



Beech (*Fagus americana*), Forest Type. (On main road  $4\frac{1}{2}$  miles S. of St. Thomas; height 125 ft.; clear length, 80 ft.; diameter, 33 inches.)

# Canadian Forestry Journal.

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## CANADA'S FERTILE NORTHLAND.

During the Parliamentary Session of 1906-7 a Select Committee of the Senate appointed to enquire and report as to the value of that portion of the Dominion lying north of the Saskatchewan watershed and east of the Rocky Mountains examined a number of persons possessing special knowledge of "The Northland," and had submitted to it papers and records bearing upon the subjects submitted for its consideration. The Chairman of the Committee was Senator T. O. Davis, who with the exception of the present Minister of the Interior, has a better knowledge of the resources of Northwestern Canada than any other member of Parliament or Senator. The report of the Committee\* has recently been published under direction of Mr. R. E. Young, Superintendent of Railway and Swamp Lands, and contains more information about the forest wealth of northern Canada than has before been gotten together under one cover. Of the agricultural and other resources of the "Fertile Northland," apart from the forests, nothing need be said here. It is now generally admitted that however great may be the value of the prairie lands of southern Alberta and Saskatchewan the well-watered, wooded country north of the Saskatchewan possesses advantages that will attract to it settlers of a class who would hesitate to settle on the open prairie. The report and the invaluable maps which accompany it may be had by applying to Mr. Young; the information there published relative to the value of the northern forests may well be summarized here.

Beginning with the eastern part of northern Canada, the territory of Ungava, Mr. A. P. Low, the Deputy Minister of the Department of Mines, who has explored the whole territory, reported that the only timber of commercial value that will be found there is on the rivers flowing into James Bay, and perhaps as far north as the Great Whale River. The timber extends inland from James Bay as far as the lakes in the centre

\* Canada's Fertile Northland, Dept. Interior, 1907

of the peninsula and between one hundred and two hundred miles along James Bay. There are rivers where the timber could be floated, and it is along the rivers the timber is found. To reach these forest districts and make them of commercial value, the best way would be via Hudson Bay and the rivers flowing into it, for the districts on the bay side. Along the rivers flowing north there are practically no timber limits. There is a fairly large timber industry at Hamilton Inlet, but none inland, and there is some good sized timber up the Hamilton River. The country is fairly well forested up to the foot of Hudson Bay, with spruce, tamarack, white birch, banksian pine and aspen. Mr. A. H. D. Ross, now lecturer on Forestry at the University of Toronto, accompanied Mr. Low on one of his expeditions, and published in *The Forestry Journal* an article on "The Forest Resources of the Labrador Peninsula,"\* which should be consulted by anyone interested in the forest resources of Ungava.

The Honorable W. C. Edwards, whose firm had had for several seasons reliable and skilful men exploring Ungava for timber limits, did not altogether agree with Mr. Low's estimate of the quality of the timber on the mountains about Hamilton Inlet. He said that back some distance from the Labrador coast and in the immediate valleys of all the streams in that district, the timber is large, as it also is in the district around Hamilton Inlet, around Melville Bay, and in the valleys of all the rivers extending from Chateau Bay to the head of the Island of Anticosti. The timber within these areas, Mr. Edwards said, is large and good, but the strips do not extend back from the streams for any distance. On the mountains about Hamilton Inlet, according to Mr. Edwards, there is a vast quantity of perfect timber. The only objection to it is that it is scrubby, but if it is preserved the time will certainly come when it will be very valuable. In Mr. Edwards' opinion the Province of Quebec has in the Hamilton River country one of the best timber districts on the North American Continent if fires are kept out. But burning is going on to a tremendous extent, the work of the few settlers who are there. Valuable areas of timber are being burned up. Settlers simply light fires in the summer time to dry the timber for their winter use. These fires extend over vast areas and enormous portions of the country have been burned. Senator Edwards said that he had taken five hundred miles of limits there and allowed them to expire, simply because of the regulations. Mr. Edwards did not know of any place where there is a greater area of pulpwood than there is on Hamilton Inlet, around Melville Bay and for a certain distance into the interior.

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\* Published January, 1905

Mr. R. S. Cook, Mayor of Prince Albert, was examined on the country north of Prince Albert. He said that in the Beaver River country there is a large quantity of very good spruce. Through the region north of Prince Albert and on to Montreal Lake it is pretty much of a timber country. There have been a good many fires, however, which have in many places burnt off the soil. There is much good poplar, but as there is plenty of spruce it is not used now to any great extent. Through the country between Prince Albert and Stanley Mission there is a lot of good timber, including large quantities of merchantable spruce. A good deal has been taken up but a good deal of it is left. There is an unlimited quantity of pulp wood; where it is not good timber it is good pulp wood. There is no calculating the amount of timber that has been destroyed by fire, but the Government is now taking steps to try and put a stop to the burning.

Archdeacon J. McKay said that around Lake la Rouge there is much good timber. Fire had done most damage in the rocky parts. A saw-mill run by water-power was put up at Lake la Rouge in 1905 by Mr. McKay. The logs sawn are the kind of timber found in that part of the country. They average seventeen logs to the thousand feet, the logs being fourteen to fifteen feet long. The diameter would be about two feet across at the butt—good, large logs and clean timber. This good timber is scattered all over the country.

As a whole the evidence taken by the Committee showed that throughout the whole northern country, from Ungava to the mouth of the Mackenzie, there is an abundant supply of timber for all local needs, and in many districts plenty for shipment to the prairie when transportation facilities are better. Very extensive areas have been swept by fire, and vast quantities of good timber have been destroyed in this way, but the needs of the treeless parts of the Northwest are small compared with the available supply of lumber north of them, and if better protection is given the northern forests the growing trees, even in the burnt districts, will have reached maturity before there is any danger of a timber famine in the Northwest.

Dealing with the more southern portions of what is still known to the average man as Keewatin, Mr. Low in his evidence referred to above stated that the forest between Lake Winnipeg and Hudson Bay had been largely destroyed by fire, but around some of the large lakes and on their islands and in other places, a fair growth of timber is found with white and black spruce, pine, aspen, poplar and white birch of eighteen inches diameter. The trees are fairly clean, and a great many of them would probably make two or three logs, so that what remains there of the timber is fairly good, except on the low swamp land where

the growth is confined to black spruce and tamarack of no great size. Throughout the more southern region described by Mr. Low, there is a good deal of wood which could be used in the manufacture of pulp.

Mr. Von Hamerstein had travelled through quite a large part of southern Athabaska. Much of it had been burnt, but in other parts there was much fine timber. West of Fort McMurray he had seen trees that would make 1,000 feet of lumber. He had taken out strips 64 feet long out of which he had cut walking beams for work upon which he was engaged. From the mouth of the Peace River at Lake Athabaska to Vermillion there is some good timber. Timber of the same quality ranges north for quite a distance. There will be a range of timber four or five miles wide and then muskeg or prairie.

