Technical and Bibliographic Notes/Notes techniques et bibliographiques

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

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

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

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

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

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

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

Seminary of Quebec
Library

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

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

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

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

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

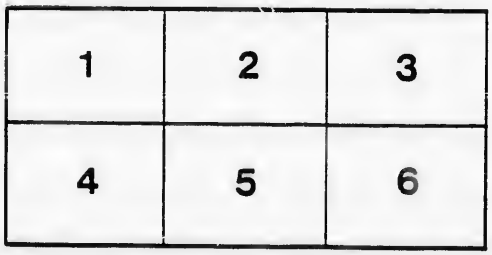
Séminaire de Québec
Bibliothèque

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

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

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

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



HOUSE OF COMMONS OF CANADA.

EXAMINATION OF

JAMES GORDON MOWAT,

BEFORE THE

SELECT STANDING COMMITTEE ON AGRICULTURE AND COLONIZATION,

ON THE

CLIMATOLOGY OF CANADA,

IN RELATION TO

AGRICULTURE AND HORTICULTURE,

21ST AND 28TH AUGUST, 1891.

PRINTED BY ORDER OF PARLIAMENT.

CONTENTS.

Practical value of comparative climatology, p. 3, 8. Climatic variations in Ontario and British Columbia, and the causes, 4, 13, 15. Duration of the Frostless season at various points of observation, 5, 12. Isothermal lines and how they should be drawn for practical guidance to horticulture, 6. Area, in Ontario, adapted to peach growth, 6, 12. Comparative capabilities and areas of the vine lands in Ontario and other countries—wine production per acre, 7, 11. Comparative temperature of European, Canadian and other vine lands, 7, 14. Cotton growing in Ontario, 7, 12. Climatic survey recommended, in the interest of fruit culture, 8, 13. Fruit growing in Nova Scotia and New Brunswick, 8, 12, 13. Smudge fires as a preventative to damage by Summer Frosts, 8. Exceptional climatic phenomena—how best guarded against effects of, 9. Barley growing in Canada, comparative climatic conditions and prices, 9. Climate of the McKenzie River Basin, 10. Semi-tropical fruits which thrive in South-western Ontario, 12. Alberta—climate of, 5, 15. Comparative mean temperature at various points in Europe and Canada, 7, 14, 15. Irrigation, 4, 15, 16. Okanagan Valley, 4, 15. Accumulated material available for a climatic survey of Canada, 15–21.

EVIDENCE

BEFORE THE

SELECT STANDING COMMITTEE ON AGRICULTURE AND COLONIZATION,

ON THE

CLIMATOLOGY OF CANADA,

IN RELATION TO

AGRICULTURE AND HORTICULTURE,

21st and 28th August, 1891.

HOUSE OF COMMONS, COMMITTEE ROOM 46,
FRIDAY, 21st August, 1891.

The Standing Committee on Agriculture and Colonization in session.

Mr. SPROULE, Chairman, presiding.

J. GORDON MOWAT, Climatologist, was called and examined on the Climatology of Canada in its relation to Agriculture and Horticulture. Mr. Mowat addressing the Committee said:—

I have to thank you for the opportunity you have given me to-day, of presenting my views on a matter which I think has a very important bearing on the experimental work so ably conducted throughout the Dominion by our Agricultural Department, and, also, on the interest of the settlers in our new districts, and of the fruit growers of the older Provinces of the Dominion. The matter about which I wish to speak is the application of Climatology to Agriculture. There is a particular necessity for this in Canada. Many of the climates of the old world are comparatively well known, and fruit growing has been carried almost as far towards its colder boundary as it can be. Even in the western parts of Siberia the climate is fully known, and several leading features officially charted; but on this continent we know too little of what our climate really is and to what extent it affects our agricultural capacity.

Origins of the present fruit trees grown in Canada.

Our fruit trees have been brought from the west of Europe, where, for a thousand years they have been accustomed to mild winters, and they are intolerant of the cold of the northern and north-eastern parts of this continent where fruits accustomed to the severe winters of Northern Asia and Eastern Europe would flourish. Our apple trees are more tender than the apple trees of Eastern Russia. Our leading grape, which yields more prolifically than the grape of Western Europe, is a recent development from our wild grape, the *cinus labrusca*. The grape of Western Europe, *vinus vinifera*, will not endure our cold winters; in which respect it is not unlike some of the other fruits introduced from Europe.

The Canadian cultivated grape a native development.

If we knew the many climates of our own country corresponding to the various climates of Europe and Northern Asia, we could put under tribute the whole of the temperate parts of the old world, from northern China

Importance of a knowledge of compara-

tive Climatology to successful fruit growing in Canada.

westwards, and introduce with less waste of effort, and much earlier results, new forms of vegetation that would be profitable to our fruit growers and farmers throughout our colder and more northern districts. We have found out, for example, that the Russian apricot is hardier than any variety we know of on this continent. The apple trees of Eastern Russia are found to be hardier, and it may be that in Eastern Siberia we may secure still hardier forms. It would be well that we should know the exact climate in which particular Russian apples succeed or reach their northern limit. St. Petersburg does not give us the hardiest apples. Moscow has severer winters; while around Nijni Novgorod the Winter climate approaches the severity of Winnipeg, and yet apples succeed there. We can scarcely look for good results from the introduction of apples from St. Petersburg into climates colder in winter than that of Ottawa. St. Petersburg is not colder in winter than Ottawa; but the district of Nijni Novgorod, much further south than St. Petersburg, compares with our winter climate about as far north as the Height of Land.* There is another reason why the climate of Canada should be investigated in detail. The Province of Ontario has a larger variety of local climate than any other level country of similar extent on the face of the globe. This is owing to the action of the great lakes and also to the small lakes, which exercise a very important local influence. We have between the north shore of Lake Superior and the north shore of Lake Erie as great difference in the mean temperature of winter as there is between the mean winter temperature of the shore of Lake Erie and the shores of the Gulf of Mexico. We have summers as cool as those of the north of Scotland, and summers as warm as those of central and much of Southern France; summers as warm as in the north of Italy, and warmer than the coast of Portugal are found in some parts of southern Ontario and British Columbia. It may be easily seen how we could lay Eastern Europe under tribute to us, from the fact, that Bucharest in Roumania has a temperature differing but little either in summer or winter from that of Toronto. That is the country from which we might hope for the introduction of valuable varieties of millet and other grains as well as fruits. It is a country which has developed agriculture considerably, and its productions are well worthy of being considered, because of the similarity of the climates of much of South-eastern Europe to that of a part of Canada.

Climatic comparisons.

Climatic varieties in Ontario and the causes.

Variety of climatic conditions in B.C.

