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A LOGGING ROAD IN ONTARIO.

*Frontispiece.*



551"

648.

# Canadian Forestry Journal.

VOL. I.

JANUARY, 1905.

No. 1.

## THE CANADIAN FORESTRY ASSOCIATION.

*By the Editor.*

The Canadian Forestry Association presents to its members and the public the first number of the Canadian Forestry Journal, which will be devoted to the interests of the Association and the advancement of the forestry movement generally. It has been felt for some time that a distinctive medium representing the Association was imperatively required if it was to bring its objects and work to the attention of the public in an adequate manner, and enlist popular sympathy and support. In pursuance of this object a decision was reached at the annual meeting that such a publication should be undertaken, and in fulfilment of that resolution the publishing committee now submit the first number.

As this marks an important step in the history of the Association, it may be well to take the opportunity of presenting a brief sketch of its development and the purposes of its organization. The project for the formation of the Canadian Forestry Association was initiated by Mr. E. Stewart, Dominion Superintendent of Forestry, who called a meeting of a number of persons interested in the subject at his office, on the 15th February, 1900. At that meeting it was decided to form such an Association, and on the 8th March following, the first annual meeting was held in the City of Ottawa, at which the Canadian Forestry Association was duly organized, with the following staff of officers:—Honorary President, His Excellency the Governor-General; President, Hon. Sir Henri Joly de Lotbiniere; Vice-President, Wm. Little; Secretary, E. Stewart; Assistant Secretary and Treasurer, R. H. Campbell; Board of Directors: Hiram Robinson, Thos. Southworth, Professor John Macoun, Dr. Wm. Saunders, Hon. G. W. Allan, E. W. Rathbun.

The considerations that determined the promoters of the movement to take such a step deserve recapitulation.



Canada has from the beginning of her history been noted for the extent and riches of her forests, and the lumber industry has been one of the leading branches of her manifold activities, and has developed with her growth, forming a principal contributor to the domestic and export trade of the country, giving employment to a large section of the population, developing a healthy and sturdy class of men, and adding to the wealth and prosperity of the Dominion. At the same time the revenue received by some of the provincial governments directly from the forest has been one of the largest sources of income, and has rendered a resort to direct taxation in any other form almost altogether unnecessary. The export of domestic forest products for the last fiscal year was \$36,724,445. In Ontario and Quebec the usual revenue from woods and forests is from a million and a quarter to a million and a half dollars each year, and in the other provinces which control their own timber lands the revenue is steadily on the increase. In New Brunswick, during 1903, it was \$196,500. In British Columbia the revenue for the present year was estimated at \$250,000, and it will probably be much larger. The total value of forest products, as stated by the Census of 1901, is for the census year, \$51,000,000.

European students of forestry, who have been forced by the condition of affairs on that continent to give the wood supply careful thought, have sounded a note of alarm as to the future. We quote from M. Mélard, one of the leading foresters of France:

"At the present moment the forestry situation in the world can be summed up in these words:

*"The consumption of wood is greater than the normal production of the accessible forests; there is in this production a deficit which is for the moment supplied by the destruction of the forests."*

"This situation is very grave. It merits the attention not only of foresters by profession, but of economists and statesmen. Forestry questions which to-day encounter so much indifference, are destined to take, before many years, a capital importance in the consideration of civilized people. May it not then be too late!"

"It is profoundly disquieting to ascertain that 215 million inhabitants of Europe, constituting the nations where commerce and industry have attained the greatest power, do not find enough of wood in the forests of the territories which they occupy.

"If Sweden, Finland, and Canada should supply alone the importations of all the countries requiring manufacturing wood, their normal production would not suffice, and their forest capital would be promptly dissipated."

Dr. Schlich, a leading English authority, discussing the same question, and reaching a somewhat similar result, concludes with the following statement:



"The great standby for coniferous timber will be Canada, if the Government does not lose time in introducing a rational management of her forests."

What is the actual forest situation in Canada to-day? Originally covered by an immense forest, stretching from the Atlantic to the Pacific, unbroken save where the prairie fire and the buffalo had won for themselves a place on the plains of the West, the axe and fire and the advance of settlement have so changed the face of nature that the hardwood forests have practically disappeared, and with the exception of birch and, to a less extent, maple, Canada is dependent almost wholly on outside sources for her hardwood supply. Those who have had opportunity of observation state that not more than one-third of her coniferous forests are mature timber, the remainder being *brulé* or small trees. In many districts fire has done its work by itself or as an accessory to the axe, with such destructive effect that large tracts, once forest-clad, are now bared to the rock or sand foundation upon which so much of the coniferous forest stands, and left useless and unproductive, efforts to convert them to agricultural purposes having proved utterly futile.

Flowing from the great forest-clad hills and mountains of the Dominion are numerous perennial streams which in their descent form water-powers of immense possibilities and value, and furnish supplies of moisture to the plains beneath, plains which, in some cases, in order to their successful cultivation, require a substantial addition to the scanty rainfall which they receive. The possibilities of electrical development and other uses of the energy furnished by these streams open immeasurable limits to Canada's industrial future. And the even flow, and in some situations, the very existence of such watercourses depends on the preservation of the forests at their sources. In Southern France, at the beginning of the last century, the slopes of the Pyrenees, the Cevennes, the Alps, were deforested and left bare to the action of the elements. The results were the transformation of even-flowing streams into rushing torrents, the erosion of the slopes into gullies and ridges, destructive land-slides, and the deposit of silt on the plains beneath to such an extent that some 8,000,000 acres of once fertile soil in twenty departments were involved in the disastrous consequences of forest destruction on 1,000,000 acres of mountain slopes. France has already spent \$20,000,000 to help repair this condition and replace the forests, and it is estimated that more than \$30,000,000 will have to be expended before the area which the State possesses, only some 800,000 acres, will be restored. Canada has no special dispensation from Providence, and a similar transgression of the laws of nature will inevitably bring the same results. Is there not, therefore, reason that this question should



be given the most careful consideration by all seriously interested in the future of the country?

In the older districts too severe denudation has already resulted in dangerous freshets in the spring time, and the failure of springs and streams in the summer, when their need is most felt, losses from violent windstorms have increased, and the supply of wood for fuel and domestic purposes is diminishing so rapidly that it will soon become altogether inadequate, if some measures are not taken to ensure renewal. The condition that is thus being brought about by artificial means exists naturally in the prairie districts. Here the need of wood for fuel and shelter is felt from the beginning. The direct bearing which the shelter afforded by a strip of timber has on agricultural production is clearly shown by the comparative results on sheltered and unsheltered plots recorded in 1900 at the Indian Head Experimental Farm, where the shelter meant a doubling or trebling of the yield, while on some exposed places the crops were a complete failure.

The esthetic value of trees has influence on one side of life which it is well that Canadians should not neglect. The beautifying of the home, the embellishment of the city street, the ornamentation of the park and roadside, with the graceful forms, the beautiful foliage and the grateful shade of forest trees, brings to each of these a charm and attractiveness which cannot but have an elevating effect on the national life by awakening the sense of beauty and attaching the affections of the people more strongly to the homes and haunts of their native land.

In laying down the programme of its principles, the Canadian Forestry Association kept all these questions in view. In brief, the statement of its objects is: To advocate and encourage judicious methods in dealing with our forests and woodlands; to awaken public interest to the deteriorating effects of wholesale destruction of forests; to consider and recommend the exploration, as far as practicable, of the public domain, and its division into agricultural, timber and mineral lands, with a view to devoting the public lands to the purposes for which they are best fitted; to encourage reforestation and the planting of trees on the prairies, in cities, towns and villages, and throughout the country; to collect and disseminate for the benefit of the public, reports and information bearing on the forestry problem in general.

The Forestry Association, although it is consolidating the influence of those favoring better forest management, is not the pioneer in this movement. Such a movement has been supported and advocated for many years by earnest and far-seeing citizens of the Dominion, most of whom have now identified themselves with the Association. By writings, by ad-



dresses, by petitions to the Government, they sought to bring the matter to the attention of the public, but the time was not ripe, and the public indifference did not readily yield. "The forests of Canada are inexhaustible" was the stock argument. "Forestry is a fad" was the general opinion. And if any interest was aroused, it was quickly lulled again by the absence of that pressure of necessity which is the greatest incentive to action. "The future may be allowed to look after itself."

Progress was, however, being made. A great forestry convention was held in Montreal in 1882, at which the American Forest Congress was organized. This conference was attended by large numbers from Canada and the United States, and the papers and discussions aroused much attention at the time, and while the effects were to a large extent ephemeral, still from that time may be dated the first effective efforts to deal with forest fires, and to make permanent reservations of timber lands, and these are the two special directions in which Canadian forest policy has made the greatest development.

Fire is the most serious menace to the forest, and protection from it must be at the basis of any system established. At first consideration it might seem preposterous that the vast extent of the Canadian forest could be effectively protected from fire, but when it is reflected that the fires that result from natural causes are comparatively few in number compared with those that originate through the action of man, the matter does not seem to be an utter impossibility. And that it is not so experience has already shown. The Dominion and Provincial Governments, with the exception of British Columbia and Prince Edward Island, have established special fire-ranging services, commencing with that of Ontario in 1885, and these have been effective in proportion to the thoroughness with which they have been worked out. The more that has been spent on the service the greater has been its effectiveness, and the results have been the saving of much valuable timber. The smoke from forest fires which was at one time the usual accompaniment of every summer in the cities of Eastern Canada has given place to almost complete immunity from such an unpleasant state of the atmosphere. A great deal still remains to be done in extending the system and perfecting its operations, but the principle of a fire ranging staff is justified beyond the possibility of hostile criticism. The fire-ranging system is an established and unassailable feature of Canadian forest policy. It is a form of fire insurance for the forest which is both cheap and effective. In the Province of Ontario, which spends the largest amount upon this service, the expenditure was \$31,237 in 1903, and the revenue received from woods and forests was \$2,307,356. Although this revenue was swollen beyond the usual proportions by bonuses



for timber limits, it may be pointed out that the large bonuses tendered were justified on the part of the purchasers largely by the immunity from fire ensured by the fire preventive service.

Timber reserves have also been established in different parts of the Dominion, partly with the object of protecting the game animals and the watersheds, but also with the purpose of providing a permanent supply of timber. These reserves, so far as they extend, and they now comprise an area of over eighteen million acres, are a concrete exemplification of the principle that lands which are unfitted for other purposes should be devoted to the growth of timber. This is a principle of first importance, for, as the forests require but little from the soil, they already exist, and can be produced on lands so rocky or sandy that nothing else of value can grow upon them. In every part of Canada, and particularly along the great Laurentian ridge, and in the mountainous districts, there are large areas bearing magnificent forests, which, bared of such covering, have no other productivity to take its place. The extent of such areas in Canada constitutes an imperative demand that the forest should be continued and reproduced.

The necessity for tree growth on the western plains was early recognized, and an effort to stimulate action in this direction was made by the adoption of the Tree Culture Claim Act, under which the holder of entry for a quarter section of land might earn title thereto by planting forty acres of forest trees. Lack of knowledge of the requisites of success resulted in almost total failure of this plan of reforesting the plains. When the Experimental Farms were established in the West in 1889, experiments in tree growing were immediately begun, and have resulted in a clearer understanding of the conditions of success and of the species which give the most satisfactory results. With the inauguration of the Dominion Forestry Branch in 1899, a still further impetus was given. A scheme for supplying the settlers with trees, to be planted and cared for under expert advice, has been worked out successfully, and gives promise of great future development.

This was the course of development the forestry policy of Canada had followed when the Canadian Forestry Association came into existence. Since that time the fire protective force has been increased, and the methods of management improved throughout the Dominion, and such a force has been established in some places where previously no effort of the kind had been made. The Forest Reserves have been enlarged and the number increased. In Ontario a plan for assisting the farming population to set out wood lots has been arranged through the medium of the Agricultural College. While the Forestry Association cannot assume all the credit for these advances, it can at least claim



that all efforts in that direction have had its support, and that it has had sufficient effect on public opinion to assist materially in making the way for such development easier. Annual meetings of the Association have been held each year, and reports of the proceedings have been published and widely distributed. The Association has, by resolution, made representations on forestry questions to different governments and other public bodies, all of which have received respectful consideration, and have had an influence on the course of forest legislation. By the editing of a forestry department in *Rod and Gun in Canada*, by public meetings and through the press, the purposes of the Association have been kept before its members and the public, and it is hoped to do this more completely through the columns of the present journal.

The Canadian Forestry Association, at the end of the fourth year of its existence, has a membership numbering nearly six hundred, including legislators, foresters, lumbermen, farmers, scientific men, and others. Its financial position is good, and in addition to the publication of the Forestry Journal, several advance steps are now under contemplation, with the object of reaching and arousing public interest more fully.

What are the possibilities of the future? In regard to this we may learn much from others.

Germany has for centuries been working out a forest administration, which from crude beginnings has developed into a highly specialized system, in which the annual returns from the forest have steadily increased both in quantity and value, although for the most part such forests are situated on poor, sandy soil, or in rough, hilly or mountainous districts. With a population of 240 persons to the square mile, Germany considers it profitable to not only keep her poor lands, at present forested, in that condition, but to increase the area of such forest lands, even by purchase. The net annual income from her 35,000,000 acres of forest land is \$63,000,000.