Mr. E. Stewart, who has from the first been one of the chief moving spirits in the work of the Canadian Forestry Association, and may indeed be called the "father" of the Association, has had exceptional opportunities of examining the forests of the north and although his reports have been read by most of the members of the Association, and extracts from them have already been published in *The Forestry Journal*, his evidence before the Select Committee so well summarizes what is known of the timber resources of northwestern Canada that it is repeated here almost as he gave it before the Committee. He said that the principal tree between the Rocky Mountains and the plains is the spruce, mostly the white spruce, and from its position near the prairie there is no doubt that it will be more sought after to meet the increasing demands from that quarter. The country along the upper waters north of the Saskatchewan and the Athabaska and Peace Rivers is partly prairie and partly wood. The varieties of timber are principally aspen and balsam poplar, the former predominating, and white spruce. The poplars as one goes north seem to increase in size and height, and as one approaches Lesser Slave Lake and between this lake and the crossing of the Peace River. Below the junction of the Smoky they grow very clean and straight trees, not over a foot or fourteen inches, but reaching a height of 17 or 18 feet, making excellent building timber, as well as fencing and fuel. In some parts there are stretches of good spruce well adapted for lumbering purposes. There has so far been but little destruction from fire in this quarter. The land is mostly level, soil excellent, and if the summer frosts do not prevent it, the country will begin soon to settle up and there will be an ample supply of timber for local uses, if not for export to the adjoining prairie regions. Mr. Stewart explained that spruce suitable for commercial purposes grows to the Arctic Sea. He was astonished to find that the limit of tree growth extended as far north as it does.



Dwarf Spruce at the Limit of Trees, Artillery Lake, N.W.T.

[Photo by E. Thomson Seton.]

He thought it extended probably ten degrees further north in this district than in Labrador. The different kinds of trees that we have in the Mackenzie Basin include white spruce, black spruce, the larch or tamarack, which is found as far north as the spruce, the Jack pine and the balsam. Mr. Stewart did not see any balsam in the Arctic circle; aspen, white poplar, balm of Gilead and birch are all found down as far as Fort Macpherson. The natives make their canoes out of birch bark at Fort Macpherson. The size of the timber becomes less as you get towards the north. There is timber growing near the junction of the Peace and Slave Rivers, probably 14 inches in diameter. Below Fort Good Hope the timber is smaller. Some of it has been made into flooring and lumber is made from the timber there. There is a large supply of spruce suitable for pulp. Replying to a question asked by a member of the Committee, Mr. Stewart said that he thought it possible to use the poplar wood for commercial purposes. The white poplar in the north is of better quality than the poplar of more southern regions.

Mr. R. G. McConnell of the Geological Survey staff in his examination stated that the good timber of the Mackenzie valley is confined to large spruce. White spruce is the main tree all through that country. You get spruce from a few inches up to two feet through all the way along the Mackenzie, on the flats, and on nearly all the tributary streams. Mr. McConnell found spruce at the delta of the Mackenzie over two feet through. Of course only an occasional one grows that size. They average ten to fifteen inches. Along the Liard there are good bunches of timber, and it is the same with all these other tributary streams. Once you get away from the flats the timber is sparse and the trees are small. You get small black spruce on the muskgs. The timber is simply on the flats and extends back two or three miles from the river. That is not solidly timbered on either side of the river. The poplar does not grow to a large tree as it does down here. It runs about three to six inches through. The rough bark poplar grows up to a foot or more. Jack pine grows as far north as Fort Good Hope, but is not very large; some of the trees would be large enough for railway ties. Mr. W. McInnis and Mr. O. O'Sullivan were examined on the country between Lake Winnipeg and Hudson Bay, both reporting that much of the region traversed by them had been repeatedly run over by fire. The reports of these gentlemen as published by the Geological Survey have already been reviewed in *The Forestry Journal*.

Mr. H. A. Conroy, of the Indian Department, has made many trips through the Athabaska and Mackenzie districts, and gave in considerable detail the result of this observation on the forests of the north. The Athabaska River from Atha-

baska Landing up to the Little Slave River, is fringed with timber probably from half a mile to two miles wide. On the lower levels of the Athabaska right down to Athabaska Lake, there is heavy timber all the way along. Behind the timber belt the country is reported to be broken by muskegs. The spruce is fairly large in some districts—fit for sawlogs, and mostly all fit for ties and small building timber. Some of it was very large spruce for that country, three feet across the stump. There is an Indian reserve along the Little Slave River, and a portion of that has good timber. The Indians have the finest piece of timber on the Lesser Slave Lake as a reservation, the spruce is large, and there is a species of poplar, what they call the black-bark poplar, which grows very large there. Mr. Conroy had seen it from three to four feet across the stump. It grows very large, and sometimes fifty to sixty feet high on this low land. The north side of Lesser Slave Lake is covered with quite a heavy second growth of poplar, some spruce, but not very much, and the poplar is not very big, probably from nine to twelve inches through, and grows very slim and tall. It is very long, just a little bunch of limbs at the end of it, and the trees grow close together all along the north side of Lesser Slave Lake. When you get back about half way between Lesser Slave and Whitefish Lakes, you strike a timber belt running from that to Whitefish Lake, and there is some spruce and a great deal of poplar. Mr. Conroy had seen spruce logs there two feet through, a great many of them in that section of the country.

Taking the country as a whole there is quite a lot of marketable timber on all the rivers and lakes, and there are millions of cords of pulpwood. The rapids on the Athabaska, and the falls on the Peace River below Vermillion afford ample water-power.

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The State of Maine is enlarging her forest fire protective system. The method adopted in this state is that of having watch-towers, connected with settlements by telephone; the watchers in the towers are equipped with long range glasses, and can quickly discover any fire and telephone information to the settlement, whence a force may be sent, if necessary, to fight the fire. The fire stations are installed by the owners of the timberland, the cost of installation running from \$600 to \$1,000, and are subsequently maintained by the state. A dozen of these stations have already been installed.



## RIVER REGULATION, WITH SPECIAL REFERENCE TO THE ONTARIO PENINSULA AND TO THE GRAND RIVER.\*

The flow of streams is due to a variety of causes, primarily, precipitation, rainfall and snowfall; extent and declivity of the drainage area; nature of the ground, rock or soil, and condition of the soil; condition of the surface, the chief element being whether it is forested or clear; the presence of lakes or large collecting basins in the stream. A steep rocky drainage area will give the greatest run-off in the shortest time. There is great difference in the nature of soils and in their permeability; as for instance between clay and loam, or gravel.

