

Tulip Tree. Forest type. Height 135 feet, diameter 48 inches, trunk to first branches 80 feet. The branches covering the trunk are those of nearby trees.

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OUR FOREST LANDS AND THEIR PRESERVATION.

At a crowded meeting of the Canadian Club held at St. John, N.B., November 12th, Lieutenant-Governor Tweedie defined his views on Forestry and Forestry Preservation. He deplored the fact that in New Brunswick general public attention had not been aroused, and that outside those immediately concerned in the manufacture of lumber, very little interest had been shown in forest preservation. Lack of interest on the part of the public and insufficient means at the disposal of the Crown Lands Department have, in the opinion of Governor Tweedie, prevented the carrying out of such a policy as would tend to preserve and protect the forests.

Dealing with the measures which should be taken for the purpose of preserving and protecting the New Brunswick lands Governor Tweedie said, "That without the assistance and co-operation of the public, the representatives of the people and those engaged in the industry, any measures adopted will, in my opinion, prove abortive and ineffective. In 1906, as premier of the province, I had the honor of introducing to the legislature the 'Public Domain Act,' and I think if its provisions are carried out that we would not be behind any other province of the Dominion in an effective forest policy. Before dealing with the provisions of that act let me say that this question is not and should not be a political one. All parties should endeavor to work out a policy that will inure to the benefit of the province, irrespective entirely of political faction.

"The time has gone by when either party should take advantage of the usual political cries connected with the administration of our crown timber lands. In the past, no matter what measures were adopted to protect the forest, the cry was raised, 'You are injuring the poor man. The forests belong to the province and should be free to every one that chooses to operate or cut the lumber.' It is not uncommon to hear even

now, that the lumbermen of the country are monopolists—that the young men of the country are being driven out by reason of the fact that lumbermen hold all the lands and land for settlement cannot be obtained—that the smaller operator cannot compete with his richer neighbor. If heed is given to these cries, nothing will be effected and the result can only prove disastrous to the interests of the province in the years to come. The public domain of the province belongs to its people, not to any one class, and until public opinion is aroused to the importance and necessity for its immediate protection, the destruction and waste which has been carried on in the past will still continue. It is not only those who are engaged in the lumber industry that are interested—everyone in the province has a vital interest in these lands—the merchant, the agriculturist, the professional man, the mechanic, the laborer, and all others, and not only the present generation, but future generations.

“I have always been of the opinion that when the Crown licenses its timber lands the licensee is entitled to have these lands properly surveyed and the boundaries of each block marked. Past experience in making surveys has proved that very often there is more land in the district surveyed than appeared by the plan and maps in the Crown land office. Some years ago surveys were made on the Tobique and in Restigouche County, and very much more valuable timber lands were found by actual survey than were known to exist. The result was that the extra lands produced, if not sufficient to pay the whole cost of survey, at least a considerable portion of it. Another strong reason for having these lands properly surveyed is that it is much easier for the lumber cruiser or scaler of the government to ascertain what quantity is actually cut upon Crown lands. Very frequently the claim is set up by the operator that a large portion has been cut on granted lands, and where these granted lands adjoin the licensed land of the government, and where the lines are obliterated, it is very difficult indeed for the scaler to properly estimate the quantity liable for stumpage, and in most of such cases the benefit of the doubt is given to the operator. It would also be much easier to enforce the regulations of the department relating to Crown lands.

“There are large quantities of land which will never arrive at a growth that will meet the requirements of the present regulations, namely—make an 18 ft. log 10 inches at the top. These lands are of a thick, stubby growth, and are to be found all over the country, but the quantity in proportion to first class lands is not known and is only a matter of conjecture. Now it is apparent that the Crown should be in possession of this knowledge, so that it might intelligently deal with the pulp wood

question, which is of great importance, in view of the establishment in recent years, of sulphite fibre mills.