British Columbia is another country which shows a very remarkable variety of climate, apart, even from its differences in altitude. At the experimental farm at Agassiz, which fairly represents the coast climate of the lower Fraser, the summer is that of the south or the middle of England—and the summer is a good long one of about 200 days between the last killing frost of Spring and the first frost of Autumn. Ninety miles further up the Thompson River we have a summer a little cooler than that of Cincinnati, and warmer than the summer of Los Angeles in Southern California. The excess over Agassiz, in July, is 14 or 15 degrees. The ordinary winter is not too severe for the peach and vine. Further up the river, in Kamloops, the weather is a little colder, but still the peach is grown. The very small rainfall is a drawback in the Thompson Valley, still irrigation is managed along that river at a cost often not exceeding $2 per acre. Southern California, famous for its great resources in fruits, entirely depends on irrigation. Of the Okanagan Valley we know too little. There are few records of climatic observations, and very little is known of its capability for various agri-

* "The Height of Land"—the ridge which separates the great water-shed of the St. Lawrence, to the North and East, from the slope facing Hudson's Bay.

cultural productions, except from the inadequate reports of travellers and recent settlers. We can guess somewhat of the nature of its climate from the fact that its level above the sea is not higher than Guelph. The Arrow Lake and Kootenay Valleys are but slightly higher. The Okanagan Valley has a breadth of arable land of twenty-six miles in some places. Its climate varies exceedingly. Into one part of the valley, probably sufficient of the moisture of the Pacific penetrates to allow farming to be carried on without irrigation, while other parts are largely excluded by intervening mountains from its rainfall. One part, owing to local topography, may escape very severe extremes of cold in winter, while other parts, owing to the neighbourhood of wide plateaus in the direction of the cold winds, may have short periods of cold almost as severe as those of the North-West. There is some reason to hope that some parts of that valley will be found capable of growing the peach and the vine. How far fruit culture can be carried eastward from the coast, we do not know, but there are the means of ascertaining in the consideration of topographical conditions as well as in the investigation of perhaps thirty or forty records, taken at different times, to enable us to arrive at valuable, and often accurate, determinations as to the climatic capacity of inland British Columbia. Were the climate of the inland part of British Columbia, south of the line of the Canadian Pacific Railway studied, the evidence afforded of agricultural capacity would be a revelation to the people of Eastern Canada. Besides its valleys, very much of this region is under an elevation of 1,600 feet—the height of northern Grey, in western Ontario—and there are further large areas which do not reach up to 2,000 feet. In many places, especially where irrigation is practicable, we could hope for more or less profitable agriculture, and we could certainly hope for a great deal from fruit culture.

Plateaus of B.C.

Every one at all acquainted with Alberta knows that, there, a large variety of climate exists. In fact a very considerable section of the Dominion has, in greater or less degree, marked differences of climate. In illustration—at Moose Fort, nine miles from James' Bay (on the average of four years, for which I have made comparison of the length of the frostless season), there is an interval of 111 days between the last descent of the mercury to 32 degrees in spring, and the first descent to that point in autumn. This period is fourteen days longer than at Beatrice in Muskoka, three days longer than at Stony Mountain, Manitoba, and six days longer than at Port Arthur, and, combined with the average temperature of the growing season, indicates a considerable agricultural capacity. The influence of James' Bay, which being very shallow is covered with ice in winter and warmed by the sun in summer, is to retard the spring, and prolong Summer and Autumn. The first fall to 32 degrees, at Moose Fort occurs on the average not until 28th September. Large differences exist in the length of the frostless season in the comparatively level area of peninsular, Ontario. There are differences of about fifty days within fifty miles. At Woodstock the season between frosts (of 32 degrees) averages only 127 days. At Stratford, higher and more to the north, and also more within the influence of Lake Huron, the average is ten days longer. At Hamilton the period is 176 days, at Windsor 172 days, and at Pelee over 200. In Quebec there is a difference between Montreal and Cranbourne, in the Eastern Townships, of sixty-four days. Sometimes in Ontario the width of a township, or even a distance of less than a mile, separates localities which, though sometimes nearly alike in their general temperature, differ a fortnight or even a month in the length of their frostless periods, and therefore differ very greatly in their capacity for growing certain vegetables and varieties of fruit

Climatology of Alberta.

Comparative duration of the frostless season, at various points of Canada.

Important effects of differences in length of the frostless seasons, upon local agricultural productions.

and grain. Differences such as these—differences even of a few days—often control the ripening of new wood, and the question sometimes of whether or not a particular variety can on the average be cultivated with success. It is evident, therefore, that they should be considered in their relation to growth of varieties of fruit and grain. By fixing, with as much precision as possible, the Isotherm of the growing season, the length of the period between frosts, and the extremes attained of winter cold, you would know if you could grow a particular variety of the apple, vine or peach in a particular locality having certain conditions of climate, you might expect it to succeed on suitable soils, wherever else similar climatic conditions were mapped out. Readily, all over the country, the northerly or rather the cold limit of successful culture of any variety dependent on climate, could thus be ascertained. Besides aiding the experimental work of the Government, it would aid our farmers and scientific fruit growers and save a very large amount of disappointment and wasted or misdirected effort. The excellent service done by the Fruit Growers' Associations could be greatly increased beyond present possibilities, because the work of testing varieties and their suitability to locality could be conducted on an intelligible basis instead of with the uncertainty and sometimes misconception that must exist now. The associations at present have only a vague idea of the differences existing between our local climates, and it is very important to facilitate their work by affording them definite information as to these differences.

Effect of misconception of climate upon growing of certain fruits.

Peach culture has been neglected in some localities, through a misconception as to the proper varieties to plant in particular climates, and the general capacity of Western Ontario for this fruit has been underestimated. So far as climatic conditions are concerned, there is reason to think that on suitable soils, the cultivation of some variety or other of the peach is possible over an area in Ontario of nearly 9,000 square miles. The Crawford, which requires a mild climate, is grown along the shore of Lake Huron, and even on the south shore of the Georgian Bay. Inland, as in the Grand River valley, below Galt, where the Crawford fails, orchards of hardy, white-fleshed varieties flourish. A knowledge of peculiarities of local climate would enable farmers to grow this fruit with success in very many inland localities instead of concluding, as has been concluded in very many instances, that because a variety has been tried by some one and has failed, the local climate is wholly unsuitable for peach culture.

Inadequacy of ordinary isothermal lines to local requirements and conditions.

The ordinary isothermal line, drawn with a free hand, is useful in its way, but inadequate for the science of the fruit-grower or experimenter. To be of greatest utility, isotherms should bend and twist with the topographical features of the country, the neighbourhood of lakes, &c. The length of the frostless season should be indicated by lines, and the average and extreme winter cold should also be indicated. With our leading fruit districts mapped out in this way, fruit-growers could also determine accurately what varieties of fruit to grow on certain soils in certain localities, and experimental work could be conducted, not only with greater efficiency, but with much greater economy than otherwise would be possible. Determination as to the best varieties to be grown could be reached quickly, instead of requiring the waiting for a long process of years of testing, and after all encountering failure and disappointment of fair prospects through those occasional extreme irregularities of the weather which climatology could indicate as features of the climate.

Available materials for correct clima-

For mapping the climatic conditions in several large and important areas of the Dominion, there is abundance of material accumulated. For remote parts, where meteorological information is more or

less scanty, there are considerations of topography and measurable influences known to climatology, that would aid in arriving at valuable approximate conclusions. There are probably between 300 and 400 localities where records are or have been made for the meteorological service. Some of the information needed for agriculture has been published, but requires reduction to a common basis for comparison; other information, such as the length of the frostless season, could be obtained by investigation of the unpublished records. tic mapping of Canada.

