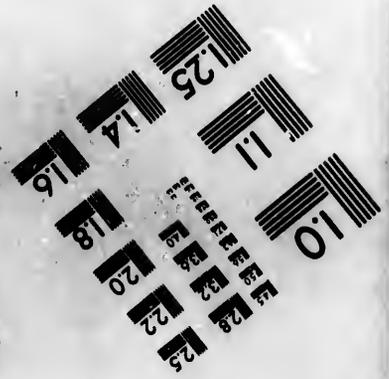
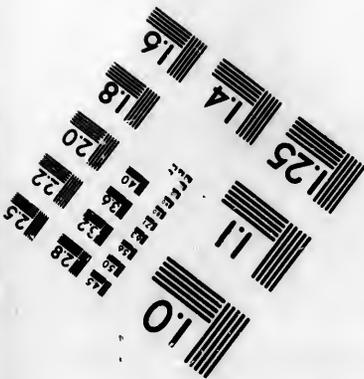
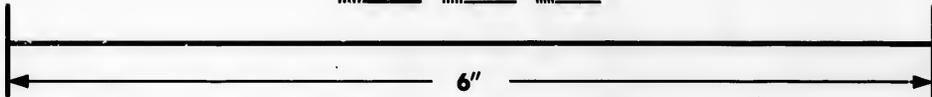
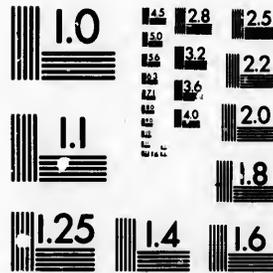


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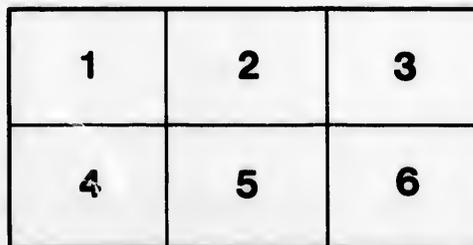
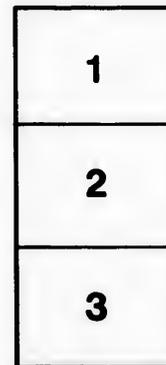
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ARCTIC AND WESTERN PLANTS
IN
CONTINENTAL ACADIA.

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By G. F. MATTHEW.
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(Read before the Natural History Society of New Brunswick,
13th April, 1869.)

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ON THE OCCURRENCE OF ARCTIC AND WESTERN PLANTS IN CONTINENTAL ACADIA.

By G. F. MATTHEW.

(Read before the Natural History Society of New Brunswick,
13th April, 1869.)

To the botanist as well as to the geologist this portion of the North American continent presents an inviting field for research; and the more so as till within a few years its flora has received but little attention. Although one cannot expect to find new species in a region, a large part of which, when viewed from a geological stand-point, has but recently emerged from the ocean, and has, therefore, received its flora from countries older and better known; yet the many peculiarities which may be observed in the distribution of plants in Acadia, form of themselves a subject in the study of which leisure hours may be profitably spent. To bring some of these peculiarities into notice by the public, and to indicate, though very imperfectly, the causes which have produced them, are the objects of the following remarks.

From the correspondence of natural features in Maine and New Brunswick, and from their situation, being alike exposed to the same variations of temperature, we would naturally expect to find no very marked differences between the floras of the two countries. This, indeed, is in a great measure the case, if we look upon Maine as a whole; but if we separate from it that portion of the State northward of the mountains which cross its centre, and eastward of the Penobscot River, a palpable difference in the vegetation of the section north and south of this divisional line is apparent.

The northern section, including the province of New Brunswick, may be designated Continental Acadia. Apparently merging into New England on the south—for there is no conspicuous natural barrier between the two countries—it is, nevertheless, as regards the indigenous plants which grow within its borders, closely allied to the neighboring province of Quebec, although a mountain range intervenes. This portion of Acadia contains four principal districts, viz.: an upper plain or plateau varying from about 200

to 500 feet above the sea, watered by the Upper St. John and its tributaries, the northern affluents of the Penobscot, and the River Restigouche. A triangular plain expands from a point within a few miles of the Maine boundary to a width of 150 miles or more, where it passes beneath the waters of the Gulf of St. Lawrence. This *Lower Plain* rarely rises more than 300 feet above the sea. Between the upper and lower plain lies a broken country rising into a knot of high hills in Northern New Brunswick.

And Lastly, there is a series of parallel ridges in the south, forming a hill-country of less altitude than the last, lying along the north shore of the Bay of Fundy. About two-thirds of ~~this region~~ ^{Con} is drained by the River St. John, which breaks from the level of of the upper plain at the Grand Falls; and, descending through several rapids and quick-waters, reaches tide-level at the western border of the lower plain, whence its course to the sea (distant 90 miles) is comparatively sluggish.

The rest of the Maritime Provinces of Canada, consisting of Nova Scotia and the twin islands of Prince Edward and Cape Breton, may be comprised under the term Insular Acadia.

Before describing in detail the peculiar groupings of species in this region, it may not be amiss to mention a few of the agencies which have given rise to the diversified forms of vegetation now existing on the earth; and then to add some remarks upon their peculiar manifestation in that part of America to which these observations more particularly relate, and to show their influence upon the range of plants within it.

Of these agents perhaps the most important is *Variation of Temperature*. It is well known that there are two directions in which this variation occurs, one on going north or south from the Equator, and the other in ascending from the level of the ocean to the tops of mountains. In both of these the temperature becomes lower in proportion to the elevation in the one case, or to the distance from the equatorial circle in the other. This decrease in temperature exerts so great an influence over plants that few species are found to be common to places widely differing either in latitude or altitude.

Soil is another influential agent in the limitation of species and the modification of individuals; some plants being peculiarly adapted to certain kinds of soil, and rarely found growing in any other, while others, although they may exist, present a puny and

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sickly appearance when found growing in soils not adapted in texture and composition to their nature.

Moisture also is of the utmost importance to the well-being of all cellular bodies, as well vegetable as animal; and is in fact so much a necessity that when deprived of it they cease to live. These three agencies are those which have played the most important part in diversifying the vegetation of the globe; but two of them, viz.: temperature and moisture, present themselves under a somewhat peculiar aspect in Acadia.

The renovation of the ocean by the interchange of waters throughout its vast expanse, is affected through the medium of ocean currents, flowing alternately to and from the poles. Such of these "ocean rivers" in the northern hemisphere as flow northward are continually thrown further and further east as they approach the arctic circle, by the retarded rotation of the earth from west to east; while such as run southward are thrown to the west. Hence, while Europe is bathed in the warm waters of the Gulf stream, running in a long arc northward across the Atlantic, the polar current, having a westerly momentum, clings to the American coast, and Acadia not only shares the cool climate prevalent along this seaboard, but owing to its semi-insular position, has its temperature still further lowered. This is strikingly evident when the climate of St. John is compared with that of cities in Europe—such as Bordeaux, Turin and Venice,—under the same parallel of latitude. The principal cause of this difference of temperature is the fact that here we have the ^{on} north-east a refrigerator in the Gulf of St. Lawrence, traversed as it is by a branch of the polar current, which entering at the Straits of Belleisle, sweeps around the shores of the Lower Provinces and finds an outlet in the Gut of Canso and further east. We have also a cool vapor bath in the sea fogs, which in summer bathe our south-eastern shores, and whose influence on vegetation will be noticed in the sequel. Thus we see that within the limits of these maritime provinces there are variations of temperature, which mere extent of surface or elevation of land will not account for, but which are mainly dependent on ocean currents and their concomitants.