"Many intelligent and capable lumbermen hold to the idea that pulp mills are a great menace to the forest wealth of our country, and that with their greater development it is only a question of a few years when our lumber lands will be depleted. With this view I do not agree, because if a proper policy be carried out in regard to the cutting of lumber, it is clear to me that pulp mills might be well supplied without doing any appreciable damage to our forest lands. One thing, however, is important, and of vast importance, and that is that on no account whatever and under no pretext should the operator be allowed to cut lumber below that allowed by the present regulations, except in cases where the land is of the stubby growth mentioned, and which would not in any event produce merchantable lumber of the regulation size.

"With this latter view I know that a great many will disagree, because every proposition to curtail or limit in any way the privileges the operator formerly enjoyed necessarily is unpopular. I am fully impressed, however, with the necessity that exists to-day for a more vigorous policy in this regard, and feel that if such policy is not pursued in the near future the province will eventually suffer.

"Hemlock timber, till very recently, was of comparatively little value, large quantities of it having each year been cut down and the bark, which is used for tanning purposes, peeled. The log, however, was left in the woods and millions of feet in nearly every section of the province have been left to rot and decay. The time has gone by for this extravagant waste and any party who peels bark now on our Crown lands should be required to take the log out of the woods. This wood has now become quite valuable. The time has arrived when indiscriminate and wasteful cutting of it should not be allowed. I am inclined to the view that in the near future hemlock will be largely used in the manufacture of the coarser kinds of paper. I know that to a certain extent it is now being used in our pulp mills, and have no doubt it will be more largely used in the future.

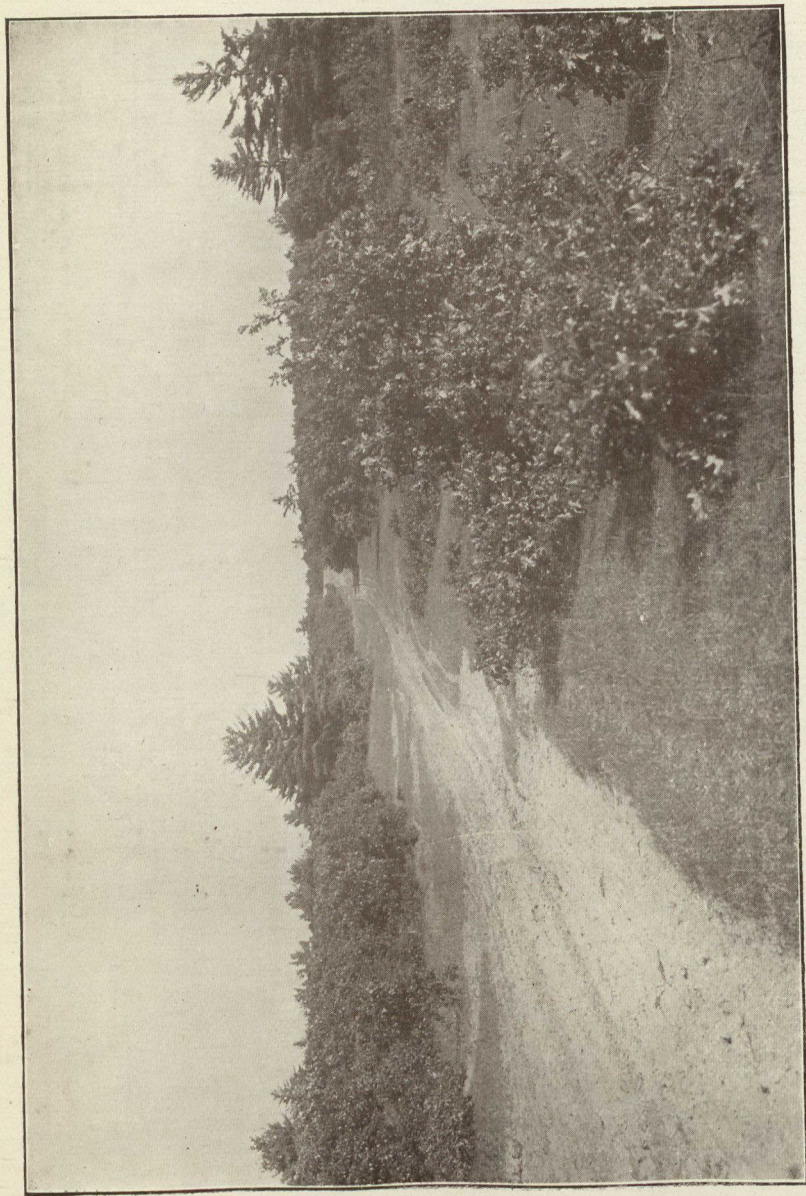
EXPORT OF PULPWOOD.