The great capacity of parts of Canada for fruit growing, and the great present development of the industry, and its greater future possibilities, urge the wisdom of the investigation suggested. As to what might be done in the development of some of our fruit industries, and as indications of our capabilities in fruit growing, I may mention, that from personal examination of our vineyards I have found that the average yield per acre of Ontario vineyards planted with our common Concord grape, is about two and a-half times as great as the yield anywhere in the Old World. The average yield of French vineyards from 1852 to 1872, before the phylloxera prevailed, was about 199 gallons per acre. In no country in Europe, nor at the Cape nor in Australia, is the average above 240 gallons. The average of the Concord vineyards of the Niagara and Lake Erie country is about 650 gallons per acre. This grape is considered in Europe an excellent claret grape and has been largely introduced from America. In four departments of the south of France there are 600,000 acres planted with the Concord. It was introduced from America as a stock for grafting because it was phylloxera-proof, but the growers soon found that it yielded wine of as good a quality as the European grape and more abundantly. In Portugal, too, they are now cultivating it freely. So successful has this grape been that it promises to become the principal claret grape of the world. I mention these facts to illustrate the great capability of Ontario for fruit. We now produce about a million gallons of claret besides a large quantity of sweet wine. It is not improbable that within a short time, if the requisite care and attention are paid to developing this industry, the export of Canadian wine may rival in total value—and may far exceed in total profit—our cattle and cheese exports combined. Several of our vine growers are making dry wines well adapted in point of quality to secure a large demand in the British market. It is important not only for the fruit growers but for the sake of encouraging the immigration of farmers, that our climatic capacity for fruit growing should be known. The impression produced by publishing the actual facts of the case in Europe would be distinctly favourable in disabusing the minds of British farmers, of the misconceptions entertained in regard to Canada. A country that grows the vine is associated in their minds with the sunny lands of Europe. It is of interest to notice that at Vevay (near Geneva) one of the wine producing centres of Europe, the mean temperature of the summer season is about that of much of Muskoka; Vienna which is in a wine country and further south than Tokay, one of the best wine districts in Europe, has a mean temperature (66.4 deg.) for the five warmest months, exactly the same as Hamilton, Ontario. Windsor, Ont., (67·3) and Spence's Bridge, B.C. (68·1) have summers still warmer. Superiority of large districts in Ontario, for grape growing as compared with leading vine lands of Europe, in the quantity of wine product per acre. Comparative Climatology of European and Canadian vine lands.

Cotton has been grown on Pelee Island for 20 years and without the special manuring given in the back parts of the Carolinas, to mature the crop before the frost comes. Pelee has a longer frostless season than much of the inland portion of the Southern States. Facts such as these Cotton growing in Ontario.

* Pelee Island, situate in the West end of Lake Erie. The Island is 9 miles long by nearly 5 miles wide, and distant eight miles, south West, from Point Pelee in Essex county, Province of Ontario. Latitude 41° 46 North—, Longitude 82° 39 West of Greenwich.

are encouraging to fruit growers in Canada and should help to counteract a tendency to underestimate our climatic capacity.

Method of obtaining reliable climatic information in Canada, local and general.

I may now briefly summarize some of the features of the work which I suggest should be undertaken in the application of climatology to agriculture. There should be a sort of climatic survey made of the whole Dominion, taking into account the average temperature of the growing season, the length of time between the last frosts of spring and the first of autumn; the average rainfall, the average and occasional extremes of winter cold, and such other conditions of local climate as have a direct bearing on agriculture. The large amount of meteorological data accumulating for many years in the meteorological office would furnish a basis for this work. Railway surveys could aid. So also elevation and many other considerations of local and general topography, such as the existence of small lakes, mountains, cold producing plateaux, the direction of the axes of valleys and the character of their surroundings, etc. The records could be supplemented for our remote and northern districts by correspondence with Hudson Bay posts, and with missionaries and others, so as to arrive at valuable tentative conclusions for such regions as have sparsely supplied observations.

The apple growing region in Nova Scotia.

Subsidiary to this general plan, should be an investigation of the climatic capacity of our principal fruit Provinces and districts. In Nova Scotia, for instance, the Annapolis valley has been producing by far the greater proportion of the apple crop of the province, but there are many other parts where, on suitable soils, the climate admits of apple growing with equal or nearly equal success. There is reason to think from a consideration of the climate, that over a wide area across to the Atlantic coast, and almost as far south as Yarmouth, most varieties of the apple, on suitable soils, could be grown almost as well as at Annapolis.

Climate of Quebec.

The climatic capacity of the Province of Quebec is very much underestimated. The Lake St. John district has capacities which are not fully realized in most parts of Quebec, and scarcely at all in Ontario. The country north-east of Lake St. John, which a railway is very likely to traverse before many years, has a warmer climate than might be supposed possible at first glance, from the temperature which prevails along the shore of the lower St. Lawrence.

Peach and vine regions of Ontario.

There should be an investigation made of the peach and vine climates of Ontario, and of the local climate of Northern Ontario where little lakes exist, on the southern and eastern shores of which the frostless season is sometimes three weeks to a month longer than in the lands at only a short distance away. A difference of from ten days to two weeks in the frostless period usually exists between the western side and the eastern side of a small lake. The east and south sides have a longer season, because they are away from the north-west winds. By taking advantage of these little lakes, the culture of a particular fruit or variety of fruit might be extended, in spots beyond its general limit, and thus add to the resources of the settlers of our colder districts. We can possibly extend the cultivation of some varieties of tree-fruit up to the height of land.

Practical precaution against local summer frosts.

Another thing that might be investigated is the utility of smudge fires. Smudge fires are not much used in England, because after the time that the first severe weather occurs the temperature is usually too low to allow further gardening; but in the interior of Europe the climate is very much the same in respect to the occurrence of frost as on the continent of America. We generally have in September or early in October, one or two nights of frost that would kill tender vegetables, such as tomatoes, and yet afterwards there are two or three weeks of warm weather which would admit of gardening being carried on if the previous

frost had not killed everything worth growing. On the continent of Europe smudge fires are used to prevent these frosts. A smoke so thin that it does not hide the stars should sufficiently check radiation of heat to maintain the temperature on the surface of the ground six or eight degrees, and that is usually sufficient to save gardens from early frost. There are conditions in the North-West and in Ontario in regard to temperature, from which one may judge of the approach of frost. In Western Ontario when the mercury is as low, at six o'clock, as fifty degrees, on a calm, clear evening, at least a light frost on the following morning may be expected, while in the North-West probably a higher temperature at that hour would allow for a frost before the following sunrise. I think that test of the effect of smudge fires would show results that could be put to practical account by market gardeners, and even by farmers in the North-West and Manitoba. Of course there would be a great deal of trouble in dealing with large fields, but smudge fires could be easily applied in preventing damage to orchards, hop yards and gardens, and in preventing destruction of blossoms by the later spring frosts.

Exceptional circumstances unfavourable to orchards.