In comparing the relative heat and cold prevalent in various parts of Acadia, and other portions of the British possessions, it has not been thought necessary to notice the temperature of the colder months of the year, during which nature, in these latitudes,

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sinks into partial inaction, but only of those when she is in full activity.

The following table, condensed from the Canadian Year Book for 1868, will enable the reader to follow these changes during the five warm months, and to effect a comparison of the mean summer temperature in various parts of the Dominion. It also serves to show that the summer temperature of St. John is comparatively low. It is probably this, and the want of any observations by which an estimate of the climate of the interior could be formed, which has led the author of that portion of the Year Book from which this table is drawn, to include the whole of New Brunswick in the same climatic division with Prince Edward's Island, and that portion of the south shore of the St. Lawrence between Gaspé and Quebec. As regards the northern part of New Brunswick, this would appear to be a natural division; but when the climate of central New Brunswick is better known, I am inclined to think it will fall within the division comprising the eastern townships and that part of Upper Canada between Lake Ontario and the Ottawa River. Instead of falling within the region where wheat can scarcely be grown with profit, this portion of New Brunswick is likely to be recognized hereafter as a country much more favorable to farming operations than might be inferred from the classification given in the work above cited. It is distinguished from other parts of the Province by the presence of a group of plants, which indicate a climate in which Indian corn can be brought to perfection. The analysis of the Acadian flora given on succeeding pages will, it is believed, fully bear out this opinion.

TABLE No 1.

	May.	June.	July.	Augt.	Sept.	Oct.	Sum Mean
Labrador	35.0	42.0	48.0	51.0	42.0	31.0	47.0
St. John's, Newfoundland	39.3	49.0	56.2	57.9	53.0	44.5	54.0
St. John, N. B.	47.3	54.5	59.7	60.0	55.0	45.7	58.1
Thunder Bay, L. Superior .	48.9	58.7	62.2	58.8	48.2	41.9	59.9
Halifax, N. S.	48.9	56.3	62.3	63.7	57.0	47.0	60.9
Toronto	51.5	61.0	66.3	65.7	57.4	45.0	64.3
Wolfville (<i>Normalis</i>)	51.6	61.9	67.5	65.5	58.3	49.2	65.0
Quebec	51.6	63.1	67.5	65.9	57.6	44.6	65.5

Not only the coldness, however, but the humidity of the atmosphere, in many parts of Acadia, exercises a powerful influence upon its flora.

It is a well-known fact that the land and sea breezes which

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alternately fan districts bordering the sea in inter-tropical regions, result from the periodical heating and cooling to which such lands are subject every 24 hours. Analogous to this is the prevalence of certain sets of wind on the coast of large areas of land in temperate latitudes, during the summer, and of others during the winter months.

It is on these lands in going north from the coast that we meet with a new group of species, which range thence up the St. John River and its tributaries into Northern Maine. The influence of natural drainage of soils upon the distribution of species in the neighboring Province of Canada, has been observed by Mr. Macoun, of Belleville, in some remarks drawing attention to the occurrence of certain western species on the dry gravel ridges in that neighborhood; and the presence of continental forms in certain parts of the interior of Acadia, such as the valleys of Kings County, in the southern hills, the dry terraced lands of the St. John River and its tributaries, and the rich calcareous districts in the south-west part of the upper plain, are but manifestations of the same law of distribution, lands thoroughly drained being in a condition to absorb and retain more heat than those which are wet. Were it not for the depressed position of a portion of the lower plain, along the base of the southern hills, which is little above sea-level, and the imperfect drainage which results from the flatness of this region, there would be a more decided exhibition of western species in the southern counties than we now find.

It is to be regretted that so small a part of Continental Acadia has yet received the attention of botanists, and that the material for working out the subject of this paper is so imperfect. It is, therefore, quite possible that a part of its contents may not be confirmed by more minute and extended investigation. The scantiness of the material may be inferred when it is stated that out of the fourteen counties into which the Province of New Brunswick is divided, a detailed examination has been made in *parts of four only*. The *three* catalogues upon which these remarks are based, comprise species collected in Kent County, by Rev. James Fowler, and Rev. J. P. Sheraton; in Central York, by Prof. L. W. Bailey; and in a part of St. John and Kings, by

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page 11 as far
as line 34,
page 12 & 13,
and page 14
to line 34*

* See article on flora of Canada, by Drummond, Can. Nat., Vol. 1, new series, page 405.

the writer. Reference is also made to notes taken by Prof. Bailey, during a rapid journey through the northern highlands, and by the Rev. James Fowler, when at Dalhousie, as well as to the report of G. L. Goodale, of the Maine Scientific Survey.

In Continental Acadia, as previously defined, there are four principal types of vegetation, exclusive of maritime species, viz. :

- I. Arctic and Sub-Arctic.
- II. Boreal.
- III. Continental.
- IV. New England type.

The latter includes all indigenous species which have an extensive range in Acadia, especially in its southern parts.

I. *Arctic and Sub-Arctic (or Alpine and Sub-Alpine).*—This type, as being the most ancient flora of the country, and also being found on the low lands at the parallel of 45° N., half way between the equator and the pole, deserves our first attention.

The species so far as known are the following :

No. 1.—LIST OF ARCTIC AND SUB-ARCTIC SPECIES.

SPECIES.	Southern Hills.	Lower Plain.	Northern Highlands.
<i>Alsine Grœnlandica</i> (Greenland Sandwort) - - - - -	*S'	....	....
* <i>Rubus Chamœmorus</i> (Cloud-berry) - - - - -	*S'	*E'	....
<i>Solidago virga-aurea</i> (Golden Rod) - - - - -	*	....	....
<i>Senecio pseudo-arnica</i> - - - - -	*S'	....	....
<i>Vaccinium uliginosum</i> (Swamp Huckle-berry) - - - - -	....	....	"
<i>Calluna vulgaris</i> (Heather) - - - - -	....	....	....
* <i>Empetrum nigrum</i> (Crow-berry) - - - - -	*S'	*E'	....
<i>Carex capillaris</i> - - - - -	....	*E'	....
<i>Asplenium viride</i> - - - - -	*S'	....	....
* <i>Solidago thyrsoides</i> (Thyrsoïd Golden Rod) - - - - -	*S'	....	....
* <i>Vaccinium Vitis-Idæa</i> (Hill Cran-berry) - - - - -	*	*E'	....
* <i>Emphrasia officinalis</i> (Eyebright) - - - - -	*S'	....	*E'

[Species in this list marked S', occur only near the sea-shore on the Bay of Fundy and coast of Maine. Those marked E' have been gathered along or near the shores of the Gulf of St. Lawrence.]