In France a similar policy has been followed, and although the recklessness of the Revolution period interfered with its steady advancement, since 1870 no forest lands belonging to the State have been alienated, but instead the area has been increased from year to year, and improved methods of management are being developed.

Canada's system of forest administration cannot, however, be wholly the same as that of any other country, and must start on a simple basis.

Its foundation has been laid in the policy, almost universal in Canada, of keeping the forest lands under Government control, in the fire-ranging system, and in the setting apart of forest



reserves. The reserves give an opportunity for a more careful and minute study of forest conditions than is possible in the great area of the general forest, and are the first steps toward the final conquering of much that has become a wilderness, but which may yet blossom, if not as a rose, at least with a beauty and verdure and value of its own. The aim of the management must be to produce a forest of well-formed trunks, clear and clean, and the evolution of the forest by which this is reached is a question requiring careful study. Various influences affect the results beneficially or otherwise. Different species of trees have varying effects on one another. Some will grow in dense shade; some require light. For some a great deal of moisture is necessary; others prefer dry locations. Insects do their destructive work, as for instance the larch sawfly, which killed the tamarac throughout the northern forests; rot and fungi and storms all have their effect.

The problems of economy, of engineering, of transportation, of management, of scientific investigation, that a study of forest administration opens up will give scope for the best intellect that Canada can produce, and display a field for investigation, fascinating in itself and in its possibilities of practical application for the good of the country.

The educational institutions have recognized the meaning this movement has for them, and have been turning their attention to the possibility of providing the scientific training that may be necessary. Sackville University has had a course of lectures on Forestry. Queen's University, during the term of 1900, also held a similar series, and both she and the University of Toronto have been looking towards the establishment of a School of Forestry. The Ontario Agricultural College is taking active steps in its special sphere.

The forestry movement should appeal to all Canadians. Canada has been blessed by Providence with a wealth of forest. It has inwoven itself in her poetry and her history. It clothes with beauty her sterile lands, making them productive and giving healthy occupation to a happy people. In the advance of the civilization of the nineteenth century two-thirds of this forest has been swept away by fire, uselessly and needlessly. Rocky and sandy wastes have been bared and left desolate. Is this all that the intelligence of man can do? Has the twentieth century no other purpose to accomplish? Will the close of another cycle find the destruction much more surely and completely established? Or will the expiration of another hundred years find the forests clothing the rocky hills and valleys with their beautiful verdure, well-ordered, productive, abounding in wealth for the state, furnishing the needs of Canada and the regions beyond, supporting a hardy and intelligent populace, form-



ing a shelter for the wild animals and a place of pleasant resort for the people? The accomplishment of such a purpose is well worthy the support of all patriotic citizens, of all who love their native land, and have an interest in its future. Such is the purpose which the Canadian Forestry Association has set before it as the ideal for Canada, to which it proposes to work, and for which it appeals for support.

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A request was made recently to the Bureau of Forestry for the Province of Ontario for a forester to assist in the management of timber limits in Algoma, to which the only reply that could be sent was, that there was no supply to meet the demand. Such a request, however, emphasizes the fact that the need of trained foresters is beginning to be felt.

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At a recent meeting of the Board of Directors of the Canadian Forestry Association, a resolution was passed expressing the opinion of the Board that in view of the annual destruction of timber in British Columbia, and the difficulty of guarding the forests from fire, it is desirable that the Bush Fires Act of that province should be amended so as to prohibit the starting of fires for the clearing of land between the first day of May and the first day of November in each year, unless a special permit for that purpose be granted by the Forest Ranger, or other officer appointed for the district in which such permission is asked.

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A great deal of interest has been excited in the County of Renfrew, in Ontario, by the preparations being made for the erection of what is popularly known as a "stump factory." The object of the establishment is to utilize the red pine stumps in that district by reducing them by the action of heat in a retort, and it is expected that the chemical products and charcoal will return a good profit. Similar establishments have been in operation in Michigan for some time with satisfactory results. The farmers in the vicinity of the proposed location have great expectations of having lands cleared at a profit, thus accomplishing two purposes, as the result will be a considerable increase in the agricultural value of the lands.



## CANADA AS A FIELD FOR INTELLIGENT FORESTRY.

*E. Stewart, Dominion Superintendent of Forestry.*

The production and proper utilization of the unoccupied forests of Canada is a matter that demands the serious consideration of the Canadian people. Very few countries possess so large an area of forest lands as Canada, and while a part of this is fit for and will be brought under cultivation for the growth of agricultural products in the future, a large proportion is unfit for this purpose, and can be more profitably left for the production of timber and to protect the game, which is also an important product of our northern regions.

Before, however, dealing with these unoccupied forests of the north, let us consider for a moment the uncleared lands of the older provinces granted by the Crown for agricultural purposes, and also those under license as timber limits.

According to the census of 1901, 34% of the total area of the farms of the five eastern provinces is still in forest. If this quantity of woodland were uniformly distributed throughout all parts of these provinces, the most exacting economic forestal demands would be met, but this is very far from being the case. In the older settlements in most cases very little woodland is left, the high average percentage being made up by the newer districts, but here too the axe and the forest fires are busy in bringing about similar conditions to those now prevailing in the old frontier countries, in some of which the country is almost denuded, and resembles in bleakness our western plains. It is a well understood fact that a certain proportion of the area of any district should be left in forest. This may vary from, say, 10% to 30%. There are some districts in the older provinces where there is not 5% left, and the result is to be seen in the disastrous spring floods followed later on in the season by droughts, where in former years, before the country was cleared up, neither the one nor the other was ever experienced. This state of affairs is becoming so common in many parts that it is high time that the municipalities should take action to encourage the farmers to leave a portion of their farms in forest by reducing or freeing such wooded areas from taxation or by other means to this end. But the farmer himself will not only be doing good to the community at large, but also best serving his own interests by allowing a certain portion of his farm to remain in forest as a wood-lot. Space will not permit me to deal with the farmer's wood-lot further than to say that there are very few farms which have not a certain percentage of land that is better adapted, and can be more



profitably used, for that purpose than for the growth of agricultural products.

Our people too frequently fail to realize the elements of reproduction and growth that are constantly going on in the forest; that though they do not require to sow, yet there is a proper time to harvest a wood crop, and that a little care in the protection of the young trees from destruction by stock or otherwise will be amply rewarded by the young trees which should take the place of those that have reached maturity, and which the owner has removed. There is another fact regarding trees very different from agricultural products, and it is this: no rotation of the forest crop is necessary. The same varieties can be grown on the same soil for an indefinite period.

A considerable percentage of our forest land lying immediately north of the present settled districts in Ontario and Quebec, but not extending beyond the northern watershed of the St. Lawrence is held under license by lumbermen and capitalists. These licensees have only the right to cut the timber of certain varieties on their limits. In former years the bush operations of the lumbermen were invariably followed a year or two after by a forest fire, that not only burnt up the dry brush that he had left on the ground, but also destroyed all the remaining standing timber, and not only that, but more frequently than otherwise the fire did not confine itself to the area cut over, but spread to other parts and often destroyed large adjoining areas of good timber. It is gratifying to know that great improvement in this respect has taken place within the past few years, and that the destruction in those districts by forest fires has greatly decreased, owing to the greater care exercised in the use of fire, and by a patrol system which cannot be too highly commended.

Another step in advance, however, is necessary, and that is with reference to the proper harvesting of the timber crop so that the same limit may continue through the increment of growth to furnish a timber crop in perpetuity. Here is a great field for intelligent work. The time has now arrived when the timber on those limits has reached such a value that no holder can afford to disregard the extensive young growth of pine not yet large enough for saw logs with which every limit abounds, and which if protected will more than repay a good rate of interest on any care that may be necessary to protect it. There is a great opportunity here for the intelligent forester. Not only is it necessary to protect the limit from fire; to cut only trees that have arrived at a state of maturity, but also to remove the useless or inferior varieties in order that the more valuable may have room to grow and that the area may be utilized to the best possible advantage.

Let us now consider the conditions of that vast stretch of unoccupied forest country lying north of what has been referred



to. It extends in an east and west direction, from ocean to ocean, a distance of about three thousand miles in length, with an average breadth of probably about five hundred miles, between the arable land on the south and the barren lands of the far north. Is there anything in connection with this great region demanding our attention? To this or almost any question regarding it an answer is difficult to give, for the reason that we know so little about it, but this very ignorance suggests one thing that should be undertaken, and that is exploration and examination in order to ascertain the value of what we there possess. Very little information of a definite character can be obtained at present even concerning its geography, no matter how diligent the enquiry, and much less concerning its resources and capabilities, while to the great majority of our people this region is a veritable "terra incognita" of which no more, perhaps less, is known than of the steppes of Asia, or the deserts of Africa, and yet it is, so to speak, Canada's wood-lot. It occupies the same relation to the arable land to the south that the rough and uncleared portions of the individual farm do to the cultivated parts of it.

I have said elsewhere that we as a people occupy the position of a farmer who has settled, cleared up and erected buildings on the front of his farm, but who has never even visited the portion outside his enclosures. What would be the course of any intelligent farmer on starting to make a home on one of our bush lots? Certainly the very first act would be to explore and thoroughly examine every part of his homestead. He would then clear up those parts best adapted for the growth of crops, and leave the less productive portions for pasture, and the roughest of all to serve his purpose as a wood-lot; and this is precisely what the nation should do with reference to its unoccupied lands. The first thing is to learn what we really possess and its character; second, to invite settlers to locate only on land which will reward them for their labour; and, third, to retain in the hands of the Government such forested land as is unfit for agriculture but is better adapted for the growth of timber than for any other purpose. The policy should be to afford the settler the means by which he may earn his living by granting him good land on which he can grow his crops, whereas to make him a gift of the natural timber outside his own homestead would be virtually giving him possession of a crop which he had no part in producing, but which was the natural product of the soil, and which it had taken a century to produce. This should be regarded as an asset of the whole country. There can be no valid reason whatever adduced to support the theory that the timber on non-agricultural lands should be given away to the individual. In the case of agricultural lands the farmer's intelligent labour is the chief factor in producing his reward, but in the case of the virgin forest he does



not produce it, but simply appropriates what nature unaided has taken perhaps a century or more to produce.

Forestry for several reasons is a subject that belongs peculiarly to the State. One reason why this is the case is the far-reaching effects which the forests have on the character of the country in modifying its climate, and in regulating its water supply, both of which affect the community at large. Another reason is owing to the length of time required for trees to attain maturity. A long period of from fifty to one hundred years or more is required for our forests to attain their greatest commercial value, so there is no inducement to the individual looking to his own immediate interest to engage in the raising of a timber crop when he knows that his earthly career will have closed long before the return for his labour can be realized; whereas the life of a nation is not measured by years only but by centuries.

We have in that great region, which is well described as our subarctic forest belt, as I have stated, a vast tract largely unfit for agriculture. Within it are many great lakes and rivers which owing to the cool temperature of the water contain fish of the best quality. The land is covered with timber, a large part of which it must be admitted, is of less commercial value than that growing farther to the south, but which is already attracting attention for the manufacture of pulp. The most widely distributed tree of that region is the spruce, white and black, which is *par excellence* the tree for that purpose. This region too is the home of a great variety of the most valuable fur-bearing animals, and it is scarcely necessary to say that their existence depends very largely on the preservation of the forest which is their home. We have also in these wilds, owing to the numerous rivers and streams with which the region abounds, and the rough and broken state of the country, rapids and waterfalls innumerable which will furnish sufficient power for all purposes and at little expense. Of its mineral wealth it is too early to speak yet, but there is little doubt that the explorer will find rich rewards for his enterprise in this virgin field. The larger lakes and rivers afford means of communication throughout almost every part of this great district.

When all these conditions are duly considered, surely we have a region of country worthy of careful investigation. A moment's reflection will reveal what an important part the forest exerts over its welfare. Permit the destruction of this forest covering by fire or otherwise, and what will be the result? To say nothing of the evil effects on the climate of the fertile lands farther south that would result from the destruction of this barrier against the northern air currents, the severe winter of those high northern latitudes will be made almost intolerable by the winds that will



then blow uninterruptedly over the denuded land; the streams bereft of the present natural reservoirs which the forest covering at their sources affords, will then be torrents in the spring time, and dry during the summer and winter months, causing destruction to the fish and to navigation; the fur-bearing animals and other game will practically disappear, and instead of having a land with many possibilities, we will have an arctic desert.

Fortunately the land in this great region is practically all in the possession of the Crown, so that little difficulty stands in the way of conservative forestry there. From what has been said it is evident that there is a great field for intelligent forestry in Canada, which it should be the aim of the people and of the Governments, both Federal and Provincial, to have put in practice with as little delay as possible.

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Dr. A. Harold Unwin, formerly of the Dominion Forestry Branch, but now of the Imperial Forest Service, writes from West Africa that he has started work in the Western Division by inspecting concessions, i.e., timber limits that are being worked, and also rubber tree plantations that are already set out. This year two hundred new plantations are being worked, scattered over a tract of country about one hundred miles square, and as the inspection has to be made on foot, it takes some time to see the district.