Whether forestation has much influence on precipitation is not entirely clear. There are generally other governing conditions. As to the Ontario Peninsula there are the vast adjacent bodies of water—the Great Lakes. As far as records go it appears that precipitation has not decreased in Ontario with deforestation. The influence of forestation is in retarding and diverting. The forest floor is more or less obstructed with litter, and is soft and permeable. Water finds its way slowly into creeks and rivers, much disappears into the ground to come up lower on the slope in the form of springs. A large part evaporates, and vegetation, tree growth, by transpiration, absorbs a large amount of water. Owing to evaporation and transpiration together the total run-off from a forested area is, in fact, somewhat less than from a non-forested one. Conservation and continuation of the flow, with ground water, and slow melting of the snow, are, however, very much better with the forested watershed. The forest acts as an equalizer, being a check both on extremely high and on extremely low water. Where the ground is bare and compact the water rushes quickly over the surface, forming torrents, washouts, and floods.

Large basins or lakes in the course of a river exercise an important function in its regulation. Water, though in great quantity, will increase the depth of a basin of large area very little; the head of water at its outlet will also be but little increased, and the flow will be long-sustained. With artificial control of the outlet the natural automatic regulating value of a large storage basin in a stream can be much enhanced.

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\*Paper read at Engineers' Club, Toronto, March 5th, 1908,  
by W. H. Breithaupt. M. Inst. C.E., 43 Victoria St., Toronto.

The percentage of precipitation that reaches the streams, that is the percentage of run-off to rainfall, after evaporation, transpiration, etc., varies greatly with the nature of the drainage area, and may be anywhere from 40 to 60 per cent., and less or more in exceptional cases. There is also variation with meteorological conditions. After a long dry period a very heavy precipitation may not show much in the streams, while after a wet season a smaller precipitation may give a much larger run-off.

The requirement then for river regulation is to retard and conserve the water after rain-fall or snow-fall, and this is done either by forestation, including timbered swamp areas as forest, and is most effectively and to the best general benefit done in this way; or by storage on a large scale. Ground water, which for its up-keep depends so directly on forest area, is one of the most important features of general benefit due to forestation. Various towns in the Ontario peninsula, for instance, and fairly large centres of population, depend for their water supply on deep wells. Impair the supply of ground water and the water available from such wells must inevitably be largely reduced.

All larger streams normally originate in mountains or uplands, and the relatively most important areas for up-keep of the flow of a stream are the mountain slopes or upland drainage areas proximate to its source. To have such areas in forest is therefore of the first importance. In older countries, in Europe, this is effectively done, and in the United States the Federal Government is now, in the Appalachian and White Mountains Bill before Congress, giving particular attention to this question. In Germany the forest covers 26 per cent. of the surface, mountain slopes and headwaters of streams being as much as possible in forest, and, incidentally, the forests are one of the most prolific sources of public revenue. The Ontario Peninsula, only a short time ago (not much over 50 years for the greater part of it) one of the most densely forested areas in either temperate zone, now shows, as far as can be ascertained from the Government returns, which are very defective, under 15 per cent.—it is actually probably nearer 12 per cent.—of the surface as woodland. With deforestation stream flow in the Peninsula has greatly changed. Spring floods are very much higher, and there are floods on heavy rains, while during the season of minimum flow many streams, which were formerly considerable throughout the year, practically disappear.

Practically no topographical survey, further than a little unimportant work along the frontiers by the Department of Militia and Defence, is on record for the Ontario Peninsula. The elevations of all railway stations, however, and they are fairly well distributed, together with other general data, give a



Roadside Beech (*Fagus americana*)  $4\frac{1}{2}$  miles S.E. of St. Thomas, on main road; diameter, 20 in.; height, 90 ft.; width of crown, 60 ft.

good idea of the broad, general features of the topography.

On a contour map the striking feature is what may be called a table-land or plateau varying not more than 200 ft. in elevation above sea-level, from 1,500 to 1,700 ft., near the northerly limit of the peninsula, with slopes abrupt to the east and north, abrupt also for the first few contours to the west and south, but after that gradual to the west and more gradual to the south-west and south. The rim of water, with its very extended shore line of lakes and connecting channels is, not considering the Niagara River or Lake Ontario, almost level, varying only about 9 ft. from Georgian Bay, El. 581, to Lake Erie, El. 572. The 1,500 ft. contour encloses only about 550 square miles. Practically all of the larger rivers of the Peninsula but one rise within or near this contour; the Nottawasaga and branches, and the Beaver to the north, the Saugeen and branches, and the Maitland to the west, and the Grand River and its tributaries to the south. The uppermost branch of the Thames rises further down the slope, about at the 1,300 ft. contour. A smaller but important river, to the north, is the Sydenham, which rises between the 1,100 and the 1,200 ft. contours; and there is another Sydenham River in the flat country of Lambton and Middlesex counties, a sluggish stream rising a little above the 800 ft. contour.

The characteristic of the rivers of the Peninsula is that their drainage areas are most extensive toward their sources, and narrower and smaller in the lower, flatter country where many smaller streams flow directly to the lakes; and that their declivity, after leaving the head plateau, is also greatest in the upper part of their course. The headwater drainage areas are the chief factors in governing flow; a large run-off there is quickly carried down and overflows the river's banks in the lower country.

Precipitation appears to be largest on the western slope of the Peninsula, over 40 inches of water per annum, due to the prevailing west winds. The air is saturated with moisture in its travel over the lakes, strikes the up-slope of the ground, is deflected to colder strata, and rain or snow results. There is larger precipitation, especially snowfall, also on the head plateau. Before settlement this was covered to great extent with dense, heavily wooded swamps, retainers of snow until late in the spring and natural slowly drainage reservoirs, replenished with each rainfall, giving ideal condition for conservation of stream flow. The swamps have now been mostly drained and other forestation removed. The cleared and drained land appears, most of it, not to be of great agricultural value, and might in itself give as good or better economic return as forest, including swamps with good tree growth under this classification. The

general result is, however, the consideration. The table land should revert to its former condition. It is difficult to imagine so comparatively small an area elsewhere the reforestation of which would have such far reaching results. The area in question comprises the greater part of Artemesia, Egremont, Proton, Melancthon, Arthur, West and East Luther, and East Garafraxa Townships.

Besides the prevention of disastrous floods the questions of pure water supply for cities and towns, and of power generation along the various rivers with their very considerable fall emphasize the importance of regulation of flow.