Another matter worthy of investigation is the prevention of damage to orchards by long continued periods of unfavourable weather. There was such a period between 1879 and 1882. Unseasonable winter weather broken by severe frosts occurred, and also extreme heat and drought in the summer of 1881. The rain-fall, for years, was less than usual. These general conditions obtained from Arkansas to Ottawa, and from Chicago to New Jersey. Over this large area, yellows subsequently prevailed in the peach orchards, dry rot attacked the vines, the apple and other trees suffered from premature decay, and fungus growths played havoc with the plums. The rule holds in plant life as in animal life, that if a plant is weakened in vitality it becomes subject to parasites. We can recognize the occurrence of these conditions of weather, almost every year, in some part of the country or another, and could advise the farmers where particularly unfavourable conditions are noted at any time, to specially cultivate their orchards and thus prevent the destruction of many trees or mitigate at least the effects of the bad weather.

I think, that in connection with this work, articles inserted in British agricultural and other journals, descriptive of our fruit industries and containing suitable climatic comparisons presented in an attractive way, would be useful in inducing British farmers of means to emigrate to older Provinces as well as to the North-West. The price of land in Ontario might thus be enchanced by showing the real facts in relation to our climate and its capacity.

Comparative climatic conditions for the growth of Barley in Canada and Europe.

There is another question worthy of mention in this connection: that is, our capability for growing two-rowed barley. We have been experimenting with seed from England—from a cooler and moister climate than our own. It is objected to two-rowed barley that our summer is too warm at the time our barley matures; others say that our climate is too cold and the season too short. The Saale barley is grown in a warmer climate than that of England, and yet it is better than the English barley. Some of the Austrian barley districts are warmer than the Saale valley, and correspond in climate with some parts of Ontario; yet the best barley from these parts of Austria has brought an average, for years, of over $1.20. It may be that by an examination of the climates of the great Austrian barley districts and of the Saale country we could find parallels in various parts of Canada—probably in parts of New Brunswick and portions of the eastern townships as well as further west.

By Mr. Watson:

Q. What is the price of the two-rowed barley you are referring to? —A. $1.40 has for a long time been the average for the Saale and $1.23 for the Austrian barley.

The determination of whether we have barley climates corresponding in essential conditions with those of the best barley districts in Europe, would do much to an early and profitable determination of the course, farmer in various parts of the country, should pursue in regard to barley growing. It would, in these districts, lead to earlier and fuller utilisation of the advantages the British market can afford. This would be the case especially where the weather during the past few seasons, testing the seed, has been less favourable than usual and has resulted in grain somewhat inferior to that most in demand in Britian. In the selection of seed grain of varieties best adapted to the various two-rowed barley climates, the investigation of these climates and their correspondencies in Europe is important. This investigation also possesses a general commercial importance to the country at large as well as to the farmer. It may be that some of our barley countries will be found adapted climatically to the growth of two-rowed grain, while others are better fitted to continue cultivation for the United States markets.

In view of contemplated railways and other developments in the country between Manitoba and Hudson's Bay, between Sault Ste. Marie and Labrador, and in the Mackenzie River Basin, it might prove of advantage in guiding Parliament as to land grants that may be asked, as well as in the general railway policy, if such agricultural resources as these regions possess should be measured from the standpoint of climatic capacity. The summer climate very rapidly improves in receding southward and westward from the chilly shores of Hudson's Bay; and there are climatic reasons for thinking that the country eastward of Lakes St. John and Mistassini, is richer in agricultural resources and in climatic capacity than is popularly imagined. A demand has been made on the Government for an exploratory survey of the Mackenzie River basin where the climate is known to be mild compared with equal latitudes to the eastward. It would, in a measure, satisfy the public demand, if an investigation of the agricultural capacity of the climate of that great valley were made. Climatic records, correspondence with missionaries and others would shed much light on the varying agricultural resources of the valley, and determine whether in its milder parts, wheat and other grains might be profitably grown. In regard to all the regions mentioned, it would throw light in a large measure on how far a population connected with railways or other enterprises could depend on local supplies for subsistence.

Climatic determination of the Mackenzie River Basin.

There are other things connected with the application of climatology to agriculture and fruit growing, which, had time permitted, I would have preferred to mention. I thank you for your patient attention to my remarks which are, owing to the lateness of my hearing of the meeting of the Committee, not presented in as compact form as could be wished. I think the work proposed, in saving of expenditure to the Government, in economy in and better direction of experimental and agricultural work all over the country, would much aid in the proper direction of fruit growing generally, and of tree planting in the North-West. It would have the profitable result of preventing much waste of money and effort by farmers and fruit growers, and, especially in the newer portions of the Dominion, of directing attention to, and encouraging the settlement of excellent districts which would otherwise remain long undiscovered, and of preventing disappointment and waste of effort through mistaken judgment as to the capability of particular districts.

By Mr. Ferguson:

Q. You drew attention to the comparative value of the Canadian and French grape, and their wine producing power. I understand that the greater richness of the Canadian grape largely depends upon the quantity of saccharine?—A. The amount of saccharine in the grape is chiefly governed by the heat of the season.

Q. Is it not true that the quantity of sugar largely depends upon the brightness of the sunshine during the time when the grape is maturing?—A. Both in Ontario and on the Rhine, vine growers look upon a hot August as important in securing a good and strong wine.

Q. What I wish to know is whether we have a better growing period in summer—towards the end of summer—for the grape, than they have on the Rhine?—A. Yes; and we have a further advantage. In the central and northern parts of Europe cloudy and often rainy weather sets in about the middle of September. In Canada it does not begin till October—generally late in October. The early cloudiness means delay in the maturing of the grape, and the rains involve the washing away from the grape of the "bloom" which is a species of yeast plant, and thus fermenting proceeds more slowly and less satisfactorily. Along the Rhine where they produce hundreds of millions of gallons of wine per annum, the grape thoroughly matures, on an average, only once in three years. Frosts occur even as early as August. It is a very common thing for vine growers to pick off green berries before throwing the bunches into the vats. The conditions of summer on the Rhine are inferior for grape growing to those on the lower Ottawa. There are in Ontario and the St. Lawrence valley, nearly 30,000 square miles of territory climatically adapted to grape culture. In France 5,000,000 acres are devoted to grape growing and 1,000,000,000 gallons of wine are produced, yet the climate of the most of France is not more suitable for the production of wine than that of a considerable part of Ontario. The best wine climates are between a mean temperature of 64 and 73 degrees for the three mid-summer months. Our wines are stronger than the Rhine wines and many of the wines of central France, owing to the great heat of our summer. Excepting in western New York and in the northern tier of counties in Ohio, the United States nowhere east of the Rockies, is as well adapted for the grape as southern Ontario. In the Ohio valley the heat and moisture are too great and mildew plays havoc with the vineyards. Southern California is not better adapted for clarets, than Southern Ontario.

Comparative wine producing resources of Germany, France and Canada.

Temperature and comparative qualities of wine products.

COMMITTEE ROOM, 16,
FRIDAY, 28th August, 1891.

The Committee on Agriculture and Colonization in session.