The concessions cause a great deal of supervision, as no concessionaire may cut any tree under twelve feet in girth at ten feet from the ground, and must plant twenty mahogany seedlings for every large tree he cuts, and must also preserve any young mahogany growth he may find. The latter operations are directed by the forest service. There are twenty-eight foresters, all natives, for the work in the Western Division. In the Central Division there are six foresters. The latter division includes mainly rubber plantations, though there is splendid timber at some distance from the railroad.

The appropriation for the service is \$50,000, and gives ample for everything except the extension of the plantations. The revenue of the colony is good, and increasing, so that it is expected there will be a larger appropriation in the near future.

The foresters also have charge of the game in the districts, which consists of several herds of wild elephants, quite a responsibility to undertake.

There is no pine in the country, but the question of introducing Long Leaf Pine is being considered. It will grow well, and the imported timber stands the climates, ants, &c., splendidly.



## FOREST INFLUENCES.

*Professor J. B. Reynolds, Ontario Agricultural College.*

At the present time much is being said and written concerning the forest. Forestry problems include a consideration of forest management, of the forest as a resource, and of the forest as a condition. The last question, the forest as a condition, comprises the subject of this paper, and upon this subject I shall try to present the best information available.

Dr. Fernow states this question topically, as follows:

The forest exerts an influence

I. Upon the climatic condition within its own limits and beyond.

II. Upon the distribution and character of the waterflow.

III. Upon the mechanical condition and erosion of the soil under its cover.

I. The climatic influence of the forest is, conjecturally, four-fold: (1) Upon the temperature of the air and of the soil; (2) upon winds and storms; (3) upon evaporation and the humidity of the air; (4) upon the precipitation—rain and snow. I say conjecturally, for the influence of the forest upon precipitation is by no means established, or generally admitted.

### *Control of Temperature by the Forest.*

The forest exerts its influence upon temperature by reason, principally, of the tree-crowns. These shade the ground and prevent the heat of the mid-day sun from having its full effect; conversely, the same crowns check the radiation of heat from the forest soil and air at night and in winter. Thus, the maximum temperatures within the forest are lower than those in the open, while the minimum temperatures are somewhat higher. In summer, the lowering of the maximum is much greater than the raising of the minimum. In winter the extremes are about equally reduced. Hence, the net effect of the forest in summer is, to lower the mean temperature of the forest air; and in winter, this cooling effect almost or entirely disappears. The net annual result is to cool the air—the mean annual temperature within the forest being lower than that in the open; and to moderate it, the extremes of high and low, both daily and annual, being reduced. The moderating effect of the forest is much greater than its cool-



ing effect. The amount of influence thus exerted depends, of course, upon the character and the closeness of the tree-crowns,—a thick stand of forest having a greater quantitative effect, in the direction indicated, than a thin stand; while an evergreen forest has less effect in summer, and greater effect in winter, than a deciduous forest.

#### *Control of Winds and Storms by the Forest.*

One of the most important influences of the forest is due to its action as a wind-break. On its windward side, the effect of the forest is slight. But on the leeward side, the checking of the velocity of winds results in partial or complete stagnation of the air, with the phenomena attendant upon stagnation, namely, increased humidity of the air, decreased evaporation from the ground and from plants, higher temperature during the day, and lower temperature at night. Hence the effect of the windbreak is occasionally injurious, in favoring night frosts. But this is only occasional. The ratio between the *width of the area protected* and the height of the windbreak, has been variously stated by different observers, but a moderate estimate is, that for every foot of height of the windbreak, an area of ten feet in width is protected. Thus a belt of trees 30 feet high will protect from cold, drying winds, objects on its leeward side at a distance of 300 feet back from the belt.

*Protection from lightning* is, in all probability, afforded to buildings by single trees, to a greater extent by clumps and belts of trees, and it is equally probable that extensive forests, while they may increase the frequency, reduce the intensity and destructiveness of thunderstorms over their own areas and beyond.

#### *Influence of the Forest on Evaporation and Humidity.*

In the forest, evaporation from three sources is to be considered: (1) Evaporation from the soil; (2) transpiration from the leaves; (3) evaporation from rainfall intercepted by the leaves, branches and trunks of trees. German experimenters have established for these quantities the following values: As compared with the amount evaporated from a free water surface in the open (1) the evaporation from soil under forest litter and within the forest, is 13 per cent; (2) transpiration from the leaves, 77 per cent; (3) evaporation of intercepted rainfall, 61 per cent; total, 151 per cent. On the same basis of comparison, the amount of moisture added to the air over cereals on the average is 173 per cent; over sod, 192 per cent; over bare soil, 60 per cent.

The forest, therefore, is more conservative of moisture than sod or cereal crops, but returns to the air  $2\frac{1}{2}$  times as much moisture as does the bare soil.





TREES AND SHRUBS AT EXPERIMENTAL FARMS.  
Brandon and Indian Head.





EXPERIMENTAL FARM AT INDIAN HEAD.

(1) Row of Poplars. (2) Balm of Gilead. (3) Manitoba Maple (4) American Elm



The absolute amount of water-vapor in forest air is very slightly greater than that in the open, and on account of the lower temperature of forest air, its relative humidity is generally higher than that of air in the open.

*The Influence of Forests upon Precipitation.*

It has been generally stated by those anxious to emphasize the deleterious effects of deforestation, that the wholesale destruction of the forests has resulted in decreased rainfall over the deforested areas. This may be the case, but positive proof is lacking. It seems probable that the rainfall over certain parts of Ontario has decreased within the last 25 years. But whether this is a consequence of the clearing of the land, or merely a result of those changes of climate that occur over large cycles of time, who can say? There is no component of the climate that is more variable and uncertain than the rainfall. An experimental inquiry into the relation between the forest and rainfall is, from the very nature of the problem, exceedingly difficult. To conduct such an inquiry, all factors, other than the forest, that can cause a difference in the observed rainfall, must be eliminated, and the experiment must cover a long series of years. Many such attempts have been made, with conflicting results. Experimentally the question is still undecided, but the consensus of opinion is that the forest has little or no influence on the amount of rainfall.

The question may be examined theoretically with some interest. Rainfall is the consequence of evaporation of moisture from the earth's surface, with subsequent condensation of vapor caused by cooling of the air containing it. Where there is no evaporation there can be no rainfall, unless vapor is carried over from some other area. Deserts are rainless because there is no evaporation there, and because the air above desert regions is too hot and dry to allow of cooling and condensation of vapor that may be carried over them; also these areas are usually so situated that vapor-bearing winds do not reach them.

Rainfall over any locality may be increased either by an increase of evaporation from the area in question, and a subsequent condensation and fall over this area, or by an attraction exercised upon large air movements whereby clouds and vapor-laden winds are diverted to the locality and precipitate rain there upon.

Of the various causes of rainfall, the principal is the upward movement of moisture-laden air and the cooling by expansion as the ascending air reaches levels of less and still less pressure. This upward movement may be part of a great cyclonic movement, covering hundreds of miles in horizontal extent, such as



one of our winter storms; or it may be part of a merely local air-movement, such as our summer showers usually are; or it may consist of a forced movement up the slope of a mountain-side. The question is, to what extent may the forest modify any or all of these movements, so as to affect rainfall?

First, as to the cyclonic movement, even if evaporation is increased over a forested area, the vapor is carried possibly hundreds of miles by the great horizontal movements of air in this class of storms; hence, increased evaporation over a forest does not increase the rainfall. Next, can the forest induce atmospheric conditions that will divert the storm-path? Theoretically, this seems impossible for great cyclonic areas, and doubtful even for local storms.

Secondly, as to storms of local origin, such as the thunderstorms, vapor formed from any region may be deposited again over that region. Hence, if evaporation is increased by the forest, it seems likely that rainfall also in the summer time, when local storms abound, may be increased. Referring now to the table of evaporation given above, we may see that evaporation from a forested region is less than that from sod or cereals, but more than that from bare soil. The substitution by the farmer of grass, root, and cereal crops for the forest in Ontario, would, therefore, tend to increase evaporation from the cultivated areas, and thus whatever effect the forest may have upon local rainfalls would be intensified by deforestation and cultivation.

As it does not appear probable that the forest on a mountain side can intensify the effect of the mountain in causing rainfall, we are forced to the theoretical conclusion that the effect of the forest in increasing rainfall can be but slight, and is probably in most regions nil. This theoretical conclusion is, on the whole, supported by such experimental data as have been obtained by the various investigators.

II. We come now to the consideration of the influence of the forest upon the distribution of the water-flow.

The forest controls the distribution of the water (precipitation) that reaches it, in the following ways:

- (1) By intercepting part of the rainfall.
- (2) By diminishing evaporation, within its own borders and beyond.
- (3) By transpiring large quantities of water, and thus diminishing the water-content of the soil.
- (4) By the influence of the forest-litter, (a) absorbing part of the precipitation, (b) offering a mechanical obstruction to surface flow and thus preventing run-off, (c) protecting the surface



soil from the beating of heavy rains; and thus, keeping it in a more loose and receptive condition.

(5) By the shade and by its control of the winds it holds the snow cover until late in the spring, thus giving opportunity for the water to penetrate the ground slowly instead of running off in floods.

Of these factors 1, 3 and 4 (a) tend to diminish the amount of water in the soil, and thus to lower the water-table. The other factors tend to increase the water supply relatively, and to raise the water-table.

(1) The amount of rainfall intercepted has been variously stated by different experimenters. Of course, a light shower is almost entirely intercepted by the tree-crowns of a dense forest, and given back to the air immediately as vapor; while the greater part of a heavy or long continued rain must reach the ground. On the average from 10 to 20 per cent of the total rainfall is intercepted. This amount is, of course, a direct loss to the forest soil.

(2) As has been already stated, the wind-breaking power of the forest is one of its most important influences. The cold, dry winds of winter, sweeping unchecked over the vast treeless plains of the North-West make it exceedingly difficult to rear fruit trees. Still more destructive to tree life is the warm, dry wind known as the Chinook. The Chinook, in Northern America, has been known to consume entirely in twelve hours a snow cover of  $2\frac{1}{2}$  feet deep, and to raise the temperature 57 degrees in 24 hours, while the humidity fell in the same time from 100 to 21 per cent. It is probable that the treeless state of the North-West is the result of these sudden and extreme changes of temperature and humidity. If a forest could be interposed in the path of the Chinook, its well-known action in checking the velocity of the wind, and in preventing extremes of temperature and humidity, would result in self-preservation. At any rate, the beneficial effects of shelter belts, clumps of trees, or wooded areas, upon orchards and crops that lie to the leeward is unquestioned. The high winds are checked, and the fruit trees are not subjected to winter drought. The snow is allowed to lie evenly, and to remain longer. The general effect, summer and winter, of the forest in reducing evaporation is most beneficial. An Illinois farmer sums up his observation upon this matter thus: "My experience is that now, in cold and stormy winters, wheat protected by timber belts yields full crops, while fields not protected yield only one-third of a crop. Twenty-five or thirty years ago we never had any wheat killed by winter frosts, and every year a full crop of peaches, which is now rare. At that time we had plenty of timber around our fields and orchards, now cleared away."



To mention the influence of the forest-litter (4), and the holding of the snow cover (5), suggests the third topic of my article.

III. *The influence of the forest upon the mechanical condition and the erosion of the soil under its cover*, is due simply to the impedence offered to the fall of water by the forest litter. A heavy rain falling unimpeded upon bare clay soil, almost invariably packs it, puddles it, and injures its texture, its capacity to convey water. Upon lighter soil the effect of the rainfall is less injurious, but is always in the direction of compacting. The forest litter, by breaking the force of the rain-drops, allows the soil to remain open and friable. The tree roots also, penetrating the soil, form channels for the entrance of water. Then, on sloping ground and on hillsides, the loose litter retards the run-off, and allows the water more time to percolate the soil. Thus, the rainfall is encouraged to become ground water, which, from the resistance offered by the compact subsoil, flows slowly down to lower levels, and supplies springs and streams perennially. In the forest, with its litter removed, the rainfall and the melted snow, instead of becoming seepage water, largely run off the surface, denuding the hillsides of serviceable soil, and stripping them to the bare rock; while the rapid rush of surface water occasions destructive freshets. Later in the season springs and streams dry up.

Mr. J. W. Toumey, of the Washington Bureau of Forestry, writes in the Year-book for 1903 on "The Relation of Forests to Stream Flow." The following is a quotation from that article: "In a careful study of the behavior of the stream flow on several catchment areas in the San Bernardino Mountains, it has been found that the effect of the forest in decreasing surface flow on small catchment basins is enormous, as shown in the following tables, where three well-timbered areas are compared with a non-timbered one:—

PRECIPITATION AND RUN-OFF DURING DECEMBER, 1903.

Area of Catchment basin.	Condition as to Cover.	Precipitation.	Run-off per square mile.	Run-off percentage of precipitation.
Sq. miles.		Inches.	Acre-ft.*	Per cent.
0.70	Forested . . .	19	36	3
1.05	do . . . .	19	73	6
1.47	do . . . .	19	70	6
0.53	Non-forested	13	312	40

At the beginning of the rainy season, in early December, the soil on all four of these basins was very dry as a result of the long dry season. The accumulation of litter, duff, humus, and soil

\*640 acre-feet equal 12 inches of precipitation over a square mile.



on the forest-covered catchment areas absorbed 95 per cent of the unusually large precipitation. On the non-forested area only 60 per cent of the precipitation was absorbed, although the rainfall was much less.