Of these species *Senecio pseudo-arnica* is introduced on the authority of Prof. Asa Grey, as occurring at Grand Manan, and the Mountain Sandwort (*Alsine*, or *Stellaria Grœnlandica*,) is added on the same authority, it having been found at the sea level, on the coast of Eastern Maine. The common Scotch

Heather, (*Calluna vulgaris*), has been found near Halifax, by Prof. Lawson, and is more abundant at Cape Breton and Newfoundland. It is accredited to New Brunswick, by Loudon. Prof. Bailey noticed the Bog Bilberry (*Vaccinium uliginosum*.) and the Cow Berry (*Vaccinium Vitis Idea*.) growing on Bald Mountain, the culminating point of the Northern Highlands, but does not seem to have met with any other representatives of this type at the north. We may, perhaps, except the mountain Cinquefoil (*Potentilla tridentata*.) gathered on the Tobique River, but which, although commonly considered Sub-Alpine, has such a range in Acadia, as to show that it may perhaps, with more propriety, be looked upon as a Boreal form. These, and the remaining species of the list, not noticed above, find a congenial climate at St John. One very obvious cause of their presence here, as already observed, with regard to other species, is the abundance of cool sea fogs in summer time, and consequent low temperature and moist atmosphere. The more thoroughly Arctic species, such as the Cloud Berry (*Rubus Chamemorus*) and the Crow Berry, (*Empetrum nigrum*.) show a partiality for the peat bogs, so common in our "Barrens," where they grow in company with the Bastard Toad Flax, (*Comandra livida*.) and other high northern forms.

The Sub-Arctic species of our list, have been mostly gathered on the cliffs and terrace banks, bordering the Bay of Fundy. On these, the Eyebright, (*Euphrasia officinalis*.) and the Thyrsoid Goldenrod (*Solidago thyrsoides*) abound. The first of these has also been met with at Dalhousie, on the Bay of Chaleur. The mountain Cinquefoil has an extensive range throughout Acadia, having been seen near Mount Katahdin, on the Lower Tobique, at several points around the Bay of Fundy, and on the coast of Maine. It even flourishes at Windsor, Nova Scotia, where the mean summer temperature cannot be far from 65° Fahr. The Green Spleenwort, (*Asplenium viride*.) a native of Newfoundland, Gaspé, Labrador and the Rocky Mountains, grows on the sea cliffs near this city, in company with *Carex canescens* var. *vitilis*, *Cinna arundinacea* var. *pendula*, &c. I may add that the Cowberry, (*Vaccinium Vitis Idea*.) which goes by the name of Hill Cranberry with us, is not only quite common near the coast of the Bay of Fundy, but has also been met with by Mr. Fowler, at Richibucto.

The comparison of the position of this little group of Arctic

forms, with that of a similar assemblage of Alpine plants on the White Mountains of New Hampshire, is one of very great interest, when it is considered that the Acadian Sub-Arctic flora grows at the sea level. Let us then look at the vertical range of some of the plants above named on those eminences, the highest peaks of North Eastern America.

Dr. Dawson gives 4,000 feet above the sea as the upper limit of evergreens. Here firs cease to grow, and the mountain side is covered with small shrubs and herbs. On the Plateau between Mounts Washington and Munroe, at a height of 5,000 feet, the Arctic flora is in full possession, and extends thence to the summit. If we note the range of such of our own Arctic and Sub-Arctic species as grow there, we find that they come no lower down the mountain side than to points varying from 4,500 to 3,500 feet above the sea. It is supposed that the principal masses of rain clouds hang at a height of from half a mile to one mile above the earth, in regions near the sea level, encircling the mountain tops with their vapory masses; and the clouds clustering at such a height around Mount Washington, would wrap those little Alpine plants which grow towards the top of the mountain, in those thick mists in which they delight. Need we wonder then that such lowly forms should find a congenial home on the cool mist-covered hills of Maritime Acadia.

By its cool summer temperature, its humid climate, and consequently its vegetation, St. John, when compared with these New England mountains, may be looked upon from a botanical point of view, as standing upon an eminence nearly 4,000 feet high; for it is at this height, on the White Mountains, that evergreens cease and Alpine plants take their place. Fancying ourselves standing upon this elevation, and looking around us through the medium of Mr. Murdock's observations, and those of Acadian botanists, we see across "the Bay" and beyond the fertile valley of Annapolis, the hills of Nova Scotia, rising ridge upon ridge to a mountain range, equal in height to our own, and our sister city of Halifax on its crest; for she has more fog and rain than we have. Around her grow the Scotch heather, the mountain Cinquefoil, and other Alpine forms mentioned in the preceding list.*

* I infer this from the table, (at foot of opposite page,) prepared by Mr. Murdock, from his own notes and data, published by the late Colonel Myers, of Halifax.

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Mr. G. Murdock, in a paper on the Meteorology of St. John, read before this Society in 1863, pointed to this phenomenon as exhibited in the vicinity of this city, in the following words: "In the wind columns it is observed that the increase and duration of southerly weather follows very nearly that of the temperature. July is the month of *maximum* southerly weather, and December of *minimum*. From July to December, there is a constant diminution, and from this latter month to July again a steady increase." Of these southerly winds, the south-west is by far the most frequent, and, if continuous, sooner or later brings upon the southern coast of Acadia those fogs for which St. John is unfortunately so notorious. That such is the case may be inferred from the following table, compiled by the same accurate and pains-taking observer, showing a mean of the number of foggy days per month for the years 1861-1867:—

TABLE NO. 2.

	May.	June.	July.	Augt.	Sept.	Oct.	Sum. Mean.
Avrge. number of foggy days	3.3	4.2	6.2	6.7	3.4	2.3	5.7
Rainy days	10.0	6.8	9.9	7.6	8.1	7.6	8.1
Mean estimate cloudy days	6.4	6.4	6.3	6.2	5.5	6.1	6.3

From this table we gather that, during each of the two hottest months of the year, St. John is enveloped for nearly a week in constant fog; and this misty curtain, by its presence, not only excludes the direct rays of the sun, but by its coolness lowers perceptibly our summer temperature.

During the months of July and August, there is also a large rainfall, and if we add to the rainy and foggy days those which are cloudy, but nineteen days out of the two mid-summer months remain during which the sun shines upon us in unclouded splendor.

If we give due weight to these sources of humidity and cold, and consider, also, that our position on the sea-side is an additional cause of a diminished temperature, we need feel no surprise at the sub-arctic summers which prevail at St. John,

TABLE NO. 3.—MEAN OF 1864 AND 1865.

	May.	July.	Aug.	Sept.	Oct.	Sum Mean.	June.
Halifax foggy days.....	12.5	6.	6.5	1.5	3.5	6.7	7.4
St. John, N. B., do. do.....	4.	4.3	6.5	1.7	1.	5.3	4.
Halifax rainy days.....	16.	12.5	11.	7.	16.5	15.75	8.
St. John, N. B., do. do.....	12.5	7.5	8.5	6.5	7.5	7.8	5.5

nor at the sub-arctic type of vegetation which flourishes around us. It is well known that humidity, in its influence over the distribution of Arctic plants, in a limited degree represents cold. But when a climate is both cool and moist, as ours is, it presents a double attraction to these little northern adventurers.

Having seen what a chilling effect these south-west winds, with their accompanying fog and rain, have at the coast, let us now follow the same breezes into the interior.