Mr. James Gordon Mowat was recalled in continuation of his examination at the last preceding meeting of the Committee, on the Climatology of Canada. In response to the invitation of the Chair, to proceed with his remarks on the subject under review,

Mr. Mowat said:

Mr. Chairman and Gentlemen,—At the last meeting of the Committee, in a rambling way, I covered a good deal of the ground that I might otherwise have had to take up to-day. Many here have heard that evidence, and it is therefore unnecessary to repeat it. But I wish to call attention to a few facts in regard to Climatology that I perhaps did not bring out fully then. I proposed that a Climatic Survey of the

Dominion be made. We have a Geological Survey and it answers a useful purpose, but in a country so much given to Agriculture, with such great agricultural possibilities before it, a climatic survey dealing with the agricultural capacity seems only second in importance to a geological survey. The reasons for asking for a survey are: That our climate differs remarkably within very short distances. In southern Ontario, for example, the frostless period—that is the season between the last killing frost of spring and the first killing frost of autumn—varies 50 days within a distance, sometimes of 50 miles. That 50 days implies a large range of climate, a vast range of possibilities in the growth of varieties of fruits. A single degree in the mean temperature of summer, and a single week in the average length of the frostless season often determines whether a particular variety of fruit will succeed or not. Some of our apples that cannot endure the climate of Ottawa succeed admirably along the St. Lawrence river. Some varieties that will not flourish on the uplands of Grey, succeed two miles below, along the borders of the Bay. We have an illustration of the difference of climate in the Beaver Valley—a valley running southward from the Georgian Bay through the uplands of Grey. Twenty miles inland, even the peach is known to succeed. The peach succeeds with difficulty at Toronto, but we have it in the interior of Grey, owing to local peculiarities. If we wish to take advantage of our immense fruit and agricultural capacity, it is important that we should know what these peculiarities are. Woodstock has one of the shortest frostless seasons in south-western Ontario: there are only 127 days between the last spring and the first autumn descent of the mercury to 32 degrees. This is the average of four years. Hamilton, again, has 176 days of a similar period, and Pelee Island has no fewer than 200 days. On that island the last killing frost of spring occurs about the middle of April, and the first killing frost of autumn not until November—giving nearly seven months of a season almost entirely free from frost. The differences in vegetation from parts of the inland counties in consequence of the long period for growth is remarkable. In the corner between Lake Ontario and the Niagara River, protected not only from the north-west winds but the due west winds, the fig and the almond are grown a little and succeed with very slight winter protection. The fig tree bears abundant crops. I have seen almonds grown that will compare with the fruit sold in the stores; while figs grow well and ripen in August and September. At Pelee Island, cotton has been grown for 20 years without special manure. The guano which is used in parts of North Carolina is not needed here. Sorghum, both the Chinese and the Orange from South Africa, grow admirably in south-western Ontario, especially in Essex. All the species of the Magnolia known on this continent, but one, grow in southern Ontario. These are illustrations of what the extreme capacity of our climate is on the warm side. The peach, as I remarked the other day, could be grown on suitable soils over 9,000 square miles of Ontario; the Crawford peach of course over a much smaller area. The Crawford is grown, however, along the shores of the Georgian Bay, from Thornbury or Meaford up to Owen Sound. It is grown along the coast of Lake Huron and here and there for a short distance inland, and the hard white fleshed varieties of the peach succeeds even near St. Mary's and up the Grand River to near the town of Galt. Some variety or other of the peach may be said to be capable of cultivation over a great part of the western peninsula of Ontario. Possibly in some favourable situations, on sunny slopes, the peach may succeed on a limited scale—perhaps nearly a commercial scale—in Nova Scotia. In the Annapolis valley and inland, a little back of Yarmouth,

Differences in length of the frostless season, locally defined.

Remarkable variety of fruit products.

Extent and boundaries of the vine and other fruit lands of Canada.

we may hope to find—judging entirely from climatic considerations—some areas where varieties of the peach may be grown a little, especially those varieties that do not require as great heat as the Crawford. In British Columbia the peach climate includes many favourable situations on the eastern side of Vancouver Island: (the other side is too wet,) and the low lands at the mouth of the Fraser; also probably the Thompson valley. The records of temperature show that up the Thompson valley are climates—as far at least as summer is concerned—better adapted for peach culture than those of the coast district or than much of southern California. For the vine, the area capable of growing it in Canada, with equal success, extends from a little above Quebec, over a large part of Ontario; south of the 46th parallel. In part of New Brunswick—in the interior—it would also succeed; with the trouble taken that is common in Ontario and Quebec, of laying the vines down in winter. There are other sections in the Maritime Provinces that could grow grapes with profit, but to a lesser extent than the most favourable parts of New Brunswick. The best grape climate in British Columbia is not on the coast, but in the interior. To the interior we have reason to look for a large—perhaps the largest—proportion of the fruit that will be sent from British Columbia to the North-West Territories. The coast climate will produce good fruit, possibly a little inferior in flavour; but in the interior, we may, I am inclined to think, expect better flavoured fruit. Irrigation will be necessary in most of the inland parts where it is grown, as it is in southern California.

As to the differences of climate that make this Climatic Survey desirable, we will return to Ontario again. Small lakes are found over the northern and eastern parts of the Province of Ontario. In regard to differences of temperature near these lakes, a distance of six miles, with only little difference in elevation, produced in one case a difference of 30 days in the frostless period—the figures being 127 and 97 between the two stations compared. The season in the neighbourhood of the lake was the longer. The west sides of lakes in eastern Canada have not so long a season as the east or southern sides. This is owing to the fact that our frosts generally occur from the west and north-west. The water in these small lakes becomes heated up by the summer sun; this lengthens the autumn season, admitting of the ripening of new wood in many varieties of fruit trees that would fail in average situations in the country around. We may hope by knowing what these peculiarities are and mapping them out, to extend fruit growing along the margin of these lakes considerably beyond the present northern limit, and in that way add considerably to the resources of settlers in our northern and eastern counties. A suggestion may be made towards the utilization of some of the differences of climate. The ripening season of the strawberry, in much of Ontario, is pretty well over in the early part of July, but along the north-eastern and northern shores of Lake Superior, the summer is so cool that the berry ripens according to locality at various times in August and later. Settlers in these parts of the country might easily obtain, were the trade organized, a considerable increase to their income by the shipment of strawberries. Advantage has been taken of differences in climates in New Brunswick and along the shores of Gaspé, to such an extent, that St. John and Boston are receiving shipments of strawberries two or three weeks later than formerly. In the north of Scotland a like variety in the time of berry-ripening prevails. That in Ontario we have a greater variety in the ripening season of this berry—over two months—is not to be wondered at when we find the climate on the north shore of Lake Superior differing in mean temperature both in

Causes producing climatic differences in contiguous localities.

summer and winter, from the climate of the Lake Erie shore, as much as the climate of Lake Erie differs from the climate along the Gulf of Mexico.