RAIN-FALL AND RUN-OFF DURING JANUARY, FEBRUARY AND MARCH, 1900.

Area of Catchment basin.	Condition as to Cover.	Precipitation.	Run-off per square mile.	Run-off percentage of precipitation.
Sq. miles.		Inches.	Acre-ft.*	Per cent.
0.70	Forested....	24	452	35
1.05	do ....	24	428	33
1.47	do ....	24	557	43
0.53	Non-forested	16	828	95

The most striking feature of this table as compared with the previous one is uniformly the large run-off as compared with the rainfall. This clearly shows the enormous amount of water taken up by a dry soil, either forested or non-forested, as compared with one already filled to saturation. During the three months here noted, on the forested basins about *three-eighths* of the rain-fall appeared in the run-off, while on the non-forested areas *nineteen-twentieths* appeared in the run-off.

RAPIDITY OF DECREASE IN RUN-OFF AFTER THE CLOSE OF THE RAINY SEASON.

Area of Catchment basin.	Condition as to Cover.	Precipitation.	April run-off per sq. mile.	May run-off per sq. mile.	June run-off per sq. mile.
Sq. miles.		Inches.	Acre-ft.	Acre-ft.	Acre-ft.
0.70	Forested....	1.6	153—	66—	25—
1.05	do ....	1.6	146—	70—	30—
1.47	do ...	1.6	166	74	30
.53	Non-forested	1.	56	2—	0

The above table clearly shows the importance of forests in sustaining the flow of mountain streams. The three forested catchment areas, which, during December, experienced a run-off of but 5 per cent of the heavy precipitation for that month, and which during January, February and March of the following year had a run-off of approximately 37 per cent of the total precipitation, experienced a well-sustained stream flow three months after the close of the rainy season. The non-forested catchment area, which, during December, experienced a run-off of 40 per cent of the rainfall, and which during the three following months

\*640 acre-feet equal 12 inches of precipitation over a square mile.



had a run-off of 95 per cent of the precipitation, experienced a run-off in April (per square mile) of less than one-third of that from the forested catchment areas, and in June the flow from the non-forested area had ceased altogether."

This has been the universal accompaniment of deforestation in Ontario and elsewhere. For the Ontario farmer this last consideration is of great practical importance. The question of preserving or renewing forests on a large scale is not for him. That is a State affair. But the denuding of local hillsides and watersheds can yet, in many sections, be stayed, or, if denuded, they may, without excessive labor and expense, be replanted, and the evils of wholesale removal of the forest, to some extent, mitigated.

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The Secretary has received several requests for copies of the First Annual Report of the Canadian Forestry Association, which it has been impossible to comply with, as the supply has been exhausted. If any members of the Association or others have spare copies the Secretary will be glad to be informed. No charge has been made for any of the reports of the Association when issued, but no doubt those who are anxious to obtain copies of the first issue would be prepared to do so even if it should be necessary to make some return to the present holders.

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There has been considerable excitement in Toronto recently in regard to the removal of shade trees from the streets. Whether the agitation is well directed or not may be a question, for sometimes the removal or replacing of trees is a necessity, considering it only from the point of view of the trees themselves. The form of butchery which passes for improvement in some civic administrations, and which is perpetrated by persons without even a rudimentary idea of proper cutting or pruning of trees, cannot, however, be too severely condemned, and there is great room for improvement in this respect in Canadian cities and towns.



## A GLANCE AT FOREST CONDITIONS IN NEW BRUNSWICK.

*G. U. Hay, D.Sc., St. John, N.B.*

Two years ago, while camping out near Kedron Lake, in the south-west part of New Brunswick, I came upon the remains of a magnificent white pine, lying prostrate in the woods. From this a section had been cut off close to the butt, the diameter of which was nearly three and a half feet. The length of the piece cut off and carried away, perhaps for exhibition purposes, was a little less than five feet. The remainder of the tree, a fine bole, straight as an arrow, and nearly one hundred feet in length, was left to rot in the woods. It had evidently been felled not many years before, since the cut end was not greatly weathered, and there were traces of still unhealed wounds left on the smaller trees that had been caught in the death of this monarch of the forest as it crashed to earth.

The commercial value of this huge trunk, had it been manufactured into lumber while it was sound, could not, at the lowest estimate, be less than one hundred dollars, even though there were great difficulties in transporting it from the forest where it lay.

I recall the sight of another huge pine trunk in a secluded part of the forest in Northern New Brunswick. A single log had been taken from the fallen tree, which, covered with moss, had sunk half its thickness into the loose forest mould. It had lain there probably fifty or more years.

One is loath to believe that a lapse of fifty years has brought about no better sentiment in regard to forest preservation or the repression of individual acts of waste and vandalism.

If in the first instance quoted above the section of pine was used to exhibit the size of our trees and demonstrate our forest wealth, would not companion pictures of a huge moss-covered pine trunk rotting in the forest, or a picture of what may be seen everywhere in New Brunswick, decaying pine stumps of large size, about the only evidence now of its former existence as a timber tree, be just as appropriate to our needs—and far more useful—showing the wasteful lumbering that has been done in the past, and the necessity of an education of a practical and helpful character to teach people to respect trees and appreciate their value.

There is another picture, so common that it may be only briefly alluded to here, and that is of the destruction caused by



forest fires. There is scarcely a mountain or hill in New Brunswick from whose top one may not look down upon some scene of desolation where the ravages of fire are only too evident. And what is true of New Brunswick is true of the other provinces of Canada. Fortunately a bountiful Nature soon clothes these blackened wastes with fresh foliage. But the best parts of the forest are gone; and with them often the accumulation of leaf mould, the product of successive centuries of growth and decay.

The white pine as a timber tree has almost totally disappeared from our forests. The only large grove of red pine that I know of is the one found on a ridge or moraine extending into the great Nepisiguit Lake. The butternut or white walnut is becoming so scarce that it is now almost impossible to be obtained at any price. The same is true of the basswood. Thousands of noble hemlocks have been sacrificed for their bark. Large timber trees of the black spruce, which has been New Brunswick's greatest source of forest wealth, are becoming scarce, and the lumber operators of the present day are clearing out large portions of what remains, and pulp-mills may soon make havoc of the young growth.

Of the species of forest trees in New Brunswick, upwards of forty in number, the above include, with a few others, such as white spruce, cedar, hachmatack, the chief commercial products used for manufactures and export. The scarcity, with the consequent higher price of these staples, has brought into use others of less value, such as the hemlock, hitherto regarded only for its bark; even the "almost useless" poplar is found to be serviceable. Many of our hardwood trees, so called, of which New Brunswick has many fine forests, have yet been untouched with the exception of birches, and are destined as their uses become better known, to constitute a great source of wealth to the province. Furniture made from yellow birch is little inferior to walnut. Rock maple, beech, elm and other hardwoods are also greatly prized for furnishings and other purposes.

A few days since I passed along a road that I had not seen since a child. Then there were some trees of generous size mingled with smaller growth that gave a pleasant shade. Now the whole character of the road seemed changed. There were a few hollow, fire-eaten trunks where once stood noble trees. Blackened stumps lined the road-sides, hidden at intervals by a struggling tangled growth of poplar, birch and spruce. And yet there are fine farms here and there, with well cultivated meadows and a few houses—very few—with shade trees around them. But continued "choppings" and fires had made bare the uplands and bereft them of all semblance to beauty or utility. Tree weeds and blackened stumps are poor substitutes for fine trees along a roadside.



The above are a few of the many instances which might be adduced to show that man has exhibited a woeful lack of intelligence and judgment in destroying the woods which were so abundant when the country was discovered. In a comparatively few years he has wasted with a lavish prodigality Nature's slow production of hundreds of years. If great forests of useful and beautiful trees had been rare in this country they would have been husbanded with a care and forethought commensurate with their value; but because they have been so abundant and easy to convert into money, they have been destroyed with such an ignorance of Nature's processes, and with such a disregard of the rights of future generations, that the results are lamentable and little short of calamitous. Forests that should have been kept intact by a wise system of cutting out the larger growths and allowing the smaller ones to mature, have been depleted of everything that would do for timber, while the refuse, strewn everywhere, has fed the fires and doomed many a fine forest region to destruction.

There are a few forests left intact in the depths of the New Brunswick wilderness where lumbermen have not yet penetrated and which are yet unmarked by the dismal tokens of the fire scourge. A few of these it has been my good fortune to visit—near the headwaters of the numerous branches of the Tobique. What a delight it was to wander through these great natural parks, chiefly of hard or mixed woods, through which one might drive a team, and to look upon the perfectly rounded boles of birches, spruces, elms, beeches, and occasional pines, their tops reaching to the height of from seventy to one hundred feet.

Mingled with my feeling of admiration was one of regret that in this beautiful province of New Brunswick, once so nobly endowed in its luxuriance of forest wealth, which might have increased under wise management with successive generations, trees had been destroyed where they should have been cultivated. Our forefathers in the settlement of the country did much for which it is presumed we are sufficiently grateful; but would that they had left undone some things which were done! Forest destruction, however, was a part of the first settlers' work, and a necessary beginning to civilization.

But among the early settlers there were many who spared some of the forest trees and found comfort in their beauty and shade. They did not begrudge a few feet of soil to the rightful owners, nor treat the trees as enemies or encumbrances, to be rooted out and destroyed. Many of the noble elms that adorn the broad intervals of the St. John, Kennebecasis, and other rivers, show the wisdom and sense of beauty that distinguished the early settlers of these regions. The magnificent grove of red and white pines, on the grounds of Judge Wilkinson, on the south



side of the Miramichi, between Chatham and Newcastle, the only easily accessible place, perhaps, in New Brunswick where a large grove of these fine trees may be seen, is a good evidence—and many others might be shown—that the old settlers loved trees, and spared them for adornment and shade near their dwellings.

Though we may regret the wastefulness and improvidence of former generations, the present duty is to preserve the remnants of our woodlands, to create a sentiment in favor of trees, and to protect and cultivate them in large forest areas, not only for purposes of lumber, but to husband the water supply of the country, maintain and increase its area of fertile soil, and reclaim by reforestation, wherever practicable, the fire-swept wastes. Nature cannot be looked to to restore our forests as they were. Man must give his intelligent assistance; and it would seem to be wisdom to begin now, when the demand for wood products is greater than it has ever been in the history of the world, and when the market value of these products is constantly on the increase.

The first step naturally is to exercise a close supervision on our forests as they are, to restrain the output of lumber by judicious cutting, to leave standing all trees not up to a standard size, to get rid of undesirable trees, and the undergrowth that interferes with the admission of light, and to protect the forest from the danger of fire by removing all brush and refuse. The latter is obviously so important a preventive measure that some lumbermen—not by any means all—attend to this as a matter of wise economy, and their care is rewarded by greater exemption from fires, although, as in the case of a farmer freeing his fields from weeds, he is not safe unless his neighbors follow his example. The forest region on the Little Tobique River, New Brunswick, lumbered by Mr. G. F. Hale, is one that is kept in good condition, and there may be others which have not come under the writer's observation.

The regeneration of our forests cannot of course be expected from lumbermen, whose object it is to cull out the marketable trees without regard to the improvement or protection of the young growth. In individual cases such as that cited above, a lumber operator, after years of cutting, may leave his forest depleted of all the largest trees, but in such a condition under his intelligent management that it will prove a valuable asset to the country. How desirable a condition of things! But such ideal conditions may be realized if the forester is called in to the aid of the lumberman, if a rigid system of supervision is instituted by Government, and if education in forestry becomes a part of our general system of instruction. Plants, trees and other outdoor things interest all healthy children; and in our Nature-Study course, if the study of trees could be made prominent, and em-



brace a more intimate and intelligent knowledge of their habits and uses, and how to take care of them, it would lay a good foundation for future study. Such instruction can only be effective by a close acquaintance with the trees themselves, and by making the groves temples of instruction as they once were.

It is generally conceded that the study of forestry as a science belongs to the university or college, and not to the secondary schools. In the University of New Brunswick which is supported by the Government, there is a fine opportunity to establish a department of forestry, of which advantage might be taken by students from the other eastern provinces of Canada. The situation of the University at Fredericton, not far from the extensive forests, and near some of the greatest lumber industries of the province, is an ideal situation for a school of forestry. The improvement of practical courses in science, kindred to forestry, which has recently taken place in the University, renders it comparatively easy to establish a course in that subject, and thus materially advance the greatest industrial interest of the province. Clearly it is the duty of the Government to take this step.

It is now four years since Professor W. F. Ganong proposed a plan of reserving a section of forest about the Nictor and Nepisiguit Lakes for a provincial park, which incidentally should serve as a resort for the people, but where the best methods of lumbering might be tested and a practical study of forestry problems be made. Although the Government signified its approval of the scheme, no practical steps have since been taken to carry it into effect. The establishment of a department of forestry at the University would open a new avenue to activity for the young men of the province; the setting apart of a reserve forest which could easily be reached from Fredericton by the extension of the Tobique Valley Railway, would serve as a practical school for students, and open a new era in our lumber industry.