As soon as the fogs pass the coast, they are rapidly absorbed by the atmosphere (expanded by warmth radiated from the heated earth), and may be traced in their progress inland, in the long banks of cumuli-clouds which hang over the southern hills; and are finally dissipated entirely in the onward progress of the southerly winds, which now possess nearly the original warmth and most of the moisture that they had when first they began their journey from the Gulf Stream. Now pre-eminently invigorating and refreshing, these winds course onward toward the shore of the Gulf of St. Lawrence, stimulating the growth of many species of plants, which cannot abide their chilling influences at the coast. As may be inferred, they bear a very different reputation along the Gulf from that which attaches to them with us. In spring and early summer, they blow down the valleys of the Miramichi, and other streams debouching on that coast, as warm breezes, prevalent during the night and morning, giving a great stimulus to vegetation; but in the evening they are pushed back, or forced upward by a strong, cold wind from the Gulf, but lately relieved from its wide fields of floe-ice. The latter (N. E. winds) often blow with much violence about 4 or 5 o'clock in the afternoon, and such is their chilling influence, that flowers which have been in bloom in Fredericton for a fortnight are (about 1st June) only opening their petals on the Miramichi. There is nearly the same difference between St. John and Fredericton at this period, although the first flowers of spring, such as the Mayflower, *Epigæa repens*, usually opens with us a little in advance of their time of flowering at the capital. The advent of spring is undoubtedly first felt at St. John, but the increase of fog and chilly winds in the month of May checks the growth of plants with us, while the very same winds give an increased impetus to their growth and expansion in the interior, where, at the 1st of June, vegetation, in its summer development, is a fortnight in advance of the coast, and subsequently much more.

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In table 1 it will be seen that the valley of Cornwallis, in Nova Scotia, has a summer mean of 65 deg. ; and it is probable that a large area in the interior of Continental Acadia will be found to have, at that period, a temperature equally high. At Fredericton "90 deg. in the shade" is not rare, and at Woodstock the mercury is said to rise to 100 deg. Fah't.

In default of any meteorological tables shewing the climatic changes of the interior of Acadia, I have been somewhat prolix in thus enlarging on the S. W. winds, in order to give some idea of the varying influence which this important agent exercises over the growth of plants.

Of *soils*, Continental Acadia possesses a great variety, which have a proportionate influence with the causes already noted upon the range of plants within its borders.

The Highlands, both North and South, being mainly made up of metamorphic rocks, which are comparatively impervious to water, the drainage of the soil upon them is thereby much impeded. Hence, it happens that, notwithstanding the hilliness of these districts, there are, especially in the southern hills, numerous peat-bogs, interspersed with bare rocky tracts known as "barrens." These barrens extend for many miles along the coast of the Bay of Fundy, where granite and hard metamorphic rocks prevail, and where the natural drainage is imperfect, and the soil scanty and unproductive. The drier portions are covered with a profusion of ericaceous shrubs, &c., such as blue-berries (*Vaccinium Pennsylvanicum*), Labrador Tea (*Ledum latifolium*), Leather Leaf (*Cassandra calyculata*), Sheep Laurel (*Kalmia angustifolia*), *Rhodora Canadensis*, &c. In the swamps, and on mossy slopes, knee-deep with sphagnum, grow the Sweet Gale (*Myrica Gale*), Marsh Rosemary (*Andromeda polifolia*), Cranberries (*Vaccinium oxycoccus*), &c. The larger depressions are occupied by peat bogs, or lakes and ponds, with which such tracts are often studded. There is a striking resemblance in the aspect of these barrens, dotted as they are with numerous little sheets of water, and interspersed with belts and clumps of evergreen trees, to the open tracts in Newfoundland, so graphically described in your late Vice-President's paper on that island, and to the Laurentian region of Canada.

The arable lands along this coast are chiefly clay flats, usually covered with terraced beds of sand. The soil on the ridges is mostly gravelly, and here the forest growth is of Black and Yellow

Birch (*Betula lenta et excelsa*). Beech, Maple, and other forest trees of the interior are seldom or never seen. Beneath the shade of the evergreen growth on the clay flats we find the Tway blade (*Listera Cordata*), the Mitrewort (*Mitella Nuda*), the Rattlesnake plantain (*Goodyera repens*), the Dwarf orchis (*Platanthera obtusata*), the one-flowered Pyrola (*Moneses uniflora*), and other shade-loving plants.

We have seen that the prevalence of a moist climate and impervious soil, coupled with a low temperature, give rise to thick evergreen forests, peat-bogs and swamps saturated with moisture; and while producing, even during clear weather, great radiation of heat and moisture, these causes have contributed to encourage the growth of such northern plants as those above mentioned on the maritime slopes of our southern hills.

On the declension of this hill-country toward the plains of the interior, however, another set of agencies comes into play. It has been already intimated that the summer skies of the central districts are clearer than those of the coast, and the precipitation of moisture less profuse. In the valleys, among the more northerly ranges of the southern hills, much of the soil is loamy, and naturally well drained, as well as fertile. These rich loams are co-extensive with the lower coal formation in New Brunswick. They border the Lower Plain throughout, fill the valleys of the Kennebackasis and Petticodiac Rivers, form islands on it along its N. W. side, and re-appear in the valley of the Tobique among the northern hills. The fertility of other loams, such as those of the interfluvial lands on the St. John River, and the upland tracts around Houlton and Woodstock on the Upper Plain, is evidenced by the growth of such species of plants as the Dwarf Ginseng or Ground Nut (*Aralia trifolia*), Closed Gentian (*Gentiana Andreuxii*), Showy Orchis (*Orchis Spectabilis*), Bass Wood (*Tilia Americana*), *Desmodium Canadense*, the two Osmorrhizas, Wild Ginger (*Asarum Canadense*), and Butternut (*Juglans cinerea*).

Immediately north of us, but, as regards its flora, about 1,000 feet below, is the elevated plain of the Kennebackasis Bay, beyond which we may look down another 1000 feet, into the sunny valleys of Kings County. Over the Nerepis hills the great plain which occupies the central part of Acadia is visible, and far beyond it the plateau of Northern Acadia stretches away to its junction with the Notre Dame mountains; while to the

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dwarf orchis
(*Moneses*

South-West our imaginary mountain top connects, by scattered peaks rising through the fogs of the Bay of Fundy, with a similar elevation in eastern Maine, whence it declines, and finally sinks beneath the waters of the Atlantic.

II. A BOREAL or High Northern type of vegetation may be seen mingling with these Arctic forms, but also extending over many parts of Acadia, where they have not been found.

Of this character are the following:—

No. 2.—LIST OF BOREAL SPECIES.

SPECIES.	North-east Coast of America.	Valley of St. Lawrence.	North-west Territory.	Continental Acadia		
				Southern Hills.	Lower Plains.	Upper Plains.
<i>Anemone parviflora</i>	*	*	*	...	W*	N*
— <i>multifida</i>	*	*	*
<i>Stellaria uliginosa</i> (Swamp Chickweed).....	S*	...	...
<i>Parnassia palustris</i>	W*	...
<i>Astragalus alpinus</i> (<i>Phaca astragalina</i>).....
— <i>Robbinsii</i>	N*
✓ <i>Oxytropis campestris</i>	W*	N*
<i>Hedysarum boreale</i>	N*
<i>Geum macrophyllum</i> (boreale).....	S*	...	...
<i>Potentilla tridentata</i> (Mountain cinquefoil).....	W*	N*
<i>Ribes rubrum</i> (Red Currant).....	E*	...
<i>Sedum Rhodiola</i> (Stone crop).....
<i>Saxifraga aizoon</i> (<i>Saxifraga</i>).....
<i>Nardosmia palmata</i> (Sweet Coltsfoot).....	E*	...
<i>Artemisia borealis</i> (Wormwood).....	N*
<i>Aster graminifolius</i>	E*
<i>Tunacetum Huronense</i> (Huronian Tansey).....	W*	...
<i>Vaccinium Canadense</i>	E*	...
<i>Castilleja septentrionalis</i>	E*	...
<i>Primula farinosa</i>	N*
<i>Utricularia minor</i> (Bladderwort).....	E*	...
<i>Rhinanthus Crista-galli</i> (Yellow Rattle).....	S*	E*	...
<i>Halenia deflexa</i> (Spurred Gentian).....	N*
<i>Collomia linearis</i>
<i>Echinospermum Lappula</i>
<i>Shepherdia Canadensis</i>	E*	N*
<i>Rumex salicifolius</i> (Dock).....	S*	...	...
✓ <i>Comandra livida</i> (Bastard Toad-Flax).....
<i>Betula pumila</i>	E*	...
<i>Alnus viridis</i>	E*	...
<i>Populus balsamifera</i>	E*	...
<i>Pinus Banksiana</i>	E*	S*
<i>Piantanthera hyperborea</i>
<i>Spiranthes latifolia</i> (Ladies' tresses).....
<i>Calyso borealis</i>	W*	...
<i>Allium schanoprasum</i>	S*
<i>Tofieldia glutinosa</i> (False Ashpodel).....	E*	N*
<i>Juncus filiformis</i> (Thread Rush).....	E*	...
— <i>Stygius</i>	E*	...
<i>Scirpus sylvaticus</i>	E*	...
<i>Eriophorum russeolum</i>	E*	...
<i>Carex lenticularis</i>	E*	...
— <i>hexilis</i>	E*	...
— <i>rostrata</i>	E*	...
— <i>canescens</i> , var. <i>vitis</i>	S*