What the value of the far northern wilds of Ontario is we do not know. A great bog is said to exist over much of the interior but at Moose Fort, nine miles up the Moose River, the mean temperature of summer is about the same as in the north of England; the July a little warmer. The fall is warmer than at Winnipeg; the spring is later and colder. The mean length of the season between killing frosts is 111 days, or six days longer than at Port Arthur, and fourteen days longer than at Beatrice, near Lake Muskoka. That fact, combined with the general temperature and season, would indicate a considerable agricultural capacity in that district. It is well to know what the capacity of far northern Ontario is, as railways are projected and very likely to be carried through, before long, to the shores of James Bay, perhaps to tap the alleged coal fields. It is important, too, that we should know something of the climate of northern Ontario and Quebec along these lines. As to the climate away to the north and north-east of Lake St. John, there are reasons to think that the temperature, owing to the vastness of the Labrador peninsula, has warmer summers than is popularly imagined. The cool shores along the River St. Lawrence give no indication of the real heat of that interior, and the probability is that the summer there is much more favourable than is commonly supposed for the growth of vegetables and perhaps common grains, the supply of which would be a partial means of livelihood to settlers who may be drawn in there through spruce lumbering, railway or mining industries. British Columbia affords the most forcible illustrations of large differences in climate within short distances. Take the case of Agassiz and Spence's Bridge on the Thompson River. The distance between these two places is about ninety miles. The summer of the former place has a mean temperature a little over sixty degrees in July, while at the latter the mean temperature is seventy-five degrees. This is very nearly the temperature of this month in Cincinnati about the same as at Philadelphia, higher than at Jerusalem or Syria, and only three degrees short of Alexandria in Egypt. At Spence's Bridge the month of March is as warm as April in Toronto; and the month of April as a Toronto May, and the month of May has almost exactly the same mean temperature as a Toronto June; the season is very long, fully five months without frost, and over seven months of growing weather. The winter season is very cold—about the temperature of Kingston in Ontario,—but with this difference that in ordinary seasons the thermometer falls little—sometimes not at all—below zero. It may be that in portions of the valley near this station at very long intervals—intervals of many years—frosts occur that will interfere in some measure with the successful culture of the peach; in regard to this the evidence is not yet quite clear. Okanagan valley has an elevation of about 1,000 feet, or less than a large part of the midland counties of Western Ontario, or of Grey, where the altitude rises to 1,600 or 1,700 feet. The valley is exposed to occasional hot winds from the interior of Washington territory, but the climate is, in its main characteristics, much the same as in the Thompson valley, though probably differing much in different parts of the valley on account of the surroundings. From wide high plateaux which touch the borders of the valley here and there, the cold produced by radiation may pour, under the influence of certain winds, into the valley and produce locally a cold extreme not found in other portions of the valley. The Arrow Lake Valley and the Kootenay Valley have an elevation but

little higher than that of the Okanagan; it is important that the peculiarities of their climatic capacity should be known. Settlers are pouring into the Okanagan country, and unable as they must be, with but a few years of personal experience, to judge of the capacities of the climate, they may make serious mistakes of various kinds in agriculture. They may, for instance, be misled by the ordinary temperature of the winters and make serious mistakes in the planting of fruit trees in situations, which, owing to the surroundings, are unfavourable, and neglect other situations where owing to different surroundings fruit growing could be carried on with success. Illustrations are quite familiar both in Canada and the United States, where the middle slopes of a valley are climatically more favourable to fruit growing than the flats above and the valley beneath. In other cases again the plateau is the most favourable, and still in other cases the valley. This is governed largely by the direction of the valley with respect to certain winds and also by various other circumstances and local surroundings. In British Columbia, if in the direction of a cold movement of air from the north or north-east there exists near by, a narrow plateau or mountain range, the cold would not be nearly so severe as where the plateau is of wide extent and great elevation. There are very many circumstances of local topography which have to be taken into account in aiding in the determination of the peculiarities of local climate or in supplementing the meteorological records. Two valleys or two portions of the same valley at similar elevation may possess very different climates. Where there is a small mountain range in the direction of the prevailing winds, a valley is not liable, other influences being equal, to so great cold as where there is a wide elevated plateau in the same direction. This difference, as I have said, may be found in different parts of the same valley; the climate differing radically according to the character of the surroundings. Wherever these peculiarities exist they would have to be taken into consideration in the mapping in detail of the climate. To the climatologist the influences of surroundings are largely measurable. Analogies derived from all over the world permit a climate so varied as British Columbia's, with even meagre records to be so investigated as to afford valuable considerations to the farmer and fruit grower. In Alberta the climate varies almost as much as in the interior of British Columbia, though generally the valleys, owing to their greater elevation, are colder. I think that much may be done in ordinary agriculture in some of these valleys—those in which the surroundings are such as to indicate favourable climatic conditions, and less of summer frosts than usual. This is a matter for test and future investigation. Along the slopes of the Rockies the rainfall is sufficient in some of the valleys for agriculture without the aid of irrigation. This is true also of much of the plain country, for the rainfall, although light, is usually well distributed over the early summer, and dew is often abundant at night in some localities. There is a part of the North-West lying in the district of Swift Current and Medicine Hat that probably will require irrigation for the successful prosecution of agriculture; but perhaps very little need be said of this at present as with so large a surplus of free and cheap land elsewhere, irrigation is somewhat premature. But the time will come when the country will demand irrigation, for irrigation will be a necessity, if good crops on the average, are to be hoped for in this large section of the North-West. It is in place for me to state here that this portion of the North-West has a warmer summer than Manitoba, and a decidedly warmer average for the year. Medicine Hat is the warmest meteorological station in the North-West—with a July mean of over 67 degrees, and an annual mean (over 42 degrees) as high as

Topography as affecting climate.

Montreal, and much of Eastern Ontario. Under equal conditions otherwise, irrigated lands will produce more certain crops and larger yields than can be obtained from similar soils where the country has to depend upon natural rainfall. Under these circumstances we may expect these plains that are passed by now, by the practical farmer, to ultimately become, where the soils are favourable, profitable portions of the territory.

By Mr. Trow :

Q. In reference to irrigation, where would you expect to supply the water from at a sufficient elevation?—A. In many localities in the extreme west, from the slopes of the Rockies. In the southern parts, further east, large quantities of water are to be found in some localities by sinking wells where the slope of the underclay is favourable and admits of the water percolating through from salt lakes and marshes; but this is a matter of geology, and careful attention would have to be given to the geological structure of the local districts. It would be a matter of scientific observation to ascertain whether the character of the slopes indicated a sufficiently large supply of water. It does not depend so much upon what the surface may be, but what the slope is below the surface. We have an illustration of what I have just stated in southern Ontario. On the sandy slope from near Ingersoll, down to Lake Erie, the water percolates along the hard-pan and is so abundant that in one place I found that the simple expedient of placing a few yards of tile down on the hard-pan, and transversely to the slope of the hard-pan, and connecting this intercepting tile with the surface, resulted in abundant streams of water. By methods the same in principle there may be found large quantities of water in many localities in the North-West, which often can be cheaply turned to account for irrigation. There is much of the country, however, that cannot, by any of the means likely to be resorted to within a century, be profitably irrigated.

By Mr. Davin :

Q. I understand you to say that what the North-West needs is irrigation?—A. Yes; but it is a matter for the geological department to say what the prospects in any particular district are of getting water. There are portions that will need irrigation, for the average rainfall in some places is only five inches in the year. In Manitoba, a problem to be solved some day, is getting rid of the injurious effect of swamps. The Gladstone district seems to be peculiarly subject to frosts, owing to the wetness of the soil. Owing to the features of much of the country, there are grave difficulties in the way of a practical solution of the matter.