"What condition would this province be in if it were not for its forest wealth? If the operator were allowed to cut the lands indiscriminately—why, in a very few years, there would be nothing left but a waste, howling wilderness of no value whatever. The country would be completely demoralized and ruined, not only from a lumbering standpoint, but also from an industrial standpoint. And here I may remark that of late a great deal has been written and said throughout Canada in regard to the

government allowing our manufactured lumber to be shipped to the United States in the shape of rossed wood, to supply its pulp and paper mills. I agree at once that if it could be made clear that all the wood that is at present exported from this province could be profitably manufactured into paper within the province, then it would be advisable to prevent its shipment to the United States; but that is not clear, and I can see a great many difficulties in the way. Those who in this province advocate the placing of a duty and are calling upon the federal and provincial governments to pursue this policy, in my opinion, have not thoroughly considered the question. The same conditions do not exist in all the provinces—Ontario and Quebec have great water powers—and many of them. They likewise possess all the other facilities and requirements necessary for successfully manufacturing all kinds of pulp paper. New Brunswick is not so favorably situated in this respect. It has few water powers—the one at Grand Falls being the largest, and is considered by many to be the greatest power in the Dominion east of Niagara. There is a fall of about 10,000 horse power in Gloucester County, and a very few more smaller ones in different parts of the province, so that it will be seen it is not every locality within the province where a pulp mill can be successfully started. Outside of power, abundance of water is a great essential in the manufacture of pulp and paper, and unless it can be liberally supplied it is useless to talk of establishing pulp mills. Mechanical pulp mills cannot be run at a profit with steam, and water power is necessary to economical running. For these reasons, therefore, we might find, if the export of the raw material were prevented in localities where mills could not be erected, quantities of pulp wood would for many years be unmarketable, and there are many districts within the province where the raw material could be supplied, but which by reason of the drawbacks I have mentioned pulp mills could not reasonably be expected to be erected. If any such mills are to be built within the province in the future they will be built where the most favorable conditions exist and where a large supply of pulp wood can be obtained; but I am of opinion that in New Brunswick the number of pulp and paper mills that will be erected will, for years to come, be small.

RE-FORESTATION.

“From time to time we hear of the necessity of re-forestation, but to my mind the necessity does not exist at the present time for such a policy. We have thousands of acres of land within the province where the growth is too thick and where it would be of great advantage to pursue a thinning out process, and if the lands of the province are ever classified as I have



Scrub Oak Lands in Norfolk Co., Ontario. A few White Pine seed trees may be seen.

suggested, I have no doubt that such a course will be adopted.

"Large tracts of valuable lands have been burned over in the years gone by and which to-day are not productive. These lands might well be set apart and lumbering upon them prohibited for a number of years. Under proper supervision and protection they would in a few years become a valuable asset of the province. I think the district known as the Cains River country might properly be removed from license and protected in the way I have suggested. Millions of dollars worth of lumber has been destroyed in this region in the past, and under proper protection, as it is a quick growing country, it would become of great value in the future.

FIRE THE GREAT ENEMY.

"One of the greatest enemies to our forests is fire, but fortunately since the policy of leasing the land for twenty-five years was adopted, more care has been exercised by the licensees, in consequence of which fires have not for the past 13 or 14 years been so destructive; but nearly every year, without exception, fires do occur in some portion of the timber region. It is difficult to trace the origin of these fires, but very frequently they occur through the carelessness of persons going through the woods. Oftentimes they are caused by carelessness of the stream drivers, frequently by fishing parties, and sometimes by gum pickers. Lightning very often causes a fire, but my experience is that in most cases the origin can be traced to an individual or individuals. Now that our forest lands have become so valuable it is incumbent upon us to have more stringent regulations, and to take greater precautions against fire. To do this, it would be fair that both the licensee and the government should contribute. There is a mutuality between the parties, and the protection afforded is for the common benefit. I know that many lumbermen claim that the Crown should bear all the expense of such fire protection. This view is not a reasonable one. When the government leases streams for fishing purposes there is a provision in every lease that the lessee shall put on a number of guardians for the proper protection of such streams, and shall pay their wages. There should be a regular fire service connected with the Crown land. A competent man should have charge as chief fire ranger, and a sufficient number of men should be employed in each district whose duty it would be to report to the chief fire ranger at stated periods. These wardens should patrol their district daily during the dangerous seasons, which are generally the months of May, part of June, October and part of November, and while danger and damage cannot absolutely be prevented, still with a proper system, energetically and practically worked out, the chances of loss may be greatly reduced.