The Grand River rises in Melancthon Township, within the 1,700 ft. contour and empties into Lake Erie near its outlet. Its total fall is about 1,100 ft. Its tributaries in their order from upstream are the Conestogo, the Speed, Eramosa, and the Nith. It has a total drainage area of about 2,600 square miles, about 1,325 square miles above Galt, below the outlet of the Speed, and about 450 square miles above Elora. After leaving the plateau the greater part of the fall is in the upper third of the river's length. Its spring floods have very greatly increased, especially during the last thirty to thirty-five years coincident with the clearing and drainage of the head water swamp areas, while its minimum flow which formerly sustained large water powers at many places along its course is now of little or no power value.

The flow in the dry season is now only about 80 cubic feet per second, a small fraction of former low water, while at flood the river overflows the well-marked old channel and covers the wooded banks on which are some trees of only 35 to 40 years' growth, indicating the period of beginning of excessive floods. Were the precipitation from one-quarter or even one-fifth the drainage area husbanded the minimum flow could be increased four-fold or more and flood crests obviated. The discharge of the Grand River at a point above the outlet of the Speed is now only 80 to 100 feet per second at low water, and 10,000 to 20,000 cubic feet per second at flood. Considering a minimum of 30 inches of precipitation per annum on 400 square miles of surface, say at the head drainage area, and a minimum run-off of 40 per cent., the annual stream discharge would be 11,151,360,000 cubic feet, sufficient to give a flow of nearly 400 cubic feet per second throughout the year. But the precipitation from a much larger area than 400 square miles could be husbanded. Above the 1,000 feet contour there are several good sites for storage basins on a large scale. A storage capacity of 10 square miles 10 feet deep seems to be readily practicable. This would mean 2,787,840,000 cubic feet, ample provision for regulation, and for generation of power to the

extent of 8,000 to 10,000 horse-power continuously between Galt and Elora alone. This capacity would also suffice for storage for 3 days of a flow at the rate of 10,000 cubic feet per second, and would thus give effective flood regulation. The great water-power gain could almost be considered as a by-product in view of flood regulation, good water supply, and other economic advantages obtained. In fertility of soil and in other advantages the Grand River basin is fitted to support a large population. It already has a number of large manufacturing centres.

Reforestation and particularly restoration of the swamp areas of the headwater townships, and provision of large storage basins should both be carried out; each measure complements the other, and they cannot be too strongly recommended.

The first requisite is a definite knowledge of the topography. This is now known only from the few railway elevations and from the broadly general features. A full topographical survey, definite gaugings, examinations of sites for storage basins, and delimitation of especially the head drainage area should be no longer delayed.

Precipitation gaugings, rainfall and snowfall, throughout the Province are also urgently required. Definite records have been kept, but only in a few places in Ontario, for about 65 years. A feature of one series of records is that in 50 years there have been 29 rainfalls of over 2 inches in 24 hours, some as high as  $3\frac{1}{2}$  inches in 24 hours. Otherwise there are only uncertain records, many of them volunteer work, and much of this has been discontinued. A small appropriation would enable the accurate keeping of such records at all High Schools in Ontario, and the work would be an admirable incentive to physical study and research.

In view of the fact that south-western Ontario is destined to be the manufacturing centre and the most densely populated section of the Dominion, the conservation and development of its natural resources, among which the one herein outlined is in the first rank, is of preponderant importance. Sooner or later the work of limited reforestation and river regulation must inevitably be undertaken. Delay will but make it greater.

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A business in wood preservatives is now being carried on in Toronto by the Carbolite Carbolinum Co., whose headquarters are at 302 Manning Chambers. Mr. S. S. Van Vlack is the Secretary of the Company, and the Directors are Messrs. W. S. Calvert, M.P., of Strathroy; Geo. S. May, M.P.P., of Ottawa; J. A. McAndrew, and Arthur Ardagh, of Toronto, and S. S. Van Vlack.

## BRANTFORD BOARD OF TRADE.

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The following is a copy of a resolution adopted at a joint meeting of the Citizens of Brantford and the Brantford Board of Trade, held April 2nd, 1908:—

Whereas it is deemed advisable by the Brantford Board of Trade, that the attention of the Provincial Government should be drawn to the following conditions and considerations which prevail in respect to the rivers of the province:

1. The extreme and ever-increasing variation in the volume of water flowing down the rivers during the different seasons of the year, causing more frequent and more violent floods than formerly. At times the rivers are raging torrents, carrying destruction in their wake, at other times they fall to insignificant proportions, impairing the value of the water powers connected with them, and otherwise diminishing their utility and detracting from their beauty.

Notwithstanding the large expenditures which some municipalities have made upon works to avert damage by flood, there is still a sense of insecurity, owing to the fact that a combination of circumstances may at any time cause floods of unprecedented heights, and overflow embankments which a few years ago were deemed sufficient.

2. Among the chief causes of these unfortunate conditions which prevail are the destruction of the forests and the extension of the systems of drainage, which have accompanied the settlement and the agricultural development of the province. The natural obstructions, such as forest, bog and marsh, which originally held the flood waters in abeyance, and allowed them to find their way but gradually to the channels of the rivers, have been very largely swept away and replaced by artificial arteries to facilitate the rapid escape of the waters to the rivers. The result is that the channels of the rivers which constitute the main trunk drains of a wide country, must carry away in a few days a volume of water which formerly took weeks to escape.

3. The methods necessary to mitigate existing troubles are, to preserve or restore the forests and swamps at the sources of the rivers, and to construct at suitable places along their course artificial basins, as substitutes for the natural ones which have disappeared, in order to retain the surplus waters and store them for use in the dry season.

The works constructed by the individual municipalities serve a useful and necessary purpose in confining the waters within the banks, and averting local flood damage, but are insufficient to deal with the fundamental troubles.



Beech (*Fagus americana*), Cultivated. (1 mile south of London, Ont.; diameter 36 in.; height, 80 ft.; width of crown, 80 ft.)



4. The preparation of the land by drainage and otherwise for the pursuit of agriculture, has greatly enhanced the value and productiveness thereof, and large advantages have resulted to the province generally in consequence; but while the benefit has been general, the responsibility of taking care of the swollen waters has hitherto been local. It is surely but just, that a share of the burden of the provincial waters, which find their way to lakes through the channels of the rivers, should rest upon the province generally.

In addition to the more practical considerations of security to life and property and the development of power, regard should also be had to the scenic beauty of our rivers, and their value to the people for fishing and sporting purposes, and for these reasons we regard it as important that combined action should be taken by provincial and local authorities to prevent further injury, and to improve present conditions.

5. Be it therefore resolved: That the Brantford Board of Trade represent to the Provincial Government the conditions which prevail on our rivers and petition the Government to investigate by commission, or otherwise, the entire subject, including the present troubles and their causes, the best remedies to apply in order to mitigate the evils, together with plans of necessary works, and with estimates of costs of same.