## THE FOREST RESOURCES OF THE LABRADOR PENINSULA.

*A. H. D. Ross, M.A., Yale Forest School.*

The Labrador Peninsula has an approximate area of 560,000 square miles—two and a third times that of the Province of Ontario, or 65% of that part of the United States lying east of the Mississippi River. The interior of this vast territory has always been beyond the line of accurate knowledge, and previous to the explorations of Mr. A. P. Low, B.Ap.Sc., of the Geological Survey of Canada, not one-tenth of it had ever been properly mapped.

In 1892 it was my good fortune to accompany Mr. Low, as botanist and assistant surveyor, in his exploration of the East Main River, which rises near the centre of the peninsula and flows west into James Bay. In four months we journeyed more than thirteen hundred miles in canoes, and did 368 miles of geological and micrometer survey work.

The peninsula is roughly pentagonal in form, being bounded on the south by the Saguenay, Chamouchuan, Waswanipi and Nottoway Rivers; on the west by James Bay and Hudson Bay; on the north by Hudson Strait; on the north-east by the Atlantic Ocean; and on the south-east by the St. Lawrence. The size of this immense peninsula may be judged from the fact that the air line distance between Cape Wolstenholme at the extreme mouth of the Saguenay River is 1,040 miles, whilst Belle Isle is a trifle over a thousand miles from the mouth of the Nottoway River. From the mouth of the Nottoway to Ungava Bay is as far as from Ottawa to Port Arthur; and from Ungava Bay to the nearest point on the St. Lawrence is as far as from Ottawa to Halifax.

In 1893 Mr. Low and his assistants explored the Kaniapiskau and Koksoak Rivers flowing north into Ungava Bay; in 1894, the Hamilton River, flowing east into Hamilton Inlet; in 1895, the Manikuegan River, from Summit Lake southward to the St. Lawrence; and in 1896, the line was carried across from Richmond Gulf to Ungava Bay by way of the Clearwater, Stillwater, Larch and Koksoak Rivers. Mr. Low's reports upon the geology, climate, fauna and flora of the regions traversed show that the peninsula is not by any means the barren, worthless country it was once supposed to be. Its resources in the way of minerals, timber and fish are simply enormous, and if properly protected from exploitation will be a source of great wealth to the nation. This explains why the Province of Quebec lost no time in having its



northern boundary extended to the East Main and Hamilton Rivers, thereby acquiring an additional strip of territory 250 miles in width at its western extremity, and including the whole of Lake Mistassini, the Rupert River, the Nottoway River and surrounding country. The province now has an area of 351,873 square miles, and ranks next to British Columbia with 372,630 square miles. The name Labrador is now restricted to a twenty-mile strip along the north-east coast, and all the rest (about 350,000 square miles) of this immense territory is known as the District of Ungava.

The whole peninsula may be described as a high rolling plateau, underlain by glaciated Archæan rocks, and dotted with myriads of lakes and rivers, occupying nearly a quarter of the total area, and forming such a perfect network that with a knowledge of the country, it is possible to travel with canoes in almost any direction. The striæ and other glacial phenomena show that during the ice age the peninsula was completely covered with an immense sheet of ice, whose greatest thickness was midway between the headwaters of the East Main and Hamilton Rivers. From this central gathering ground the ice moved outward in all directions, gouging out rocky basins, and ploughing long shallow grooves between the low rocky ridges. Most of the smaller lakes have been formed by the deposition of glacial till in these grooves, and from the top of a ridge I once counted forty-six lakes lying all around me. The only portion of the peninsula not thickly dotted with lakes is the low country covered with marine sands and clays along the east coast of James Bay. Fully nine-tenths of the peninsula is underlain by medium to coarse-textured hornblende-granite-gneiss of different ages, and varying in color from red to light grey, a pinkish variety being very abundant. The average level of the interior is less than 2,500 feet, and over an area of 200,000 square miles does not vary more than three or four hundred feet. Towards James Bay there is a gentle slope, but along the Atlantic slope the level rises abruptly inland, and the coast is deeply cut by many narrow bays or fiords. Throughout the interior the ridges of low rounded hills seldom rise more than 500 feet above the general level of the surrounding country. Most of the large rivers have cut deep into the general level of the plateau, and their channels must be of very ancient origin. The rivers of the southern watershed seldom exceed 300 miles in length, and flow into the St. Lawrence. Several large rivers carry the waters of the western drainage area down to James Bay and Hudson Bay. The Koksoak and its tributaries carry the waters of the northern drainage area (nearly 60,000 square miles) down to Ungava Bay. On the eastern watershed, three large rivers flow into Lake Melville, at the head of Hamilton Inlet. The lakes and rivers interlock so closely that the longest



portages never exceed two or three miles. The lakes vary in size from small ponds to great sheets of water hundreds of square miles in extent, the twelve largest being Mistassinni, Michikamau, Kaniapiskau, Minto, Clearwater, Attikonak, Apiskigamish, Ashuanipi, Mistassinis, Nichikun, Manuan and Pletipe.

The large lakes and most of the rivers of the interior contain an almost inexhaustible supply of food fishes of large size and superior quality. White fish averaging four pounds and running as high as fourteen pounds, are abundant; lake trout averaging eight pounds and up to forty pounds are plentiful; brook trout from one to seven pounds occur in many of the rivers; pike from two to fifteen pounds abound in the quiet flowing streams of the southern, eastern and western watersheds; pickerel and chub occur in many of the smaller streams; ling from two to fourteen pounds are common in all the deep lakes of the interior, and are an important source of food for the Indians; suckers are the principal food of the Indians of many parts of the interior; a species of sturgeon is taken in great quantities half way down the Rupert River; and Atlantic salmon ascend many of the rivers in great numbers. When access is had to them by rail, these fisheries will become immensely valuable.

Most of the soil being derived from the underlying Archæan rocks is a mixture of sand, clay and boulders of various sizes. Along the river valleys it has been greatly improved by the rearrangement of the till and an admixture of sediments. In the vicinity of Cambrian limestones and shales, it is of a heavier nature and better suited for the growth of timber. With the exception of the higher hills and ridges, the forest is continuous over the southern part of the peninsula, as far north as the fifty-fourth parallel. About latitude fifty-five only half the country is timbered. As we go north the trees become smaller, and about latitude fifty-eight they disappear altogether.

The forest is almost entirely coniferous, and is of the regular northern type, consisting principally of spruce, larch, balsam fir, scrub pine, poplar, and birch. The latitude, height above sea-level, distance from sea-coast, topography of the district and character of the soil, all play an important part in the distribution of each species.

The black spruce, (*Picea nigra*, Link) forms about ninety per cent of the forest, and grows freely, either in cold sphagnum swamps or on high hills covered with sand or heavy glacial drift. As a rule it occurs in dense thickets, with long naked stems, and on the southern watershed these thickets are so dense that the trees seldom reach a large size. Northward the stands are not so dense, and the stout trunks are often clothed to the ground with branches. In all cases the branches have a characteristic droop which enables one to recognize the tree almost as far as he



can see it. In dense stands the lower branches are generally festooned with "bearded moss" (*Usnea barbata*) which gives the forest a most weird appearance. The wood is light and soft but not strong. It is fairly stiff, however, and is used for masts, spars and various small articles where a stiff wood is required. In color it is a pale yellow-white, with thin sapwood, and in cross-section shows thin resinous bands of small summer cells and narrow conspicuous medullary rays. This explains why it is so apt to split when nailed. The prevalence of knots also detracts from its value as a saw-timber, but its long fibre makes it an excellent timber for the manufacture of wood-pulp. Its fuel value is 45%, which shows it as good a fuel as chestnut, and better than Box Elder (*Acer negundo*, L.)

"Essence of spruce" is prepared by boiling the young branches and evaporating the extract to the thickness of molasses. It has a bitter astringent acid flavor, and is said to be a useful preventive of scurvy. "Spruce beer" is made either from the "essence," or by adding molasses or sugar to a decoction of the young branches and allowing the whole to stand till it ferments. The gum is often collected and used for the preparation of chewing gum, whilst the pollen is frequently sold as Lycopodium powder.

The white spruce (*Picea alba*, Link) or cat spruce, occurs throughout the wooded area of the peninsula, and prefers a well drained soil; being confined mostly to the areas of a re-arranged drift of the river valleys and marine deposits along the coast, or to the heavier drift of the Cambrian area of the interior. South of the St. Lawrence watershed it is more widely distributed, and is found on rocky hills at an elevation of 2,000 feet. It is a rapid grower, and because of its long fibre is in great demand as a pulp wood. It has a fairly coarse texture, and is tougher, stronger and more elastic than pine. As our supplies of pine become exhausted, white spruce will largely take its place. Thus, whether we regard it as the pulp-wood or the saw-timber of the future, it is evident that it is one of the coming woods, and that it should be carefully protected from fire and wasteful methods of lumbering. At present it is used for railway ties, fence posts, telegraph and telephone poles, piles and pulping purposes. It has a fuel value of 40%, and when absolutely dry, weighs 25½ pounds per cubic foot. The Indians macerate the fine roots in water, and use them to sew birch bark canoes, the seams being made water-tight with resin. As lumber the black and white spruces are not separated, and the red spruce (*Picea rubens*, Sargent) is often included. It is closely related to the black spruce, but is not as suitable for spars and masts. As pulp-woods the black and white spruce have been found to increase in value the farther north they grow. The value of the growing spruce for the whole Dominion is probably as great as that of all other trees combined, as it



extends from James Bay north-westward to the Yukon. In 1897 Mr. Henry O'Sullivan, D.L.S., C.E., explored the country between Lake St. John and the mouth of the Nottaway River. In his report he says: "Pulp is the industry of the coming age, spruce is the king of woods for pulp-making, and this country is the home of the spruce." He might have added that the immense waterfalls in every part of the country furnish unlimited power for saw, pulp and paper mills.

The black larch (*Larix americana*, Michaux), or tamarack, grows everywhere throughout the peninsula, and probably stands next to the black spruce in abundance. It is the hardiest tree of the sub-arctic forest belt, and continues as a tree to the very edge of the northern margin, where the black spruce is dwarfed to a mere shrub. In the interior it grows in all the cold swamps and is always the largest tree in the vicinity. Of late years, however, the European larch saw-fly has destroyed most of the larch between Lake St. John and Lake Mistassini, and the pest is spreading northward. The wood is rather coarse-grained, hard, heavy and very strong. In color it is a light brown, with thin, nearly white, sapwood, and contains broad, very resinous dark-colored bands of summer cells, a few obscure resin ducts, and numerous, hardly distinguishable medullary rays. This explains why it is such a stiff wood, and is so durable in contact with the soil. It is well adapted for use as scaffold poles, joists, rafters, railway ties, fence posts, telegraph and telephone poles, and for ship-building purposes. When thoroughly dry it weighs 39 pounds per cubic foot, and its fuel value of 62% seems to indicate that it is a trifle better than red maple (*Acer rubrum*) as a heat producer.

The balsam fir (*Abies balsamea*, Miller) prefers a wet alluvial soil, and occurs more or less plentifully about the margins of the large streams and lakes almost to the edge of the treeless area. From latitude fifty-six in the interior it ranges south-eastward to Cape Harrison, and south-westward to the mouth of the Great Whale River. In the Mistassini region and along the lower Rupert, it grows in abundance with white spruce, aspen and canoe birch.

The wood is very light, soft, coarse-grained and perishable. The heartwood is of a pale-brown color, often streaked with yellow. The sapwood is lighter in color, is quite thick, and contains conspicuous narrow vessels of smaller summer cells and numerous obscure medullary rays. Fuel value, 38%; specific gravity, 24 pounds per cubic foot; makes a good pulp, and is sometimes sawn into boards for the manufacture of packing boxes, or even laths and shingles, if nothing better can be obtained.

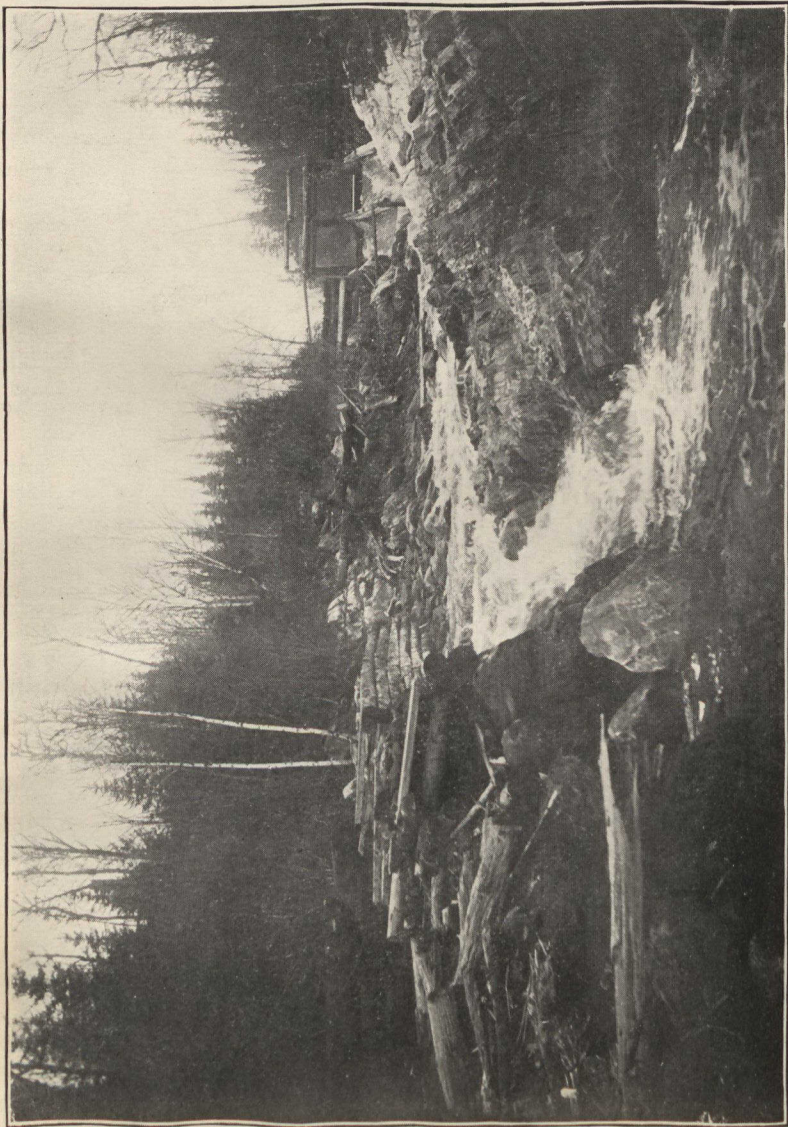
Beneath the smooth bark of the tree a transparent straw-colored resin, faintly tinged with green, collects in "blisters" or





BURNT WHITE PINE FOREST.  
Nipissing Co., Ontario.