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List of Boreal Species—Continued.

SPECIES,	<i>Continued</i>						
	North-eastern Coast of America.	Valley of St. Lawrence.	North-west Territory.	Southern Hills.	Lower Plain.	Northern Highlands.	Upper Plain.
<i>Vilfa cuspidata</i>	*	..	E*	..	N*
<i>Festuca ovina</i> , var. <i>duriuscula</i>	*	..	E*	..	..
<i>Cinna arundinacea</i> , var. <i>pendula</i>	*
<i>Avena striata</i>	*	S*	E*	..	..
<i>Elymus mollis</i>	*
<i>Woodsia hyperborea</i> R. Br.	*
(<i>Woodsia Ilvensis</i> , var. <i>alpina</i> Watt)	*
<i>Aspidium fragrans</i>	*
<i>Polygala pauciflora</i>	*	..	W*	..	..
<i>Artemisia Canadensis</i>	*
<i>Nabalus racemosus</i>	*	NN*
<i>Lobelia Kalmii</i>	*	NN*
<i>Platanthera rotundifolia</i>	*
<i>Triticum caninum</i>	*	S*	E*	..	..
<i>Pellaea gracilis</i>

N.B.—The last seven species of this list have a range intermediate between this type and the succeeding one.

[Species marked S' have been found at the seaside only in the southern hills. Those in the second column marked W., occur on the St. John River, near the centre of New Brunswick. The remainder have been gathered near and on the Gulf Shore. S' and N' on the fourth column, designate respectively the southern and northern parts of the Upper Plain, including the Aroostock and St. John districts of Goodale. Species marked E' in the third column grow in that part of the southern hills bordering the Bay of Chaleur.]

Mr. G. L. Goodale has the merit of first calling attention to the occurrence of this type of vegetation in Acadia. He says:— (2nd Report, p. 125.) “The country lying along the St. John, “from Boundary Branch to Grand Falls, is marked by the very “frequent occurrence of certain North-Western plants. And “the district comprised by the curved northern limit of Maine. “and a line drawn from Grand Falls to a point between Baker “Lake and Boundary Branch, will be found to be nearly the “range of these plants in our State. This district is so entirely “distinct botanically from any other portion of Maine, that its “limits can be said with confidence to be clearly defined. The “following list of plants may be considered as comprising the “most characteristic species of the St. Johns district:—

- “ *Anemone parviflora*.
- “ *Astragalus alpinus*.

Even in midsummer, should a bather more venturesome than his fellows swim out of the shallow coves which line the shore, he will soon find his limbs stiffened by the refrigerating power of these profound waters.

As there are here the conditions favorable to the growth of northern forms of vegetation, it will not excite surprise that the boreal type of Northern Acadia should re-appear around this Bay. Its shores have as yet received only an occasional summer glance from the botanist, and therefore the discovery of many more northern forms will probably reward the search of a diligent explorer. Among the species thus far recognized I may instance a stone-crop or live-for-ever (*Sedum Rhodiola*), a Saxifrage (*Saxifraga Aizoon*), and the fern *Woodsia hyperborea* R. Br., which Mr. D. A. P. Watt regards as a northern variety of *Woodsia Ilvensis*,* as common on the perpendicular cliffs near Rothsay. The first-named species was gathered many years ago on Cape Blomidon, N.S., by Dr. Robb, and, strange to say, has recently been found on the cliffs of Delaware River, Pennsylvania. On the rocky ledges and gravelly beaches around Kennebeckasis Bay flourish the American primroses (*Primula farinosa*) and *Primula Mistassinica*, the first named in great abundance, also the Wild Chive (*Allium Schœnoprimum*), a small *Aster graminifolius*, and Hooker's *Nabalus racemosus*. The Northern Green Orchis (*Habenaria Hyperborea*) is also sparingly met with. But the most conspicuous plant is the Northern Scrub Pine (*Pinus Banksiana*), which here attains gigantic dimensions, one individual noticed rising to the height of more than 45 feet, with a girth of 6½ feet. This tree, in its elm-like habit of growth, is in striking contrast with all the other evergreens around. At the end of May the numerous pyramidal erect spikes of flowers give it the aspect of a chandelier studded with yellow wax-lights. In Acadia it has an extensive range, for it is not only abundant throughout the Gulf districts, whence it spreads over to Grand Lake and the Petticodiac River, but Goodale also met with it in Northern Maine, where, however, it is scarce.

Around the shores on the upper part of Kennebeckasis Bay, where the waters are shallow, species of a more southern type grow, such as the Nodding Wake Robin (*Trillium cernuum*),

* *Woodsia Ilvensis* var. *Alpina*, Watt.

the Yellow Violet (*Viola pubescens*), and the two Anemones (*A. nemorosa* and *A. Pennsylvanica*.) The shrubby cinquefoil (*Potentilla fruticosa*) also is very abundant.

There are two other positions in which the species of this type are found in Southern New Brunswick. One, beneath the cool shade of evergreen trees which cover the abrupt hills between this Bay and the sea coast. On the mossy slopes under these trees the sweet Coltsfoot (*Nardosmia palmata*) opens its flowers in early spring; and the Round-leaved Orchis (*Habenaria rotundifolia*) may be found in bloom at a later period. Kalm's Lobelia (*L. Kalmii*) and the spurred gentian (*Halenia deflexa*) intermingled with other Sub-Aretic forms, abound in the open pastures. Other species, such as the swamp chickweed (*Stellaria uliginosa*), for which, like *Sedum Rhodiola*, a station in Pennsylvania is known; the large-leaved Geum (*G. macrophyllum*), and the willow-leaved dock, (*Rumex salicifolius*) have been found at the sea-side, on the borders of salt marshes, near St. John.

Looking at the known range of this type throughout Acadia, we may fairly suppose that the whole of its northern continental portion will be characterized by the presence of the foregoing and other boreal forms; and that these may also be looked for around the whole southern ^{to} height of the Gulf of St. Lawrence. In Insular Acadia it probably ^{occurs} ~~occurs~~ Prince Edward's Island, mantles over the hills of northern Nova Scotia, and in Cape Breton blends with the Sub-Aretic flora of the Atlantic coast.