That this inquiry apply primarily to the Grand River, which runs through the larger settled portions of the province, and on which the flooding tendencies are the most aggravated.

C. COOK, President.

JOS. RUDDY, Secretary.

Brantford, Canada.

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“Injectol” is a new coal-tar extract which has been experimented with in Belgium as a wood preservative, and appears to have given satisfactory results. It is described as “a very thin dark brown liquid of regular density, with a degree of viscosity changing very little with atmospheric variations.” It is said to be much superior to creosote and other antiseptic liquids in preserving power and to be much easier to force into the wood. It will, in fact, penetrate certain woods without any pressure, it is claimed. In comparative tests with poles, ties and street paving blocks, creosoted poles resisted decay only a few months, while those treated with injectol remain unattacked after three years. After a period of two years passed in a steeping vat filled with liquid manure and other decomposing substances, ties treated with injectol were found to be in good condition, while others, some treated with creosote and others treated with creosote and chlorid of zinc, were completely destroyed. Paving blocks were also tested, with similar results.

## THE TIMBER SITUATION IN BRITISH COLUMBIA.

BY ROLAND D. CRAIG.

That the last great stand of coniferous timber in the world is to be found in British Columbia is beginning to be realized by lumbermen throughout this continent at least, and during the last two years more particularly there has been a great rush to secure control of the forests of the Province. The timber seekers have come mainly from the United States where the scarcity of virgin forests is beginning to be felt acutely, but many Canadian timbermen have been attracted by the phenomenal yields and high grade products of the British Columbia forests, and have invested largely in standing timber. The yield of from 20 thousand to 100 thousand feet per acre is not at all uncommon, nor is it uncommon to get single trees yielding 5 thousand to 10 thousand feet. Anyone possessing the idea that British Columbia is covered with such forests, however, will be greatly disappointed, for the supply is far from inexhaustible, and is situated chiefly in rather narrow valleys between ranges of rugged mountains. It would be a safe estimate that not more than ten per cent. of the total area of British Columbia is covered with forests yielding over 20 thousand feet per acre.

As a world's supply the forests of British Columbia are particularly well situated, so much being either right at salt water or tributary to it, and when the Panama Canal is completed the markets of Europe and eastern America will be made still more accessible to British Columbia lumber.

As a revenue producer the forests far surpass all other assets in the province. The output of the mines during the last year was valued at \$25,000,000 and yielded a revenue of \$200,000. The cut of timber is estimated at 900,000,000 feet, valued at about \$20,000,000, but it yielded to the government a revenue of nearly \$2,000,000. It must be borne in mind, however, that this revenue does not all come from the timber cut, but that about \$1,500,000 comes as an annual ground rent from timber lands, and is an assured revenue whether the forests are exploited or not. The remainder was collected in the form of royalties, hand-logger's licenses, etc.

The Government at first disposed of its timber in the form of Crown grants or leases, which are practically interminable, and to which there is attached a very small ground rent. During the last four years, the timber has been taken up under special licenses, which are annually renewable for 16, at first, but since 1905, for 21 years, for which an annual ground rent

of \$115 per square mile for lands east, and \$140 for lands west of the Cascades is charged. Under this system about 11,000 square miles of timber land has been taken up, with the result that the best accessible timber of the province has been alienated.

Recognizing the danger of letting too much of such a valuable asset pass into private hands, the Government has stopped granting licenses and has reserved all unstaked timber.

As yet there has been no provision made for the utilization of the timber on these reserved lands, but it is expected that it will not be withheld entirely from use, but will be handled in a similar manner to the forests of the U.S. Forest Reserves, where timber can be purchased for immediate use and is paid for on the stumpage basis. Since in locating leases and licenses only the choice belts of timber have been taken up, there are many millions of feet left adjacent to the limits which, if to be used at all, must be cut with the main stand. To leave it would mean its total loss, either through fire or the prohibitive cost of exploitation.

The reservation of provincial timberlands came rather too late than too soon. The objects of encouraging the timber industry and increasing the provincial revenue had been secured to a sufficient extent, and it was time that the government looked to a future more than 21 years distant, when there will still be a need of revenue, and when, too, the value of the timber will have greatly increased. Already it is too late to reserve a sufficient amount of timber to effectively protect the timber industries of the future. Unless there is such legislation enacted as will encourage private holders in conservative utilization these forests of British Columbia, vast and wonderful as they are, will be destroyed more wastefully and completely than have the forests of Michigan and Wisconsin, and as most of the timberland is only valuable as such, the loss will be irreparable.

As it stands now some of the license holders have but 16 years, others 21 years to remove their timber, which means that on these licensed lands (exclusive of the leases), approximately 100,000,000,000 feet must be removed, inside of 21 years, an average of about 4,650,000,000 feet per year.

There is only one result of such enforced exploitation. The timber will be slaughtered in the cheapest and quickest manner, only the most profitable logs being taken out. Operators will have no interest in the remaining timber, and as a result not only will no regard be given to the reproduction, but no efforts will be made to protect the standing timber, of which it is safe to predict 90% will be destroyed by fire or be wind-felled on account of the opening up of the stand.

Should such conditions prevail, the province will undoubtedly lose about half of the revenue it would derive from this timber in royalties (50 cents per thousand at present), an item of \$50,000,000 at the present rate. As the lands are logged over, they will be thrown up, of course, and if the cutting is forced so that it is completed in half the time it should, which is unavoidable under present conditions, the province will lose in ground rent an average of \$700,000 per year.

The effect on the timber industries can be anything but salutary from the timber holders to retail lumbermen, and British Columbia cannot afford to injure her greatest industry.

The remedy for this situation is suggested in the requests of the British Columbia Timber and Forestry Chamber of Commerce which is endeavoring to secure from the government an extension of an additional 16 and 21 years respectively to the two forms of license. They are also asking that some definite assurance be given that the ground rent will not be raised during the first period of the license. High as it is there is often talk of raising it, and much further increase would prevent conservative lumbering as effectually as a short tenure.

In a democratic country like this, there are three main ways of safeguarding the forests. The first is for the Government to own and manage the forests. The second to retain control of the forests, but to sell merchantable to private operators as the market requires it. But where the timber is already in private hands it is necessary to encourage the owners in conservative utilization. To do this it is necessary that the operator have an interest in future crops, that he is not forced to cut his timber when market conditions do not warrant careful and thorough exploitation, which can be done by extending the term of the license and making the cost of holding small.

With a good market for lumber and a Government reserve to draw from in case of need, there is no danger of cornering the timber supply, or of unduly restricting cutting.

Given an opportunity, the logger can be the best of foresters or the most destructive enemy of the forests. He is not often so patriotic that he will see his fortune ruined in order that the mistakes of legislation may be rectified, but given a chance there is no one who will strive more earnestly or with greater success to perpetuate the forests.