Bases for a correct climatic survey of Canada, defined

The proposals which I wish to make in regard to a climatic survey and the development of the fruit growing industry of Canada, are as follows:—

A Climatic Survey of the Dominion, with the special view to ascertaining the agricultural capabilities of the climate of each locality: such survey to take into account the average temperature of the growing season, the average length of time between the last killing frost of spring and the first of autumn, the average and the exceptional cold of winter, the average rainfall and such other conditions of local climate as have a direct bearing on agriculture.

Material.—Published and unpublished abstracts of meteorological observations; manuscript temperature records of daily maxima and minima at several hundred places; correspondence to be had; facts of local topography, elevation, &c., to be derived from railway and other surveys.

(2.) Ascertainment of correspondence between local climates in Canada, and local climates on the continent, with a view to ascertaining how far vegetables of the old world can be cultivated in corresponding climates in the Dominion.

Material.—Large accumulation of data furnished by the meteorological services and societies of Europe in regard to Siberia, Russia, Hungary, Germany, France and Britain, and found in the form of reports, abstracts, journals, &c., in the meteorological offices at Toronto; agricultural reports of governments and societies in Europe, forestry reports, correspondence to be had.

With respect to this I wish to call your attention to an important consideration: The fruit trees which make up our orchards and with which fruit growers have long been experimenting, are nearly all introduced from the old world and are derived from varieties that have been grown for hundreds of years in western Europe where the winters are mild. Therefore, they are not the best fitted to endure the severe winters of the more north-eastern parts of America. The vine of the west of Europe is more tender than the ordinary fruit trees with regard to winter, and in eastern America can be cultivated not much further north than the Ohio river. The winter climates further north are generally too cold for it. As we proceed eastward, in Europe, we find the conditions to approach those of this continent In Roumania and along the Danube the climate is decidedly colder in winter. Bucharest differs but little from Toronto in the temperature of either summer or winter. Moscow is colder in winter than Quebec, and St. Petersburg, is about as cold as at Ottawa. The winter climate beyond Nijni Novgorod approaches the winter climate of Winnipeg. In those parts, for hundreds of years, hardier varieties of fruits have been grown than in western Europe. They have simply become habituated to the climate. It is, therefore, to eastern Europe, from the Danube to the Baltic and eastward to the Urals and beyond, that we must look for new varieties of fruit to introduce into Canada. Hungary and Austria and eastern Germany as well as Russia can furnish very desirable forms of vegetation for Canada. The more this matter is explored with a view to ascertaining the climate in which these fruits are grown—the length of the frostless season and the cold of winter, and the mean temperature of the growing season—the more likely are we to make our experimental work efficient and economical. By investigating these climatic conditions we can reach many results at once, or in five to ten years, that would otherwise take twenty to thirty years. As it is now we can only slowly learn the climatic capacities of particular districts. Russia has spent money liberally in arriving at a knowledge of her own climate and mapping some of the conclusions reached. The Austro-Hungarian Government has done the same thing. Germany has abundance of meterological data.

Subsidiary to these general lines of investigation are the following:—

Subsidiary base lines for a correct climatic mapping of the Dominion of Canada.

(*a*) Investigation of the of the peculiarities and differences of the local climates of the fruit districts of Ontario, with a view to economy in and better direction of effort and expenditure in fruit growing and experimenting with varieties of fruit and vegetables.

(*b*) Investigation of the peculiarities and differences of the local climates of the fruit districts of Nova Scotia.

(*c*) Investigation of the peculiarities and differences of the local climates of the fruit districts of British Columbia, with special attention to the great differences existing east of the Cascade mountains.

(*d*) Investigation e peculiarities of climate in Alberta.

(*e*) Investigation of the peculiarities of climate in Quebec, especially the Lake St. John country and inland region north-eastward towards Labrador.

(*f*) Investigation of the peculiarities of climate and of the local agricultural capacity of the Mackenzie River country.

(*g*) Investigation of the peculiarities of climate of the northern half of the Hudson Bay Railway route.

(*h*) Investigation of the peculiarities of climate of Northern Ontario and Quebec, beyond the height of land.

(*j*) Investigation of the peculiarities of the peach climates of Ontario and British Columbia.

(*k*) Investigation of the apple climates of Canada and Russia.

(*l*) Investigation of the vine-growing climates of Canada, Europe and the United States.

(*m*) Investigation of northern climates of Canada adapted to growing strawberries and other cultivated small fruits.

(*n*) Investigation of the northern Canadian climates, with special regard to their fitness for growing oats, barley, potatoes, and such other vegetals as might support any agricultural settlements, formed to supply local mining and other industries.

(*o*) Investigation into the effects of swamps on local climate.

(*p*) Investigation into the effect of the lakes—especially small lakes—of Eastern and Northern Canada on the lengthening of the frostless season on their eastern and southern borders, and of thus permitting the cultivation of fruits, grains and other vegetals beyond their general northern limit.

(*q*) Investigation into the effects of mountain ranges and valleys on the local climates and agricultural capabilities of the interior of British Columbia and of Alberta.

(*r*) Investigation (if deemed prudent) of the best means of remedying the aridity of portions of the North-West.

(*s*) Investigation into the relation between periods of drought and extreme weather depressing to the vitality of fruit trees and the prevalence of parasitic diseases of fruit which follows such depressing weather, with a view to promptly counteracting and mitigating the effects that may be feared at any time in any district subjected to such weather.

(*t*) Investigation into the utility of smudge fires in preventing the destruction of fruit blossoms in spring and of prolonging the gardening season in autumn.

(*u*) Investigation into the differences of valley, hill-side and plateau climates.

(*v*) Investigation into the climatic conditions of parts of Eastern Europe, where more hardy varieties of fruit are grown than those familiar to America.

(*w*) Investigation of the climatic conditions of the Saale, Austrian and other European districts noted for the quality of the two-rowed barley they produce, with a view of demonstrating whether or not Canada affords barley climates corresponding in essential respects, and of aiding in the selection of the varieties of that grain best adapted to our various barley climates.

(*x*) Comparison, when desired, of a current season in any locality with the normal season of such locality, with a view to aiding in correct deductions from results reported to the Department of Agriculture by farmers who had been making experiments.

(3) Articles in British agricultural journals on Canadian fruit and other agricultural industries and districts, with a view to attracting the immigration of British farmers. These articles to embody, where desirable, appropriate comparisons between European and Canadian local climates.

(4). Addresses to farmers' institutes and fruit growers' meetings on the subject matter of some of the special lines of enquiry indicated above.

(5). Scrutiny of prices current and demands of the fruit business abroad, with a view to the extension of the Canadian export of fruit, and the opening of new markets.

(6). Special reports for the guidance of the Government in regard to land grants to railways or other enterprises in parts of the Dominion where the agricultural and timber resources are not well known.

Most of the objects of the work proposed are obvious and require no mention.

Summary important gains to agricultural and commercial interest, from a correct climatological survey.