In the interior of Continental Acadia there is a large area overspread by a group of plants of a more southern type than those we have been considering. West of the Alleghanies they range as far south as New York, Ohio, and the south-west part of the Province of Ontario. Many of them, however, cross the Appalachian range, and are found more or less abundantly in West New England. The valley of the Connecticut River generally limits their range eastward.

This is essentially the type which G. L. Goodale looks upon as characteristic of the Aroostook country. He says:—

"This second region, which we can distinguish as the 'Aroostook district,' is characterized by the occurrence of a different flora. Instead of conifers, we find a prevalence of hardwood trees. Maples, Beeches, Oaks and Amentaceæ form the forests. Under such trees we see flourishing *Dicentra*,

"Claytonias, Adlumia, *Aralia Quinquefolia*, *Solidago odora*; "on the shores of the rivers and their tributaries *Lobelia Kalmii*, *Anemone Pennsylvanica*, and two species of *Vitis*, "*Vitis labrusca* and *V. cordifolia*."

In the following list of Western or Continental species will be found some of those above mentioned; but the range of others is such as to exclude them from this eastern fragment of a flora, which finds its home west of the Green Mountains of New England:—

No. 3.—LIST OF CONTINENTAL SPECIES.

SPECIES.	Upper Plain.	Lower Plain.	Valleys of the Southern Hills.
<i>Dicentra Cana lensis</i> - - - -	S*	....	....
<i>Adlumia cirrhosa</i> - - - -	S*	....	....
<i>Nasturtium palustre</i> var. <i>hispidum</i>	....	....	*
<i>Lathyrus palustris</i> var. <i>myrtifolius</i>	....	....	*
<i>Eriogonum chrysanthum</i> - - - -	....	E*	....
<i>Hippuris vulgaris</i> - - - -	....	....	*
<i>Artemisia biennis</i> - - - -	....	E*	....
<i>Blitum capitatum</i> - - - -	....	W*	....
<i>Listera convallarioides</i> - - - -	....	E*	*
<i>Carex Richardsonii</i> - - - -	....	E*	*
<i>cylindrica</i> - - - -	....	E*	....
<i>Anemone Pennsylvanica</i> - - - -	S*	W*	*
<i>Claytonia Caroliniana</i> - - - -	....	W*	*
<i>Conioselinum Canadense</i> - - - -	S*	....	....
<i>Aralia quinquefolia</i> - - - -	S*	W*	*
<i>Pogonia verticillata</i> - - - -	S*	....	....

Goodale's remarks on the vegetation of the Aroostook country apply signally well to the valley of the main St. John River from Eel River to the southern hills; and represent with almost equal fidelity the aspect of the western and central part of the Acadian Plain, where the soil is deep and drainage good. In approaching the Gulf this type of vegetation gives place to a collection of species having a more northerly range. In the valleys of the southern highlands, in King's County, it mingles with the New England flora prevalent to the S.W., of which several species appear to be rare or wanting along that part of the Acadian Plain facing the Gulf of St. Lawrence.

V. Maritime Type.—The extensive and varied sea-coast pertaining to the Lower Provinces affords ample scope for the growth of maritime plants. On the North Shore, Mr. Fowler has met with more than 30 species, as may be seen by the

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following list, and most of them, with a few additional forms, occur also on the shore of the Bay of Fundy.

No examination, so far as I am aware, has yet been made of the salt springs in this and the neighboring province of Nova Scotia, for maritime plants. Perhaps a few of the species which once grew around these springs, when they were at the margin of the sea, may yet linger there. *Ranunculus Cymbalaria* was collected at Fredericton by the late Dr. Robb, as appears from a specimen in the Herbarium of the University of that city, which is now distant 80 miles from the salt water.

No. 4.—LIST OF MARITIME SPECIES.

Valleys of the Southern Hills.
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SPECIES.	Gulf of St. Lawrence.	Bay of Fundy.
<i>Ranunculus Cymbalaria</i>	*	*
<i>Hudsonia tomentosa</i>	*
✓ <i>Lochea thymifolia</i>	*	*
<i>Honkenya peploides</i>
<i>Spergularia rubra</i> var. <i>marina</i>	*	*
<i>Lathyrus maritimus</i>	*	*
<i>Ligusticum Scoticum</i>	*
<i>Aster Radula</i>	*	*
<i>Solidago sempervirens</i>	*	*
<i>Plantago maritima</i>	*	*
✓ <i>Statice Limonium</i> var. <i>Carolinianum</i>	*	*
<i>Glaux maritima</i>	*	*
<i>Mertensia maritima</i>	*	*
<i>Atriplex hastata</i>	*	*
<i>Salicornia herbacea</i>	*	*
— <i>mucronata</i>	*	*
✓ <i>Obione arenaria</i>	*
<i>Chenopodium maritima</i>	*	*
<i>Salsola Kali</i>	*	*
<i>Polygonum aviculare</i> var. <i>littorale</i>	*	*
<i>Myrica cerifera</i>	*
<i>Triglochin Palustre</i>	*	*
— <i>maritimum</i>	*	*
<i>Ruppia maritima</i>	*
<i>Juncus bulbosus</i>	*	*
— <i>Balticus</i>	*
— <i>Greenii</i>	*
✓ <i>Eleocharis pygmaea</i>	*	*
<i>Scirpus maritimus</i>	*	*
✓ <i>Carex maritimus</i>	*	*
— <i>salina</i>	*	*
✓ <i>Calamagrostis arenaria</i>	*	*
<i>Spartina juncea</i>	*	*
— <i>stricta</i> var. <i>glabra</i>	*
✓ <i>Glycercia maritima</i>	*	*
<i>Hordeum jubatum</i>	*	*
<i>Asplenium marinum</i> *.....	*

* This species is accredited to New Brunswick in Hooker's Flor. Bor. Am.

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Ranunculus Cymbalaria, as above stated, has been gathered at Fredericton. But I am not aware of the existence of any others of the list inland, except the sub-maritime *Aster Rudula* and *Atriplex hastata*.

In concluding this division of the subject, it may be added, that our present knowledge of Acadian botany would lead us to suppose that the *Continental* type, besides occupying the southern half of the Plateau of Continental Acadia, also spreads throughout the valley of the St. John, and its tributaries, to the heart of the Southern Hills, and reappears in the valley of the S. W. Miramichi. That the *Boreal* type lies around it to the north-east, and to the south-east, as far as the outlet of the St. John River. Here it mingles with the few sub-Arctic species which still hold their ground along this coast, and in like manner flourishes in company with these same species, on the low points of land jutting into the Gulf of St. Lawrence. The *sub-Arctic* species form, as it were, a fringe to the general vegetation of the country skirting the shores of the Gulf of St. Lawrence and the Bay of Fundy. The occurrence of an Alpine group in the northern highlands seems as yet scarcely established, since, on the highest of those hills, Prof. Bailey met with but one species which could be referred to this type, viz., *Vaccinium uliginosum*. The *New England* type is widely spread throughout Acadia, but appears to be more especially prevalent in the south-western counties. Several species, such as the Blue-bell (*Campanula rotundifolia*), and Hemlock (*Abies Canadensis*), are reported by Mr. Fowler as scarce or wanting on the "North Shore;" and the Cedar (*Thuja Occidentalis*) appears to be a rare tree in Nova Scotia, and even entirely wanting in most parts of that Province.

SPECIAL CAUSES WHICH HAVE OPERATED UPON THE DISTRIBUTION OF PLANTS IN ACADIA.