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The State of New York, on the recommendation of the Forest, Fish and Game Commission, has purchased an additional tract of 3,500 acres in the Adirondacks. The addition to the reserve includes Mount Marcy and some neighboring peaks.

## TREE PLANTING AND FOREST PRESERVATION.\*

BY ALFRED J. EWART, D.Sc., Ph.D., F.L.S., GOVERNMENT  
BOTANIST AND PROFESSOR OF BOTANY IN THE UNIVERSITY  
OF MELBOURNE.

In Mr. Reed's admirable article on this subject in the December number of the *Journal of Agriculture*, due stress is laid upon the importance of this question as a factor in the agricultural future of Victoria, and a list of the advantages to be derived from systematic tree planting and preservation is given. In addition to these advantages, however, two others are worthy of mention, especially as they rarely have their proper importance attached to them. They are the influence of trees in maintaining the fertility of the soil, and their antispasmodic action on rainfall.

### THE INFLUENCE OF TREES IN MAINTAINING THE FERTILITY OF THE SOIL.

This action is three-fold in character. The deeply penetrating roots which most trees form over a part at least of their root-system draw up water from the deeper layers of the soil, to which the roots of ordinary crops do not penetrate. This water contains all the mineral constituents of the plant's food in varying proportions, and these salts are very largely stored up in the leaves and bark as waste products after they have been utilized. In this way they ultimately reach the surface of the ground again, while the leaves, bark, and fallen dejecta of the tree slowly rot and add to the percentage of humus in the soil, so increasing its capacity for holding water.

Ordinary crops have comparatively shallow root-systems as compared with most trees. Thus the roots of barley and mustard usually penetrate to a depth of 1 yard, while those of the perennial clover and wheat may extend to 2 yards below the surface, and those of the everlasting pea and lucerne may reach a depth of 3 yards. The roots of old, well-established deeply-rooting trees, on the other hand, may penetrate to a depth of 20 yards or more, although the greater part of the root-system will be at a considerably less depth. In addition the root can draw water laterally or upwards from neighbouring moister regions of soil, and the finer the soil the greater the distance over which this action may extend.

\*Though written in Australia and referring especially to conditions there, there is hardly a word in Dr. Ewart's paper that does not apply with equal force in Canada.—*Editor*.

In the case of soils with a friable, open surface, the whole of the rain drains into the soil, unless the rainfall is extremely heavy. Each shower of rain washes downwards a part of the soluble constituents of the soil held by surface absorption on the soil particles. These soluble materials, for the most part, are washed past the crop root-system, and join the ground water in the deeper layers of the soil, which, in the absence of trees, drains away to the rivers or to the subterranean water systems. These, for the most part, pour into the sea the calcium-potassium, and magnesium nitrates, sulphates, and even traces of phosphates leached from the soil, together with other mineral constituents not required for plant food.

The roots of trees catch these mineral constituents to a large extent, suck them in along with the water they absorb, and pass them up to the leaves. It is worthy of note that it is mainly the useful soluble salts which are absorbed with the water, whereas as soon as the plant is clogged with the useless salts further absorption of these is checked. In other words, the tree selects to a certain extent the salts it requires, and sends them up to its leaves, and these salts are precisely those which crops require. During its whole life the leaf of a tree contains a nearly constant amount of potassium, magnesium, nitrogen and phosphorus, while the calcium usually steadily increases. Although the percentage of the first four elements usually decreases somewhat before the leaf falls, which takes place ultimately whether the plant is deciduous or an evergreen, a relatively large amount remains in the ash of the fallen leaf. As these salts are set free by the decomposition of the leaf and other dejecta membra of the tree in the soil, the ash constituents partly reach superficial root-systems, partly deep root-systems, and partly are washed out of the soil. The amount of mineral manure circulated in this way by a tree during its average lifetime is considerably greater than that retained by the tree in its wood, which in most cases contains a very low percentage of nutrient mineral substances if calcium is excluded.

It follows, therefore, that belts and clumps of timber on a farm help the farmer to retain on his own land the manure he puts into it, and so reduce the annual loss by drainage of the soluble constituents of the manure applied to the crops. As Mr. Lee has shown in the December number of this *Journal*, the crops are usually only able to catch and absorb a small fraction of the essential elements supplied to them in the form of manure.

Belts of timber on the banks of streams are of the utmost importance, not merely in preventing the erosion of the banks, but also because their roots form a filter through which the drainage water from the soil must pass, and be in part deprived of its mineral matter. At the same time, the effect is to hold

up the ground water on each side, and prevent over-rapid and erosive drainage from the soil.

The branches and leaves of most trees contain from one to four parts of ash per 100 of dry weight, whereas the dry wood usually contains less than 1 per cent. of ash. Some idea of the relative proportions of the valuable ash constituents can be obtained from the following comparative values per 100 parts of ash:—

	Wheat		Wheat		
	Straw	Leaves	Grain	Potatoes	
Potash .....	10	.. 20	.. 30	.. 28	
Lime .....	6	.. 12	.. 3	.. 2	
Magnesia .....	1	.. 6	.. 11	.. 4	
Sulphuric acid.....	2	.. 4	.. $\frac{1}{2}$	.. 5	
Phosphoric acid.....	5	.. 9	.. 48	.. 10	

The nitrogen practically does not appear in the ash, but in ordinary decomposition in the soil it is slowly set free as nitric acid, which combines with the bases in the soil to form soluble nitrates.

The value of trees as humus-producers can hardly be exaggerated, for the benefits conferred upon soil by the presence of humus in it are many and various. It increases the water-holding capacity of the soil. Thus a soil containing a fair quantity of humus will hold from two to three times as much water available for the plant's use as a pure sand. The presence of humus, and in this respect the humus formed from the decaying leaves of trees is especially valuable, increases the chemical actions in the soil, and causes more of the insoluble constituents of the soil to be rendered soluble and available for mineral plant food. In addition to this, the humus itself has a special power of retaining these soluble constituents in such a manner that the loss by washing from the soil by rain is reduced to a minimum, while at the same time they can still be absorbed by the roots of the plant, and handed over as they are required. Finally, humus lightens heavy soils, and favours their aeration.

A simple experiment to show the beneficial action of humus upon the roots of plants is to place on a heavy soil or clay surface a layer of leaf mould or well-rotted manure an inch or two thick, and cover this with 3 or 4 inches of clay or clayey soil. Soaked seeds planted on the surface soon strike downwards, and if the plants are dug up and examined by the time the stems are half-a-foot to a foot high, it will be found that the greater part of the root-system has been developed in the layer of humus. This is especially well shown by the garden "Nasturtium," but also by cereals and other agricultural plants, although, when the plants are older the roots are forced to strike deeper in search of water.

