individual trees planted are from parent stock grown in this northern climate. Young trees from, for instance, Ohio or Illinois stock, even of species naturally of a high northern range, will not prove as hardy and successful in every way in Manitoba, as trees of the same species taken from stock grown in Manitoba or in northern Ontario. Such is the gradual effect of climate on generations of a species grown successively in the same place.

MONTREAL, 1884.