Beside two agents, Winds and Migratory Birds, which have had a world-wide influence in spreading vegetation from one region to another, there is a third which, from the important part it has played in modifying the flora of Acadia, deserves special attention. This is the floating ice, and drift-wood of the Polar Current, and of the St. John River.

To form any conception of the vegetation which covered Acadia in early times, we must fall back upon the researches of Geology. As regards its modern botanical aspect, the history of Acadia begins with the Champlain epoch. The clay beds of this period, which cover wide areas in Southern New Brunswick, have yielded no determinable remains of plants, except sea-weeds, which appear to belong chiefly to the Rhodosperms and Chlorosperms, and are of common occurrence in connection with fine clays near the coast. Thus we are left to infer the character of the vegetation from the climatic conditions indicated by the presence of Arctic and sub-Arctic animals in the Acadian seas at the Champlain epoch, and to the known flora of this period in Canada. At Green's Creek, on the Ottawa River, the deposits of this age contain concretions which have gathered around organic remains, such as sea-shells, fishes and bones of the seal. Many of them also contain the remains of land-plants. Dr. Dawson, to whom these relics were submitted for examination, detected the following species of plants: the Norway Cinquefoil (*Potentilla Norvegica*), the Mountain Cinquefoil (*P. tridentata*), the Balm of Gilead (*Populus balsamifera*), the Bear Berry (*Arctostaphylos Uva ursi*), the White Clover (*Trifolium repens*), the Round-Leaved Sundew (*Drosera rotundifolia*), and two kinds of Pondweed (*Potamogeton nutans*), and (*P. perfoliatum*.) Such a group of plants would find a congenial home in that part of Acadia now occupied by the sub-Alpine type of vegetation. Indeed, with the exception of the Bear Berry, they are all known denizens of that part of Acadia laved by the Arctic current. It may be perceived, then, that to reproduce the climatic conditions of the Champlain epoch, it is only necessary to submerge the St. Lawrence valley, and the plains east of the Appalachian range, and admit the Arctic current to sweep freely over these submerged lands. That such was the state of the southern half of Continental Acadia during a great part of the age in question there can be no doubt, the Southern Hills alone standing above the icy current, which swept by on either side. With such physical conditions universally prevalent in this region, the Arctic and sub-Arctic must have been the predominant type of vegetation. As the plains began to emerge during the succeeding Terrace Period, which was one of upheaval, no doubt many Boreal forms were added to those already present in the country.

These additions were largely influenced by the constant play of the Arctic current upon our shores. It acted as a circum-polar distributor of species, and to it the wide range of many Arctic and Boreal plants is evidently due. Entering the Polar Sea between Norway and Spitzbergen, it sweeps round the ice-bound shores of the Old World by Russia and Siberia. An insignificant branch escapes into the Pacific by Behring's Straits, but the main body of the current continues its course through the Georgian Archipelago, and passes into the Atlantic again between Greenland and Labrador. The retarded rotation of the earth throws this current, when entering the Polar Sea, upon the coast of the Old World; the accelerated rotation felt by the same moving mass of water on its southward course causes it to cling to the shores of America from Labrador to Florida, and envelope the eastern part of the British Possessions, which are fully exposed to its chilling influence. The principal body of the current passes southward around Newfoundland, but a branch goes westward between this island and Labrador, through the Straits of Belleisle, and courses around the Gulf of St. Lawrence, as has been already stated.

It is the transporting power of this current as a whole, and of this branch, in particular, which has more directly influenced the vegetation of our country.

Three of the largest rivers in the Old World, and an equal number of those in the New, help to freshen the waters of this great oceanic stream. The Spring floods of the great Siberian water-courses sweep down into it vast quantities of drift-wood and debris filled with the seeds of plants. Many of these are carried onward in the floe-ice toward the American coast, where they receive accessions from the McKenzie River, and in the course of years work their way through the group of islands between North America and Greenland. The Saskatchewan River also contributes its quota of organic relics to the burden borne on the bosom of the Polar current from the Arctic regions of the three continents. The peculiarity of all these great water courses is, that their sources are in temperate latitudes, while their embouchures are in Arctic or Sub-Arctic regions, and thus the waste of vegetation which they bear downward toward the sea, when they are swollen by melting snows, is cast upon the ice about their mouths. The seeds of plants flourishing in the regions from which these rivers flow might thus very readily be

transported in the course of time, upon floe ice and drift-wood, to the north-eastern parts of America.

Accordingly we find little difficulty in tracing back the course of the Boreal and Arctic types north-westward across the Continent of America, toward Asia. Attached to the table of Boreal forms are three columns shewing the range of the species to the N.W., compiled from the late Sir W. J. Hooker's *Flora Boreali Americana*, Dr. Gray's *Flora of the Northern United States* (1859), and a list of the plants collected at Anticosti by Prof. A. E. Verrill. Labrador and Newfoundland are bleak, inhospitable countries, whose flora is but imperfectly known; yet of the three score species of this list, more than one-half have been gathered there. In the St. Lawrence Valley, chiefly in that part of it below the great Lakes and around Lakes Huron and Superior, more than two-thirds of the list of Boreal species occur;—many of these being only known in the far western parts of the Valley about Lakes Superior and Huron, or on the mountain tops of New England and New York. The presence of these species in Acadia is easily accounted for when it is considered that there is a continuous water communication from the great lakes of the interior to the northern confines of Acadia. But it is more remarkable, if we fail to give due weight to the transporting powers of the Polar Current, that all the high Northern forms, with half a dozen exceptions, should be already known as indigenous to the North West Territory, between Red River, the Arctic Sea, and the Rocky Mountains. Moreover, there are three species which, if one may judge from the authorities above quoted, are not known to occur in the interspace between this region and Acadia, or to the N.E. of the latter. These are *Collomia linearis*, discovered by Mr. Fowler on the Gulf coast; *Vilfa cuspidata*, found by Mr. Goodale on the Upper St. John, and *Oxytropis campestris*, gathered by Prof. Bailly on the Main St. John. This list of adventurous emigrants from the N.W. would be largely increased were we to include species which occur in the intervening country only on the mountain tops of New England and New York.

The River St. John appears also to have played an important part in distributing plants throughout Acadia, and a few remarks on its peculiarities may, therefore, not be out of place. This is one of the most considerable of the numerous rivers which take their rise in the Appalachian range, and about one-half of

Continental Acadia is included within the limits of its basin. A connection with the sea, as singular as that of the St. John, is to be found in few rivers (if any) of equal size, on the globe.

The outlet of this river at the "Falls" (or, more correctly speaking, Rapids), is a narrow and tortuous channel, bordered by cliffs and obstructed by rocky ledges. Over this barrier, as is well known, there is a flux and reflux of the tide twice a day; but as the tidal wave must rise fifteen feet or more before it can overcome this impediment, its influence on the river above is comparatively trifling, the water within the barrier not rising more than $2\frac{1}{2}$ feet, while at high tide the level of the water in the harbour is about 13 feet above that of the river at its summer level.

It is not so generally known, however, that during the spring floods the quantity of water poured into the St. John's River, through its various tributaries, is such as to exclude any influx from the sea. At this season of the year the contracted entrance to the river, which at other seasons excludes the rushing tides of the Bay of Fundy (preventing the formation of mud flats, a striking feature in the estuaries of rivers further up the Bay), also impedes the discharge of the spring floods.