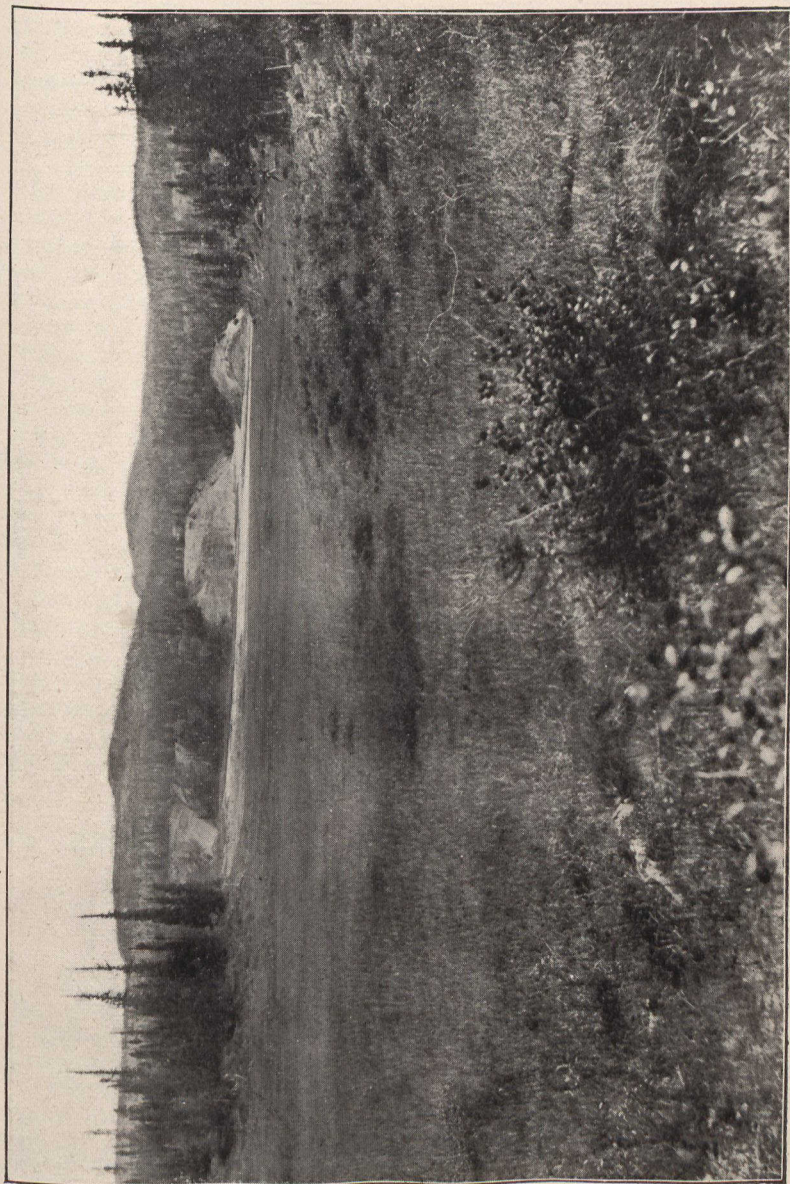
In warm climates the decomposition of humus in the soil is rapid, and hence there is little danger in this State of any excessive accumulation of humus leading to souring of the soil. The latter can, in fact, always be overcome by drainage and liming, and such soils, when properly handled, often prove to be of great fertility. Forest fires, by burning the humus off the soil, do incalculable damage, which, under primitive ancestral conditions, appears to have been made good in the following way:—After a severe bush fire had burnt off the humus and left the naked inorganic soil more or less fully exposed, seeds of *Acacia* and other plants lying dormant in the soil, and thus brought near to the surface, germinated. *Acacias* and other leguminous plants, by the aid of their root-tubercles, are able to obtain nitrogen from the air, and so develop readily in inorganic soils in which humus is deficient or absent. It is only in humus or organic soils that supplies of nitrates are continually being formed, any slight production of nitrates in, or addition of nitrates to, an inorganic soil being soon washed out by the rain. The *acacias* and similar plants gradually add humus to the soil and enrich it, so that the original forest of *Eucalyptus* or other trees may slowly re-establish itself. Bush fires are not modern things, but were certainly frequent before the advent of civilized man in Australia, and were probably frequent before the appearance of aboriginal mankind. There can be little doubt that this cycle, taking a hundred or more years to complete, has been repeated countless times over widespread areas. In fact, we are probably correct in regarding the thick, fibrous, difficultly-inflammable bark developed on the bases of the main trunks of many of the larger *Eucalypti*, as well as the absence of branches for a considerable height above ground, as being, in part at least, adaptations by the plant to constantly-recurring plutonic conditions, and these adaptations enable such trees to survive the effects of the bush fire which roars its way beneath.

The danger of devastating forest fires is naturally greater where a continuous area of forest exists, whereas with belts and clumps of timber this danger is more localized, and the agricultural value of the tree-planting better fulfilled, especially if the borders and fringes of the plantation contain such plants as *acacias* or the tree lucerne, *Medicago arborea*, i.e., nitrogen-fixing plants of economic value.

#### THE INFLUENCE OF FORESTS ON RAINFALL.

A full account of the evidence on this point is given by Mr. Maiden in the September number of the *Agricultural Gazette of New South Wales*, the general conclusion of the meteorologists being that forests do not increase the general average rainfall but do affect local rainfall. It must be remembered, however,





Pike's Portage, East End of Great Slave Lake.

Photo by E. Thomson, Sifton

that the rain-gauge, on which the meteorologist pins his faith is a very crude instrument, and that it is utterly impossible to measure the rainfall accurately in a forest by means of it, wherever the rain-gauge may be placed. In fact, many of the comparative observations are about as valuable as it would be to attempt to detect a leak in the roof by placing a rain-gauge in the garden.

In any case it is not a question of the total rainfall, but of what becomes of the rain. If the rain runs off the surface, ten times the rainfall will not keep the ground as moist and fertile as when it soaks in. An excessive rainfall is as bad as a deficient one, and renders a climate equally unfitted for agriculture, as witness the west coasts of Tasmania, Ireland, and Scotland, where humus forming conditions prevail to excess. A dry climate can be improved by irrigation, but an excessive wet one cannot be appreciably ameliorated.

In an ordinary climate trees bring back the moisture and dissolved minerals from the deeper layers of the soil, and retain them largely in local circulation. The effects of the rain and the rain itself are made to last over a longer period, and the moisture conditions of the district made more equable, instead of torrential leaching and erosive rain, alternating with devastating droughts. A forest is a sponge, to suck up moisture when it rains, and give it out again slowly when dry, and in the term "forest" all permanently-wooded bush or scrub land is to be included.