A LUMBERMAN'S DAM, CHERRY RIVER, UPPER OTTAWA DISTRICT



"knobs." This resin is the "Canada Balsam" of commerce, so much used in the arts and for mounting objects to be examined under the microscope. It is of the consistency of honey, and has a pleasant aromatic odor and slightly bitter taste. It is usually collected in small iron cans fastened to a pole, and furnished at the top with iron tubes sharpened at the end. The tube is pressed against the resin blister to puncture it, and the gum flows down the tube into the can. An average tree yields about half a pound of balsam.

The Banksian pine (*Pinus banksiana*, Lambert), gray pine, scrub pine, jack pine, Labrador pine, or "Cypress," grows freely on the dry, sandy drift ridges and rocky hills of the burned-over areas of the western half of the peninsula between the St. Lawrence and Whale Rivers, but does not thrive on the low swampy land along the eastern coast of James Bay. The wood is close-grained, soft, fairly strong, and weighs about 30 pounds per cubic foot. In color it is pale brown or rarely orange, and the nearly white sapwood is quite thick. Its suitability for mine props and general construction work has not yet been appreciated. When large enough it is suitable for railway ties, and occasionally is sawn up for lumber. Recent experiments show that good pulp can be made from it. It has a fuel value of 48%, and a dry weight of 30 pounds per cubic foot.

The aspen (*Populus tremuloides*, Michaux) does not seem to grow north of latitude fifty-four, and is somewhat fastidious as to soil. It prefers gravelly hillsides or moist sandy spots in the river valleys and along the lake shores. In the western part of the peninsula it grows abundantly on the unmodified glacial till of the drift ridges, but about the headwaters of the East Main and Hamilton Rivers (where the ice sheet was thickest) it is rather scarce. Its tiny seeds are provided with long silky hairs, which scatter them far and near with every wind that blows, and the seedlings grow rapidly in exposed situations. This explains why the aspen is the most widely distributed tree in North America, and also why it is generally the first tree to take possession of the soil on burned-over areas. Its roots prevent the washing away of the soil from steep slopes, and its leaves and branches afford shelter to the seedlings of longer-lived trees. It acts as a nurse tree towards most conifers, and plays a most important part in the re-stocking of our northern forests. With its pale bark, slender pendulous branches and shimmering leaves, it is a most graceful tree, and enlivens the sombre landscape with broad bands of color, light green in summer, but in autumn glowing like gold against the dark cliffs and gloomy conifers.

The wood is close-grained, has a cottony fibre, and is quite light and soft; but is neither strong or durable. The heartwood is of a light-brown color, and the thick sapwood is nearly white.



Its chief value is for the manufacture of pulp for paper, but it may also be used for fence rails, fuel, tannery or boxes. Dry weight, 25 pounds per cubic foot; fuel value, 40.

The balsam poplar (*Populus balsamifera*, Linnaeus), or rough-barked poplar, occurs farther north than the aspen, but is confined mostly to the heavy clay soil of the river valleys, or to the modified drift of the Cambrian areas. In the western interior it does not appear to grow north of Lake Mistassini. At Cambrian Lake (latitude 56°) on the Kaniapiskau River, it grows on low terraces to ten inches in diameter, but on higher ground is small and straggling. Along the lower Hamilton River it is quite common, but above the Grand Falls, which, it may be mentioned, have 302 feet of a sheer drop and a volume of about 50,000 cubic feet of water per second, is not seen again till the Cambrian area is reached at Birch Lake. The wood of balsam poplar is light, soft and fine-grained, and is well-suited for the manufacture of paper pulp, pails, tobacco boxes and small packing cases. The tree received its name because of the balsamic sticky exudation of the leaf-buds. In full foliage it is a splendid object as the wind blows through its branches, displaying the brilliant colors of its leaves, which are dark green above and rusty-looking below. The pollen of the poplars and spruces often blows across a lake in such large quantities as to form quite a thick film on its surface.

The white or canoe birch (*Betula papyrifera*, Marshall) grows everywhere in the southern part of the peninsula, and often forms dense thickets on hillsides which have been traversed by fire. With its gleaming white trunk, luxuriant dark foliage, and open, airy, graceful head, it is always a picturesque feature of the forest landscape. About Hamilton Inlet it grows to ten inches in diameter, but towards the upper waters of the Hamilton River seldom exceeds eight inches. Northward the trees are smaller, and the Indians have to import their bark for canoe-building. As the semi-barren lands are approached, the mixture of dwarf birches and willows growing on the hillsides forms almost impenetrable thickets.

The wood of canoe birch is light, strong, hard, tough, and very close-grained. The Indians use it for axe handles, sleds, paddles, snowshoe frames, and many other articles requiring a light, strong, tough wood. There is no American species to excel it as a spool wood. It is also used for the manufacture of bobbins, turned boxes, bowls, shoe lasts, shoe pegs, for interior finishing, and for the manufacture of furniture. In the settled portions of Canada most of the white birch has disappeared, but in the Labrador Peninsula vast areas yet remain to be exploited.

The heartwood is light-brown, tinged with red, but the sapwood is nearly white and quite thick. It has a fuel value of 59, and weighs 37 pounds per cubic foot when perfectly dry. The



bark is tough, resinous, very durable and impervious to water. For the construction of canoes, baskets, drinking cups, and a covering for his wigwam, the Indian finds it simply indispensable.

The arbor vitae (*Thuja occidentalis*, Linnaeus), or white cedar, occurs in only a few places between the Rupert and Nottoway Rivers, and south-eastward to the St. Lawrence. It prefers swampy places in which it generally occurs in dense stands. The wood is light, soft, brittle, and rather coarse-grained. The thin sapwood is nearly white, but the heartwood is yellow-brown and quite fragrant. The wood is very durable in contact with the soil, and is much used for posts, poles, ties, rails, shingles, etc. It weighs almost 20 pounds per cubic foot, and has a fuel value of 23. The thick layers of sapwood are easily separated, and are often used to strengthen birch bark canoes or to weave baskets. In the southern region the undergrowth consists mostly of Labrador tea (*Ledum latifolium*), pale laurel (*Kalmia glauca*) and blueberries. In damp places there is a considerable depth of sphagnum mosses, but as we go northward it is gradually replaced by white lichens or reindeer mosses which grow everywhere throughout the semi-barren and barren regions. Willows and alders fringe the shores of all the lakes and rivers of the forested area. In the semi-barren areas willows and birches creep up the sides of the hills to above the tree line. On the elevated lands beyond the semi-barrens they are only a few inches high.

The forest areas of commercial importance are chiefly confined to the southern part of the peninsula, and mostly to the lower courses of the streams flowing into James Bay and the Atlantic Ocean. So long as our supplies of pine hold out, spruce cannot compete with it, as pine is *the* lumber *par excellence*. The supply of pine is limited, however, and in a very few years spruce will largely take its place for many kinds of work. Besides this, spruce is an excellent pulpwood, and is accompanied by considerable aspen, balsam poplar and balsam fir, all of which make excellent pulp. The Crown Lands Department of the Province of Quebec estimates that in the Lake St. John district alone (3100 square miles) there are a *hundred million cords* of pulpwood. This figure is based on the extremely low estimate of five cords per acre. If the true average per acre were used, and a calculation made for the total forested area of the peninsula, the result would be beyond all belief. The available raw material is sufficient to provide for an annual output of millions of tons of pulp for an indefinite period.

Most unfortunately, however, this immense forest has suffered dreadfully from fire, and in many places the vegetable part of the soil has been so completely burned out that a couple of centuries must elapse before it is fully restocked. Mr. Low states that the fires are of annual occurrence, and occasionally burn throughout



the entire summer, destroying thousands of square miles of valuable timber to the south of the central watershed. In 1894, he wrote: "These fires are due to various causes, but the majority of them can be traced to the Indians, who start them either through carelessness or intentionally;" also: "At least one-half the forest area of the interior has been totally destroyed by fire within the past twenty-five or thirty years." This is a most alarming state of affairs, and causes the Bureau of Forestry a great deal of anxiety, as the general public seems perfectly apathetic about the matter. When Canadians begin to look upon the forest as belonging to the nation—as an extremely valuable national asset—they will insist upon having it better protected from fire. Meantime the Bureau has done some very effective work in diminishing the number of fires in the forests of the far north and north-west. At every portage along the principal canoe routes, notices, printed in English, French and Indian dialects, have been posted, warning travellers of the danger to the forest from fires which have not been completely extinguished, and there is plenty of evidence to show that these warnings are heeded. The greatest danger seems to be from settlers, hunters and tourists, very few of whom seem to understand the extremely inflammable nature of these northern forests. In hot weather the moisture is thoroughly dried out of the gummy leaves and branches, and the mossy ground is as dry as tinder. A tiny spark at such a time as this may give rise to one of the wildest scenes of destruction of which the world is capable. The resin and turpentine in the leaves burn with great rapidity, and the trees stand so close together that an irresistible front of flame is soon developed and sweeps forward, devouring the forest before it like dry grass in a running prairie fire. The pitchy trees burn almost explosively, great sheets of flame extending to a height of two hundred feet from the ground, and darting forward to bridge over open spaces, such as lakes and rivers, and start afresh in advance of the main column. The speed of such forest fires is almost incredible, one of them being known to travel 130 miles in 12 hours, or nearly eleven miles an hour. In a few hours millions of dollars worth of timber may be swept out of existence, and the soil impoverished for centuries. Most of the provinces have excellent laws regulating the cutting of timber on crown lands, but in all cases the protection from fire is entirely inadequate. In 1903 the Province of Quebec spent \$9,694 (\$17,000 less a fire tax of \$7,306) to protect a revenue of over a million dollars, but where will the revenue for the next fifty years come from if fire gets into the timbered areas? In the Gatineau district each fire ranger is held responsible for 360 square miles, on the lower Ottawa for 585 square miles, and in the St. Maurice district, for 1,316 square miles! This is certainly better than no rangers at all, but which of my readers would like to be held responsible for so great a



stretch of forest in a dry season? As a purely business proposition it seems to me that the Province of Quebec can well afford to spend \$50,000 per year in keeping fire out of its magnificent coniferous forests. Such an investment would prove to be the very best kind of insurance on a timber revenue, which is certain to increase tenfold in the next fifty years—provided the province has the goods to deliver.

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As a result of the visit of the representatives of the Canadian Forestry Association to Sackville University, in the Province of New Brunswick, in the early part of last year, a meeting of owners of timber lands and others was held at Sackville, at which steps were taken to request the Legislature of that province for special legislation to protect the forests of the County of Westmoreland from fire. As a consequence a special Act relating to that county was passed at the last session of the Legislature. This Act provides that the Municipal Council may, on the request of the holders of a majority of acres of forest lands, appoint a Chief Forest Ranger for the county, whose duties shall be to enforce the Fire Act, investigate fires, institute prosecutions, post fire notices, and authority is given him to call out such assistance as may be necessary to fight fires that occur. Deputy Rangers may also be appointed. The fund for payment of the service, called the "Forest Protection Fund," is to be provided for by the fines collected for offenses under the Act, and by a special assessment on forest lands to cover such additional amount as may be required.

In addition to the restrictions of the general Fire Act of the province, it is specially provided that fires near forest lands, except for cooking or warmth, shall not be allowed from the 15th April to the 15th June, and from the 1st September to the 15th October, and from the 15th June to the 1st September only after permission has been received from the Ranger. No portable or other steam engine may be operated within twenty rods of any forest from the 15th April to the 15th October without leave from the Ranger, which may be granted with or without conditions. Other special provisions are that every male inhabitant must notify the Ranger of any fire he notices; that there shall be a presumption of negligence if railway companies cannot prove their locomotives to be properly guarded; that the fact of a person trespassing or loitering or camping on land where fire starts shall, in the absence of proof to the contrary, be evidence of guilt; that any person owing land on which brush, &c., is burned between the 15th April and the 15th October is to be considered responsible unless the contrary is proved.