The investigation proposed will tend to greater effectiveness in the experimental work of the Department of Agriculture and to economy in the direction of widely extended experiments; to earlier and more trustworthy conclusions from the experiments made by farmers for one or more seasons, as these seasons may differ in essential respects from the normal.

The work would greatly aid in the profitable extension and conduct of fruit growing, and, through accurate mapping of the peculiar differences of climate in the fruit growing districts, greatly facilitate the testing of varieties and increase the value of experiments with them; it would also save much money through enabling the department to better utilize private experiment and experience with varieties grown in particular climates, and to avoid, by allowing experimental work to be confined mainly to methods of culture, much of the outlay on experimental fruit farms which may be established and which have been demanded by fruit growers. The investigation into the climatic conditions of the best two-rowed barley districts in Europe and the ascertainment of the districts in Canada where conditions exist similiar in everything that relates to the growth of this grain would greatly encourage the development of an export trade in barley and at once remove the serious doubt so often expressed on grounds of climatic unsuitableness as to the success of the Government's attempt to encourage the growth of two-rowed barley.

It is of the utmost importance to our farmers and to the commerce of the country that we should ascertain whether we have districts highly adapted for two-rowed barley. It seems probable from climatic considerations that in eastern Canada, a part of New Brunswick, for example, affords a climate very suitable for it and a section, too, of southern Quebec and the northern part of the peninsula of Ontario. It is important to ascertain whether in these and other parts of the Dominion we may look for success in this direction.

The investigation would throw valuable light on the question of the culture of old world trees in the North-West, and facilitate and give better direction to experiments with fruits introduced or which may be introduced from the colder parts of the old world. The investigation, there is strong reason to believe, would show that some of the inland valleys of British Columbia possess remarkable climatic capability for fruit growing. The enquiry suggested into the agricultural capacity of the Mackenzie River Basin would, at trifling cost, do something to satisfy the demand for an exploration of that region and would obtain in this particular respect results much more trustworthy than could be

obtained by the exploration asked for. The investigation into the climatic capacity of the Mackenzie River region, the country between Lake Winnipeg and Hudson Bay and the country along and beyond the height of land from the valley of the Moose to Hamilton Inlet would be of service to the Government by enabling them to better measure the agricultural resources of these regions and therefore would aid in their decision as to railway enterprises projected or to be projected in these regions and thus be conducive to economy. The climatic survey proposed with European comparisons would show many localities in Nova Scotia, Quebec, Ontario and British Columbia to possess capabilities for fruit culture hitherto scarcely suspected. Amongst other things, the survey would be would be likely to demonstrate that about 9,000 square miles in Ontario besides a considerable acreage in the interior of British Columbia as well as near the coast, is adapted to the cultivation of some variety or other of the peach, and that a very large portion of Ontario is equal to any other portion of America and superior to the Ohio Valley and to much of the wine growing portion of Europe for the extensive prosecution of some important branches of viticulture.

Conjoined with results obtained in this survey articles on Canadian fruit and other agricultural industries in British Agricultural Journals would prove a most potent and at the same time almost costless means of attracting to Canada British and other farmers of wealth and intelligence

The survey would in those new sections where local topography exercises a controlling influence on agriculture, prevent waste of effort and with it disappointment, and would give a more intelligent direction to the agricultural occupation of the land.

By Mr. Armstrong:

Q. How many would you require to undertake all this work—how many hands in the various portions of the Dominion? I am under the impression that you recommend a bureau to be formed for this purpose? —A. Oh, no. I do not wish to give so formidable an idea of the enterprise as that. The meteorological data to be used has nearly all been furnished already by the meteorological service. The printed abstracts of the service do not, however, give all that is needed from the records for the service of agriculture. The manuscripts would have to be studied carefully. One man can do the whole work. More or less mapping would be required. In this the isothermal lines should not be drawn with the free hand generally used for the purpose; the isothermals should curve and twist with the configuration of each district so as to show where possible, the gradations of climate in detail. The maps should show the number of days between the last frost of spring and the first frost of autumn (a very important matter in the growth of fruit and cereals) and the measure of ordinary and occasional extremes of cold.

By Mr. Walsh:

Q. It would take a long while to do that?—A. The material is at hand for the work, and in a short time many of the most important points inquired into could be put in compact form before the public. No staff would be necessary. The proposal is to utilize the data so as to make it directly serviceable to agriculture. There are records from probably between 300 and 400 stations. It may be necessary here and there to know the peculiar topography of a place, but in regard to most localities where observations have been made, no further information would be required than we have at present. The material is simply waiting to be utilized.

By Mr. Trow :

Q. In following up these reports from various sources, do you think that they are all reliable?—A. Very nearly all of them. The Canadian meteorological service is very careful and accurate. Instruments of course are rarely perfect, but errors on the instruments are known by comparison with a standard, and applied to the observation. The instruments are exposed to the air on a uniform system, so that results may be compared fairly. There are occasionally stations peculiarly situated, but the local influence can be easily measured approximately and allowed for. Nearly all the records are thoroughly trustworthy. Great care has been shown by Mr. Carpmeal and his staff in the work that they have done.

Q. With reference to those portions of our Dominion—Pelee Island and around Lake Ontario—their general character admits of close investigation. Those western sections of our country that have not been fully explored, will it not require some further search before data could be compiled?—A. For a considerable belt of territory in the North-West there are records that could be made the basis of fairly close approximation to accuracy in detail. For the southern part of British Columbia, south of the latitude of the Thompson River, the records admit of the drawing of valuable conclusions generally, as well as here and there of detailed indication of the differences of climate in important districts. As the observations of the meteorological service becomes more extended in the remote parts of the country, relative approximations could give way to the detailed mapping that some of our older districts admit of. Topographical considerations would have, of course, to be applied to supplement meteorological records. In most of our great fruit growing districts, a close mapping of the differences of climate is practicable from the material accumulated. The Fruit Growers' Association, especially the association of Ontario, has been labouring with great difficulty in the admirable work of testing varieties, through lack of definite information in regard to differences and peculiarities of local climate. Their work would be greatly facilitated—in fact, stimulus would be given to it—if such conditions as the cold of winter, the length of the frostless season, and the isothermals of the growing season were definitely ascertained and indicated. The advantage this would bring in determining the varieties of fruits best adapted to local climate, is obvious.

Q. How about testing new varieties? —A I refer to those common in America and those recently introduced from the old world. It takes time to test a newly originated variety. You do not know the sensitiviness of a new variety to the extreme frosts such as occur perhaps only once in ten years; but with respect to European varieties introduced, we have simply to compare the European climate with our own.

Q. Would not the soil have an influence?—A. Yes, to a large extent. The soil in which fruit, or even a variety succeeds best is generally well known. This affects chiefly quality and quantity.

Q. You think it would not have so much to do with the soil as the climate?—A. No; the climate is the chief consideration. Whether you can grow a thing at all or not, on any soil in any particular locality, depends on the climate. If the climate permits of successful cultivation, of course a cultivator will choose the best soil.

Having read the preceding transcript of my evidence, I find it correct.

J. GORDON MOWAT,
Climatologist.