This brief statement by no means exhausts the subject, but the evidence to show, for instance, how the methods of deforesting adopted in clearing the land for agriculture, and still more for sheep pasture, have favoured the spread of injurious weeds is reserved for a subsequent paper.

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## COMPULSORY TIMBER RESERVES ON SETTLERS' LANDS.

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BY E. G. JOLY DE LOTBINIÈRE.

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Since lumbering became an industry in Canada, no period ever offered greater incentives than the present, to the holder of timber lands, to attack and destroy our spruce and balsam forests.

Before Canada became the great pulp wood producer that she is to-day, our forests were, comparatively speaking, safe, and no one, even the most pessimistic, ever believed in the possibility of their exhaustion.

They had their natural enemies, fire, disease and insect pest, but lumbering, as carried on 30 years ago, where only mature and adult timber was felled, for conversion into dimen-

sion timber, deals and boards; was far from being a menace to the perpetuity of our forest wealth. It was rational exploitation, removing the mature timber to make room for the young growth.

But all that is now changed, spruce and balsam which thirty years ago commanded but a limited market and comparatively low prices, now have the world as a market and prices undreamt of at the period I allude to.

The reasons which have led to the rise in the value of spruce are well known. Among many I will mention but two, the scarcity and exorbitant price of pine and the unprecedented demand for pulp-wood coupled with the practically irresistible prices consumers are ready to pay for the article.

It may be of interest in support of what I have just said to draw attention to the rise in the price of pulp-wood during the last ten years. The following figures may be open to criticism, but they are on the whole, I think, fairly correct and represent the price of the wood at Quebec:

In 1899, rough wood was worth, say, \$4.25 per cord, rossed wood, \$6.75. Prices between 1899 and 1907 fluctuated considerably for better or worse, but in 1907, rough wood was selling at \$6.50 to \$7.50 per cord and rossed from \$9.00 to \$10.00.

In 1899 the United States imported from Canada 369,217 cords of pulp-wood, in 1906, 738,872 cords, an increase of 369,655 cords. I have not the figures for 1907, but I am told that the imports by the United States almost reached 1,000,000 cords. If that figure is exaggerated for 1907, it will not be so for 1908.

With such a demand for pulp-wood, and with present prices, it is not to be wondered that the future is forgotten, and that our forests are being sacrificed to the golden present.

The few remarks I wish to make, have not, however, as their object a requiem on the disappearance of our pine forests, though it might not be out of place to chant one, nor do I wish them to be considered as a valedictory to our spruce wealth. My object is to suggest to this meeting a means by which we may secure, for the Province of Quebec at least, a constant and perpetual supply of timber for our settlers, wood to enable them to build and repair their homes and fuel to heat themselves and their descendants for ever.

What I am about to suggest may appear to some here to-day as an invitation to bar the stable door after the horse is stolen. But such is not the case. It is true that millions of acres in the Province of Quebec are held in freehold, or under patent, with no restriction whatsoever as to the way timber on such areas may be treated, but, gentlemen, there are yet millions of acres of Provincial lands which will ultimately be opened to colonisation and my remarks apply to those lands.

I will now put before you a scheme devised by my father

to compel the habitant to preserve as "perpetual bush lot" a certain portion of his property. This scheme has been in operation for over 30 years and has proved a success. If success has attended the efforts of a private individual, I can see no reason why our Provincial Government, if it is willing to adopt the scheme and honestly and conscientiously carry it out, should not obtain a measure of success at least equal to that which we have attained.

Within the last thirty years, my father has made many sales of timber lands on his Seigniorship of Lotbinière. These sales have been of a two-fold nature. Some lands have been sold as "terre à bois," small bush lots of from 15 to 20 acres each, to provide fuel and construction material to the purchaser, others have been sold as agricultural lands, but with a bush lot reserve.

I will now draw your attention to the clauses in these deeds referring to the protection of the timber.

The following clause is found in the deed of sale of all timber lands, sold simply to supply the purchaser and his descendants with fuel and building material:—"It is moreover agreed between the parties to the present deed, that the said lot is sold upon the express condition, that no portion of the same shall be cultivated, that no wood or branches shall be burnt thereupon, that the lot will be preserved as a 'wood lot' by the purchaser, his heirs and assigns, and that no wood from the said lot shall be sold, under penalty of paying to the seller, his heirs and assigns the sum of \$100.00."

Where a lot was sold for the purpose of settlement, a timber reserve was always stipulated, in the following terms:—"Permission is given to open and cultivate the said lot up to such and such a limit, (and then comes the restriction) that the remainder of the said lot shall not be cultivated, that no wood or branches shall be burnt upon it, that the said portion of said lot shall be preserved as a 'wood lot' by the purchaser, his heirs and assigns for their own use and that no wood will be sold from the said reserve under a penalty of \$100.00."

In both cases the deeds further say, that the clauses I have cited are not only for the protection of the seller from fire that might spread to his adjacent lands, but to protect the purchasers also from the same danger. Allusion is also made to the fact (and that 30 years ago), that the sale in the case of a 'bush lot' is made to furnish the purchaser with fuel and building material that he can no longer find anywhere in the vicinity of his home.

In the case of lands to be settled, the forest reserve or "bush lot" was invariably made at one end of the lot or the other, so that all the bush lots should be contiguous. The purchaser was not allowed to select his timber reserve. Had he been

permitted to do so, he would invariably have chosen as his bush lot the worst part of his land and that containing the least timber.

As I said before, this scheme of my father's, which has now had over 30 years' trial, has proved a success. The lands sold as purely "wood lots" are to-day covered with a dense growth of timber and on the lands which were sold for settlement, the reserve has been almost invariably respected and the terms of the deed adhered to.

On a 100 acre lot, a reserve of say 20 acres, with the restrictions I have mentioned, as "perpetual forest reserve," would be amply sufficient to supply the purchaser and his representatives with an inexhaustible supply of fuel and building material and not only that, but every new township, instead of shortly becoming the treeless, parched desert our old settlements now are, would be covered with an ample supply of timber.

This forest cover would not only give the settler the fuel and building material he would need, but it would powerfully aid in maintaining the water powers with which a provident hand has so liberally endowed our favoured Province. Industries dependent on cheap motive power would be assured, agriculture would be enormously benefited, our settler would be free from any possible wood famine and nothing but good could result from the adoption of the policy I have but briefly outlined.

The suggestion I have made may, I trust, find sympathisers amongst those here to-day and I earnestly hope that this association, in its wisdom, will take the necessary steps to draw the different Provincial Governments' attention to the reform I have attempted to advocate. Its adoption cannot be prejudicial to the country, it can only be a practical factor for good.

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