## THE LATE JOHN BERTRAM.

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It is with profound regret that we have to chronicle the death of Mr. John Bertram, of Toronto, which took place on the 28th November, 1904. It is only necessary to read the last Annual Report of the Canadian Forestry Association to understand the loss which the Association has suffered in his removal. The paper read by him on "Forest Management in Ontario," the interested and strong way in which he took part in the discussions, and the kindly manner in which, at the close of proceedings, he referred to the pleasure which he had felt at being present, and to his hopes of attending the next meeting at the City of Quebec, all show how much and how deeply the Association has been indebted to him. From the beginning of its career he gave it hearty support, and had previously, in the year 1901, contributed a paper on "The Economic Management of Pine Forests," which attracted a great deal of attention, and first gave to many people the idea that an improvement in forest exploitation was possible. At the time of his death he was a member of the Board of Directors of the Association.

This explains why the Forestry Association should mourn Mr. Bertram's death. But his activities were far more widespread than the forestry movement. A successful business man, he had large interests on his hands in the Bertram Engine Works Company, and in the Collins' Inlet Lumber Company, and although he did not enter active politics, except for the short time from 1872 to 1878, when he sat as a member of the House of Commons, he always took a live interest in public questions, and their discussion, and gave large public service. As a member of the Ontario Forestry Commission appointed in 1897, he did valuable service to the province, and helped to shape the policy of steady progress in forest administration which that province has shown. And in his private business he carried out the forestry principles which he advocated in public, for the limits of the Collins' Inlet Lumber Company were being cut under his direction, with the aim of having a sustained yield, of cutting the forest interest only and not the capital. In 1903, the Dominion Transportation Commission was organized with Mr. Bertram as Chairman. The instructions to this Commission were to make a full enquiry into the transportation question as affecting Canada. This work had not been completed at the time of his death. Thus, he was con-



nected in a public way with what he considered the most important public questions for the Dominion. In his own words, "There are two great questions in Canada: transportation and forestry."

A man of strong intellectual power, a clear and able thinker, an honest and fearless exponent of his views, yet not seeking the public eye, his influence on public affairs has been greater than many have known or thought. Canada needs such men, and their places are not easily filled.

The heartfelt sympathy of the members of the Canadian Forestry Association will go out to the friends of our deceased fellow member.



## NOTES.

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We have secured as contributors to the Canadian Forestry Journal members of the staffs of the Forestry Bureaus of the Dominion and of Ontario, of the Geological Survey of Canada, of the University of Toronto, of Queen's University, and of the Ontario Agricultural College. In addition, we have promises of papers from others who have made special study of subjects related to Forestry. Our object will be to be of practical assistance to our readers, as well as furnishing general and scientific information in regard to forestry in a popular way.

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The Sixth Annual Meeting of the Canadian Forestry Association will be held at Quebec, on the 9th and 10th March, 1905. A good programme is being prepared, which will be thoroughly representative of forest interests throughout Canada. It is expected that the railway companies will give the same privileges in regard to rates as was kindly granted for previous meetings. Full announcement by circular will be made to the members of the Association at a later date. We trust the members will bear this meeting in mind, and make their arrangements so that the attendance shall be large and representative.

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Attention is called to two errors in the published report of the Canadian Forestry Association for 1904. A slight change in one of the words in the thirteenth line from the bottom of page 82, which was noted on the final proof of the report, resulted, owing to the necessity with the linotype machine for the withdrawal of the whole line in such a case, in the substitution of a line from the second paragraph above. The proper reading of the line is: "In Snow Lake we have the large trout (Touladi) (*Salmo namayrushi*), and possibly." In the second line of page 86, "thirty-five" should be "five."

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At the annual meeting of the Ontario Experimental Union, which was held at Guelph, on December 5th and 6th, the subject of forestry received considerable attention. Since 1901 there has been a forestry section in the Experimental Union, the object of which is to gather information about and to suggest means of



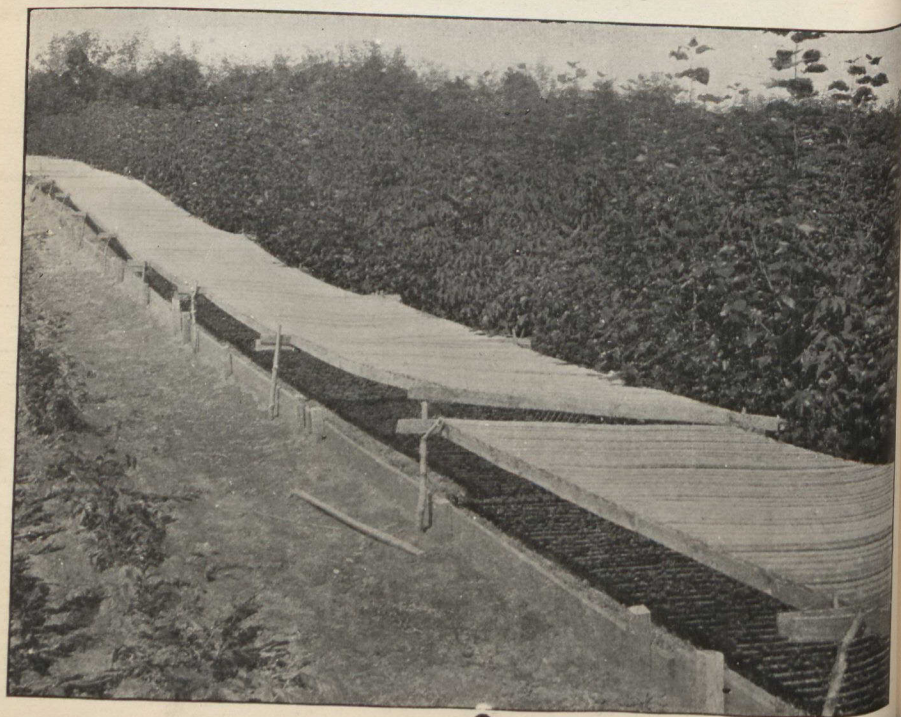


JACK PINE (*Pinus Murreyana*)  
In Natural Forest in Western Alberta.





Nursery Rows of Green Ash Seedlings, 1 year old (Indian Head.)



Method of shading Conifer seed beds—Screens made of common lath nailed on pieces 2x4



improving forestry conditions in Ontario. Since it is an agricultural institution, the attention of the committee in charge has been confined almost entirely to farm wood-lots. From the first the Committee has urged that in order to increase the productivity and efficiency of this much neglected and abused part of the Ontario farm, the Government should co-operate with the farmers of the province by giving instruction through bulletins and lectures on the subject of farm forestry, and by assisting those who require to plant by furnishing seeds or seedlings free, or at cost price. The efforts of the Union have been successful in so far that a nursery has been established in connection with the Agricultural College, from which 100,000 seedlings will be distributed next spring. It is the intention before supplying plant material to applicants that a forestry expert shall inspect the proposed planting site, and advise the planter as to the preparation of the soil, species to plant, method of planting, etc., and only those applicants who agree to carry out the directions of the expert will receive trees.

Before a large meeting, on December 6th, Dr. Clark, Forester for the Crown Lands Department, Toronto, gave a most practical address, "Farm Forestry for Ontario." He first pointed out briefly that it is worth while to develop the wood-lot, for besides its local value as a shelter for the home and crops, the increased use of wood, diminished supply and advanced price make it a most valuable asset, especially in older Ontario.

He then took up more fully a discussion of some of the most common defects of farm wood-lots under the following heads:—

1. Affecting the character of the stand:

1. Farmers' selective cuttings.
2. Overcutting.
3. Grazing.

II. Affecting vigor of growth:

1. Lack of good soil cover.
2. Access of wind to soil.

By "farmers' selective cutting," Dr Clark meant the practice followed by so many of cutting out all the good trees and leaving only the cripples and weeds. Over-cutting is still more injurious than the farmers' selective cutting in that it causes the deterioration of the soil condition, and the trees do not develop desirable forms. Grazing, he said, is probably the most injurious agency in the wood-lot, making reproduction almost impossible, and injuring standing trees. Of the various domestic animals goats are the most injurious, sheep next, cattle next, and horses least injurious.

Lack of soil cover causes the drying out of the soil, and allows it to become hard, thereby preventing the percolation of



water into the soil and making it very difficult for reproduction to take place. Wind when admitted to the forest dries the soil, removes the soil cover, and produces an unhealthy condition of the stand.

As a remedy for these defects, Dr. Clark advised:

1. Shutting out of all stock.
2. Planting wind-breaks, especially on south and west.
3. Planting up failed places.

An interesting discussion followed Dr. Clark's address, which was taken part in by Mr. Nelson Monteith, M.P.P., Mr. Southworth, Mr. R. D. Craig, and others.

Dr. Clark gave also a short course of lectures, with practical demonstration in the Ontario Agricultural College, on wood-lots, to the Farmers' Institute speakers, so that they would be able to discuss the question more intelligently at their meetings during the winter.

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British Columbia has, in company with some of the western states, been a great sufferer from forest fires during the past season, the drought which made them a possibility lasting on through the summer. The air was filled with smoke throughout a great part of the summer in many districts. Survey work was seriously interfered with, and some parties could accomplish absolutely nothing in consequence of the smoke interfering with the view of the country. A member of one of such parties states that in the district in which he was working, or rather attempting to work, in southern British Columbia, fires were occurring on every hand, and nobody seemed to consider it his business to interfere. There were no railways in that vicinity, so that the blame for starting the fires could not be placed on them. In one case a prospector's stakes were found which were six days old, and a fire which cleared the claim and a tract around was evidently about the same age. One fire was approaching a small town day by day, and the only action taken by the inhabitants was to sit down and watch it from afar and speculate as to whether or not and how soon it would reach the town. Beautiful hillsides clothed with timber of the finest quality, green and flourishing when first visited, were found in a week or two after a mass of smoking ruins, their beauty and wealth reduced to smoke and ashes. The Bush Fires Act of British Columbia provides that all officials of the Government are required to enforce the provisions of the Act, but no special staff is charged with that duty, and as a consequence no vigorous action is taken. It is a remarkable fact that British Columbia is the only province of the Dominion having control of its own forests, with the exception of Prince Edward Island, which has very little forest, which has not made



some special provision for a protective staff. The forests of that province are of immense and increasing value. Nowhere else in Canada are as large areas of noble virgin forest found. The revenue received from them by the province is steadily increasing. The market for their product is extending. In Western Ontario red cedar shingles from British Columbia rule the market, and are found in every lumber yard. The demand from the western districts is becoming larger with the advance of settlement. A province so rich in forest wealth might surely be expected to see that some special officer is charged with the duty of protecting the forests from fire, and that he receives the necessary assistance at such times as required, even if it should result in a small increase in expenditure. In the railway belt in British Columbia, which is under the jurisdiction of the Dominion Government, such a service is in successful operation, and testimonies to its good work, even during the past trying season, have been numerous and favorable.

The Province of British Columbia should place itself in line with the rest of the Dominion in this respect.

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On an official call, issued by the American Forestry Association, a Forest Congress met in Washington, D.C., January 2nd to 6th, 1905. The purpose of this Congress was to establish a broader understanding of the forest in its relation to the great industries depending upon it; to advance the conservative use of forest resources for both the present and the future need of these industries; to stimulate and unite all efforts to perpetuate the forest as a permanent resource of the nation.

The Congress included Ambassadors, Ministers, and other representatives of foreign nations, members of the Federal House, Governors of States and Territories, representatives of Forest Services, Forestry Associations, Lumbermen's Associations, Irrigation Associations, Stockmen's Associations, Railroad Companies, Boards of Trade. Among the accredited delegates provision was made for ten from the Canadian Forestry Association, and the Association was well represented.

The subjects dealt with at the different sessions are as follows: (1) Relation of the Public Forest Lands to Irrigation; (2) Relation of the Public Forest Lands to Grazing; (3) The Lumber Industry and the Forest; (4) Importance of the Forest Public Lands to Mining; (5) Forestry in Relation to Railroad Supplies; (6) National Forest Policy; (7) State Forest Policy.

On the afternoon of January 5th, a special meeting was held in the National Theatre, which was addressed by the President of the United States, and other men prominent in industrial and national life.



Some of the imports of lumber and timber into Canada from the United States during the past fiscal year are as follows, and are significant of the extent to which the Dominion is becoming dependent on outside sources, at least for hardwood supplies, the most of the woods mentioned being such species as are native to Canada, and of which there was at one time what was considered an abundant and inexhaustible supply. Cherry, chestnut, gumwood, hickory and whitewood are classed together with an import of 10,828,637 ft.; of mahogany, the quantity was 1,039,052 ft.; oak, 45,922,940 ft.; pitch pine, 15,055,596 ft.; walnut, 1,210,322 ft.; white ash, 2,416,063 ft.

The value of the export of forest products was \$33,091,032, logs being \$450,000, lumber \$27,000,000, almost equally divided between Great Britain and the United States, and square timber \$2,400,000 going to Great Britain mainly. Pulpwood to the value of \$1,788,049 was exported to the United States. Of manufactures of wood the value was \$3,699,354, the principal item being wood pulp, \$2,409,074, of which \$548,720 went to Great Britain and \$1,807,442 to the United States.