These pent up waters are then compelled to spread themselves over the lowlands of the valley of the river, and such affluents as the Kennebeckasis, Nerepis, Washademoack, Belleisle, Grand Lake and the Oromocto. Two extensive, though very irregularly shaped, lakes are thus formed,—the lower one extending, in the form of an oxbow, down the valley of the Kennebeckasis, around Grand Bay, and up the "Long Reach" and Belleisle Bay; the upper one embracing a large area, beginning at the lower end of Long Island, and extending upwards over the low lands lying around the Washademoack River, Grand Maquapit, and French Lakes, and all the interval lands between Gagetown and the Oromocto—submerging also the lands on each side of this river for many miles up. The area of the lake-like expansions of the St. John River, which lie partly among the southern hills, and partly to the northward of them, cannot fall far short of 600 square miles.

During the summer and autumn these extensive sheets of water, which ramify through the southern part of the Province at the opening of navigation on the river, have shrunk to very limited proportions, being represented chiefly by the waters of

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Grand Lake, on the one hand, and those of Grand and Kennebeckasis Bay, on the other.

As the excess of water in the southern tributaries, viz., the Kennebeckasis, Nerepis and Belleisle Rivers, has, to a great extent, been discharged before the "freshet" of the main river rises, the great rush of water down from it causes a reflux into the above mentioned rivers, which second overflow is known on the Kennebeckasis as the "back freshet." This large body of cold water, which does not subside before the first week in June, undoubtedly retards very much the development of vegetation on the lower part of the St. John River. About two weeks after the ice in this part of the river has been discharged into the Bay, that from the upper part (above the Grand Falls) makes its appearance in the harbor, and is distinguished not only by the great quantity of drift-wood and freshet debris which accompany it, but also by its clearness and solidity (hence called the "black ice.") It frequently happens that this second run of ice does not pass the falls, but southerly winds hold it in the still waters above until it becomes liquified by the increasing heat of spring. When this happens the debris and vegetable matter, brought down from the head waters of the St. John, are thus scattered over the shores of Kennebeckasis Bay and the "Long Reach," and the seeds of species once peculiar to the upper part, have by this means been distributed along the lower part of the river.

These annual freshets and their concomitants have undoubtedly effected much in the distribution of species over areas in Central and Southern New Brunswick, which they could only have reached otherwise by slow degrees. It is in this way that I would account for the abundance of many species below the freshet mark on Kennebeckasis Bay, which have not been met with on the surrounding hills, but are common in the interior of the Province. Moreover, there are several species, which are noted by Mr. Goodale, as being very abundant on the Upper St. John (above Grand Falls), which are also met with on the shores of the Kennebeckasis, such as *Nabalus racemosus*, a plant decidedly north-western in its range, the ~~two~~ Primrose, (*Primula farinosa*) and ~~*Pr. mistassinica*~~, which grow in several places along the shore; the latter with its beds of beautiful pale rose-colored flowers (tinting) the gravelly beaches of ~~Dunbar's Cove~~ *this Bay*. To these we may perhaps add the Northern Green Orchis (*Platanthera hyperborea*), and the wild Chive (*Allium schoeno-*

prasum), the latter being frequently met with on rocky and gravelly shores; also *Aster graminifolius*, *Anemone Pennsylvanica*, a ~~very~~ showy plant, with large white flowers, *Nasturtium palustre*, var. *hispidum*, *Parnassia palustris*, the White Silver Maple (*Acer dasycarpum*), the Dwarf Cherry (*Prunus pumila*), the Black Alder (*Ilex verticillata*), one of the Loosestrifes (*Lysimachia ciliata*), the Bracted Bindweed (*Calystegia sepium*), more commonly called Convolvulus, whose delicate white flowers, tinged with pink, present a beautiful contrast to the labyrinth of foliage with which they are entwined; also the Water Persicaria (*Polygonum amphibium*), the Canadian Wood Nettle (*Laportea Canadensis*), *Sparganium racemosum*, and the Canadian Lily (*Lilium Canadense*). Another plant, the "Sweet Coltsfoot," (*Nardosmia Palmata*), if not introduced by birds, probably immigrated at a much earlier period (the Post-Pliocene), as it grows far above the present level of the river.

While many North-Western and Western species have, by the spring floods of the river, or other means, been thrust into the group of species which characterize the coastal zone, others have been held at bay on the St. John River by the cool temperature and damp atmosphere, which prevail near its mouth during the summer months.

From the observations presented in the foregoing pages, the following conclusions may be drawn:—1st, One of the most peculiar features in the flora of the region to which these remarks relate, is the arrangement of several of the types mentioned, in zones around a central tract, due to the refrigerating influence of cold waters on the adjacent seas. 2d, That although there are highlands of considerable elevation in Acadia, they do not appear to exercise a very marked influence on the vegetation, except in so far as they act as a barrier to the oceanic winds. 3rd, That on account of its semi-insular position, and its full exposure to the chilling effect of the Arctic current, the maritime parts of this country have become the home of northern species not found within the limits of New England, and of many others which grow only on mountain tops, or cold, sheltered places, in that part of the United States. 4th, That although the sea-coast of Acadia is thus inhospitable, the interior has a summer climate so warm as to encourage the growth of a group of plants, which the damps and chill winds of the same season exclude from New England; such species being either entirely absent from

that region, or found only sparingly in its warmer western and southern parts.

Judging from what is known of the flora of our country, as compared with that of the Upper Provinces, we may look upon the narrow girdle of sub-Arctic vegetation, which borders our shores, as paralleled by that which extends up the St. Lawrence River as far as the Island of Orleans, and reappears on the north shore of Lake Superior. The Boreal type, which is supposed to cover much of the northern part of Acadia, reappears on the St. Lawrence at and above Quebec, and is also met with around the shores of Lake Huron, and in the northern peninsula of Michigan. The group of plants which has been referred to as a Continental type, characterizes the country around Lake Ontario. Hence, we may look upon the central parts of Acadia as represented in climate and productions by that part of Ontario which lies around the eastern and northern shore of the lake of that name, and extends thence to Lake Huron.

There is an assemblage of plants in the S. W. part of Ontario, which Mr. Drummond designates as the Erie type, and which is said to characterize the region around that most southerly of the great Lakes. Of this type we have, so far as known, no representatives in Acadia. We may assume, therefore, that there is no portion of Continental Acadia, possessing a summer as warm and dry as prevails in the more southerly part of Canada, around Lake Erie. But while a comparison of the climate of Acadia with that of the Upper Provinces may thus be instituted, through the indigenous plants which grow in different parts of the Dominion, it is to be borne in mind that such a comparison relates only to the temperature and other climatic conditions of the summer. In the winter the climate of the maritime Provinces is very much milder; so that, while the valley of the St. Lawrence may be filled with snows to the depth of six feet or more, the southern shores of Nova Scotia may be but sparsely covered, or entirely bare.

Finally, from the known climatic conditions of Insular Acadia, the character of the vegetation, in its different parts, may be roughly predicated. Thus, the fog-wrapt shores along the Atlantic coast are known to support a vegetation similar to that of the southern shores of New Brunswick and Eastern Maine. Further, the Boreal type probably extends along the northern shore of Nova Scotia into the Island of Cape Breton, and may

be expected to mingle to some extent with the sub-Arctic type along the Atlantic coast. The Boreal type may be looked for in force on Prince Edward's Island, fringed, as in New Brunswick, by sub-Arctic forms near the shores. In the central and north-western part of Nova Scotia, a partial recurrence of the Continental type may be looked for; but owing to ^{the} ~~the~~ moister summers, and ~~greater proximity to the sea,~~ ^{maritime position} it is probably more largely mingled with New England forms than it is in the valley of the St. John.

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