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The *American Lumberman*, referring to an estimate made in 1897, that not over 20,000,000,000 feet of white pine would be cut in Michigan, Wisconsin and Minnesota, calls attention to the actual cut since that date, which, at a production of 6,233,454,000 feet in 1897, has by steady reduction from year to year reached a figure of 4,791,852,000 feet, but makes a total of 39,353,218,000 feet. The *Lumberman* makes an estimate of the production for the next four years, as follows:—1904, 4,400,000,000; 1905, 4,000,000,000; 1906, 3,600,000,000; 1907, 3,300,000,000; and goes on to say that it is, perhaps, safe to estimate that there is still standing in the principal white pine states of the north stumpage in excess of 20,000,000,000 feet. Some of the mills in the north now have timber to last them ten or fifteen years, and it is doubtful if ten years from now there will be less than 1,000,000,000 to 1,500,000,000 feet of white pine cut and marketed, and in such event the statement that there yet remains only about 20,000,000,000 feet of white pine would have to be amended.

In 1892 the production of white pine in these states last reached a figure of eight billion feet, and its diminution to half that quantity means that the supply is nearing an end. In face of such a diminution in ten years, the ten billion feet of pine which are in sight in Ontario do not look at all like an unlimited supply.



## REVIEWS.

*Trees and Shrubs Tested in Manitoba and the North-West Territories: Wm. Saunders, LL.D., Director Dominion Experimental Farms.*

In this bulletin are given the results of sixteen years of experience in the testing of trees and shrubs at the Experimental Farms at Brandon, Man., and at Indian Head, in the North-west Territories. The love of trees and shrubs is almost universal, and nowhere is it more strongly felt than on the North-west plains where these are scarce. Until within the past few years, large sums of money have been spent annually by settlers in the purchase of trees and shrubs from the east, many of which, being too tender to endure the climate, have perished the first winter. The tests carried out by the Experimental Farms have made such use of trees and shrubs which have been found in Eastern Canada, as trees and shrubs which have been found hardy at Brandon and Indian Head may be safely planted in almost all other parts of the Dominion.

Of the maples, the sugar, red and Norway maples have been unsuccessful. The silver maple will grow in Manitoba, but the maple *par excellence* for the west is the Box Elder or Manitoba Maple (*Acer Negundo*). It grows readily and quickly from seed, and has been planted extensively. The European White Birch is hardy, but the cut-leaved variety less so. The Sweet and Yellow Birches give fairly satisfactory results, and the Paper Birch is native and hardy. The hickory, chestnut, catalpa, hackberry, beech, butternut, black walnut, and locust have been failures.

The Green Ash is the only one of that genus which is perfectly hardy. Among the hardy poplars are the native species and the Russian poplar. The Mossy-Cup Oak and the American Elm are native and grow without difficulty. Most of the coniferous trees tested have proved satisfactory. Notable exceptions are Bull Pine, White Pine, Hemlock and Douglas Fir.

Of the shrubs and climbing vines successful species are Viburnum, Lilac, Snowberry, Spirea, Elder, Buckthorn, Matrimony Vine, Honeysuckle, Hawthorn, Clematis, Bittersweet and others. Nothing will add more to the beauty of the surroundings of a home than a few such flowering shrubs.

The Experimental Farms have done a very useful work in this line of experiment, and the results have been brought together in a convenient form for reference.



*Tree Planting on the Prairies of Manitoba and the North-West Territories of Canada: Norman M. Ross, B.S.A., Asst. Supt. of Forestry.*

This is the first bulletin of a general nature issued by the Dominion Forestry Branch. It was written with the idea of affording practical information to the settler on the western prairies, as to the best methods of propagating, planting and managing hardy trees for shelter belts, windbreaks and plantations. The information given is from the results of planting and general nursery work, which has been found successful, and only such trees are recommended for planting as have been proved absolutely hardy under western conditions.

The advantages of plantations of trees are mentioned as the protection of crops and buildings, the holding of the snow, the preservation of moisture, the supplying of fuel, fencing and material for repairs, the beauty and comfort added to the home, and as a general result, the increased value of the property. The three main points to be observed in setting out a plantation are (1) that the soil must be thoroughly prepared before planting, (2) that only such varieties of trees should be used as are known to be hardy in the district, and suited to grow in the particular kind of soil, and in the situation where it is wished to plant them, and (3) that a certain amount of cultivation of the soil after planting is absolutely necessary,

Detailed instructions are given under each of these heads, followed by information as to the setting out of plantations, and descriptions of different species of trees, with suggestions as to their management. The bulletin is profusely illustrated, and is a creditable beginning for the Dominion Forestry Branch in its efforts to supply information to the public on forestry work.

*Cross-tie Forms and Rail Fastenings, with Special Reference to Treated Timbers: Herman Von Schrenk, U. S. Bureau of Forestry.*

The supply of railway ties is becoming a matter of absorbing interest to the railway companies, and investigations of methods for prolonging the life of such ties are, therefore, of practical moment for, while substitutes for the wooden sleeper have been and are being tried, the latter is still the main dependence of the railways. The object of this bulletin is not, however, to consider methods of preservative treatment of the wood, but forms and fastenings, and it starts with a warning that chemical treatment is not the only point to be considered in the life of a tie. Such treatment, though it may be done so as to prevent decay will not ensure woods of poor texture against physical deteriora-



tion through wear and tear. Recent tests have shown that large ties make the most stable roadbed, and the tendency of late years has been to increase their size, as it is feared that the enormously increased weight of engines and cars now requires a stronger piece of timber under the rails than the lighter equipment of the past. The idea that economy should be practised by using fewer ties to the rail length in view of the increased rigidity of the larger rails is decidedly negatived. This would mean a decrease of the bearing surface on the ballast, which would have the very opposite effect to what is desired, as it would mean a loss of stability. The effort to manufacture more ties by cutting them of a triangular shape, is unsatisfactory for the same reason. With the larger and stiffer rail a decrease in surface, if any is made, may well be on the upper side of the tie. A form of half-round tie is, therefore, suggested, with an upper surface of eight to twelve inches. It is probable that the increased stiffness of the rail will permit of a spacing, with a tie of the form proposed, very much greater than is possible with the form usually employed.

Ties are now being cut from trees of all diameters, from 9 inches upward. The influence which the new tie form will have upon the size of trees cut for tie purposes ought to be a marked one. It certainly would discourage the cutting of pole ties to a very considerable extent. It would not pay to make a tie out of a small tree, when by leaving it for a few years two ties could be made from the same tree. In other words, the present policy of cutting trees 11 or 12 inches in diameter would be found less profitable than cutting trees 16 or 17 inches in diameter. There is probably no other branch of the lumber industry in which so many small trees are annually destroyed, and the possible growth of forests retarded to such an extent as in the manufacture of ties. The practice of sawing ties from logs is going to be more and more prevalent as the old feeling that a sawed tie is not worth having disappears. The cutting of these trees will, moreover, make possible the use of large quantities of timber which now is practically wasted, and from which the lumberman has no return. This is particularly true of tops.

The subject of track fastenings is discussed in the remainder of the bulletin, because the writer believes that only with much modified systems of fastening can ties of most of the softer woods be made to last sufficiently long to pay for chemical treatment. With the present style of spike the soft wood tie does not hold with sufficient firmness to prevent undulations and creeping of the rail, which result in a more or less rapid wearing out of the tie. In driving the spike into the softer woods the fibres are broken to an unusual extent. As a result they do not withstand the lateral pressure of the rail, and consequently the spike hole



is rapidly increased to such an extent that the spike no longer holds. Water collects in the enlarged hole and decay sets in. Whenever a spike becomes so loose that it no longer holds, it is pulled out and driven in at another point. This constant respiking rapidly ruins the tie. In place of the ordinary spike the screw spike, such as is now used in Europe, is recommended. Screwed into a hole specially bored for it, it holds the rail firmly and prevents the injurious effects of the straight spike.

In tie plates the principal functions are to distribute the load from the rail on the tie, and to prevent the mechanical abrasion of the tie as far as possible. For the softer and inferior woods it is recommended that wherever possible a flat steel tie plate be used without spikes or flanges on the base of the plate, and that tests be made with wooden tie plates, one-fourth, one-half and five-eighths inches in thickness, 6 to 7 inches long, and the width of the rail base under which they are used.

*Forest Resources of Texas: Wm. L. Bray, U. S. Bureau of Forestry.*

The general impression in regard to Texas has been that it is a prairie country rather than a forested state, and while this is largely true, still this report shows that the forests are of no small importance. The existence of the forest and its composition are to a large extent dependent on the rainfall, and from the low plains on the Gulf of Mexico to the plateaus of 4,000 to 5,000 feet and the mountains of 10,000, the rainfall gradually declines from 50 inches per annum to ten inches. The species of trees present a large variety. In the swamp and hay tracts of the lower region are bald cypress, tupelo, gum, magnolia and other characteristic trees of southern lowlands, with their peculiar adaptations to life on lands generally covered by water. The alluvial bottom lands support a valuable hardwood forest comprising different species of oak, ash, gum, cotton-wood, &c. Black walnut has practically all been cut out. The exploitation of the other hardwoods is developing rapidly, as northern manufacturing firms are reaching out farther for supplies. This is one of the new districts from which the supply for Canada will now come. In spite of this it is remarkable that lands are being cleared for settlement in this district by destroying the trees, a wasteful method that most people have considered was long ago relegated to the past. There are about 7,000 square miles of mixed holly pine and hardwood forest, among which tracts of pure stand of the former give a cut of 12,000 to 15,000 feet to the acre. Short leaf pine is also an important timber tree. The greatest timber producing area in Texas at the present time is that covered by Loblolly pine, comprising a tract of some 5,000 square miles. The stand is practically pure, and the trees make a large and perfect growth, yielding logs of a maximum diameter of from 36 to 40



inches, with a clear length of 60 feet. The soil on which it is found is sandy and most of it probably unfit for agriculture. The output is about three-quarters of a billion feet a year, and at the present rate of lumbering it is estimated that the supply will last for twenty years. The development of this industry is of interest, for southern yellow pine has become one of the chief competitors of white pine in the north. Longleaf pine seeds abundantly, but there is very little seedling growth, owing to the regular and frequent fires.

Farther to the west and on higher ground are found the prairie country and mixed forest growth. A peculiarity noticed here is the meeting of the northern and the southern species of trees, the former being dwarfed and altered so as to be designated under different specific names. In the mountain region Douglas fir and western yellow pine (*Pinus ponderosa*) occur.

*The Basket Willow: Wm. F. Hubbard, U. S. Bureau of Forestry.*

Willow Culture in England was among the many forms of industry which were temporarily or permanently stimulated by Napoleon's embargo Act. Great Britain had imported her osiers and baskets from Holland until her exclusion from the Continent led to the formation of plantations at home. The Society of Arts directed their attention to the subject, and gave premiums for the establishment of willow plantations. The willow is still considerably grown in England, where the principal cultivator of late years was William Scaling, and such districts as Nottingham and the fens of Cambridgeshire produce osiers of the highest quality; but the general labor conditions and the ease with which willow is imported from other countries have prevented it from being widely cultivated or manufactured. France, Italy, the islands of Sicily and Madeira, Belgium, Holland, Germany, Austria, and Russia, are all large growers of willow, and have a good export trade of osier rods and basket ware. In all these thickly populated countries, which abound in cheap labor, willow growing and basket making have followed the development of other manufactures to a very marked degree.

Willows are adapted to a wide range of soils and climatic conditions, and are therefore among the most widely distributed of trees and shrubs. The genus *Salix*, to which these plants belong, contains a large number of species, ranging from large trees to a small low plant. From 160 to 170 species are known, inhabiting all regions, from the low grounds and river banks of temperate climates and warm countries to the arid Alpine slopes of mountains and to the boreal regions of both hemispheres. They occur in America from the Arctic Circle to the West Indies and the mountains of Chile. In the Old World they range



from Northern Europe and Asia to Madagascar and South Africa, and to the islands of Java and Sumatra.

The qualities required to constitute a perfect rod are extreme toughness, elasticity, a level, smooth, and brilliant white surface after peeling, good splitting quality, freedom from branches, great length of shoot in proportion to thickness, and a small pith. The development of a species which will produce such rods, and which at the same time is hardy and not liable to ordinary diseases, and a good cropper, is the end for which growers should strive. This demands that the greatest care should be exercised not only in the choice of species, but also in methods of culture. Good varieties give no results under careless methods; even inferior kinds will pay if well tended. It should be the object of every grower to lower the price and better the quality of his willow, for on this depends the future success of American osier culture. If rods equal to the French and cheaper in price can be put on the market, there will be an opportunity for a great expansion of basket and furniture manufactures, and the growers will more than make up in larger sales what they lose in price per pound. The net returns from properly managed plantations are estimated at from \$17 to \$76 per acre per annum for fourteen years.

The species usually planted are the Welsh or purple willow (*Salix purpurea*), the Lamley or Caspian Willow (*Salix pruinosa acutifolia*), the American green or almond willow (*Salix amygdalina*), and the white osier willow (*Salix viminalis*). This industry might find a place in Ontario, if not elsewhere in Canada.

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