"Time will not permit of my dealing more exhaustively with the subject of forest fires. The railways have caused great damage in the past, and I regard with apprehension the construction of the Grand Trunk Pacific Railway, which, when completed, will run through a large portion of our forest land, and also of the International Railway, which will run from Campbellton to the St. John River—the whole distance of 110 miles being mainly through the most valuable Crown timber lands. Some time ago it was suggested that if power was developed at the Grand Falls, that these roads might be run by electricity. If this were feasible the danger of fire would be eliminated, but I was not prepared to give an opinion upon the matter. However, if this is not feasible and the railways are operated in the usual way, the greatest care and precaution must be exercised both by the Crown and license holders of these lands in order to provide against their destruction.

"I have pointed out that under no pretext whatever should any licensee be allowed to cut lumber under the regulation size. I emphasize that suggestion, because in the proper enforcement of that regulation I see the mainstay of forest protection. There is no reason why the holder of licensed land, who is a pulp manufacturer, should be allowed to cut undersized lumber and especially if there be another regulation which is suggested by the act, namely, the operator must take out of the forest the tops of the trees. This does not mean that they will be required to take out the branches, but simply the wood—say to the diameter of four inches at the top end. If all our operators are required to do this the supply of pulp wood will be very large. If the pulp manufacturer does not desire to make the large logs into pulp he can dispose of these to the saw-mill owner.

SCHOOL OF FORESTRY.

"In order to intelligently carry out any such policy as is contemplated by this act, able, efficient and well qualified men are required. Men who will perform their duty without fear or favor; men who are not inclined to follow the lines of least resistance, but potential men, who will to the utmost of their ability protect the country, and at the same time be just to the operator. A forestry staff should be organized, with a principal or chief, and upon the selection of that principal or chief would depend, in a great measure, the successful protection and preservation of our forests. In order to successfully carry out the policy those engaged in the work should be interested in forestry protection and preservation, and in this connection I would strongly impress upon the country the necessity of having a school of forestry or a chair of forestry immediately established in our university, where our young men could be trained and

educated and thereby, by the love of these great timber lands of ours, would bend their energies towards perpetuating them. Yale and Harvard Universities have large tracts of land set apart in connection with their chair of forestry, and it would not be a difficult matter for the Province of New Brunswick to follow along the same lines. What we require in the province is practical young men—not theorists—but men who know the whole business, men who would be able to advise the operator as to the most economical way of cutting his lumber. Teaching him to abandon the old style, leaving a stump 4 or 5 feet in the woods, the best part of the tree, and in other ways avoiding extravagance and waste.

“Now, Mr. President and Gentlemen, while time will not allow me going fully into the whole question of forestry, still I think I have touched upon the points that are at the present time most important—for the consideration of the people of the province. If the warning I have uttered is heeded by the people there is no doubt but the forest lands of the province will not only be a source of wealth for the present generation, but will be perpetuated for years to come.

“One other word of warning I would utter, and that is against over-production. When the capabilities of our lands are thoroughly ascertained by actual survey and inspection, as I have before mentioned, it will be an easy matter for any competent man to decide what lumber might be cut annually over these lands without injury to their future growth; and the yearly crop of lumber cut should not, under any circumstances, exceed the annual capability of the lands.”

NINTH ANNUAL MEETING.

An invitation has been received from the Board of Trade of Montreal to hold the Annual Meeting of the Canadian Forestry Association in the rooms of the Board, and it has been decided by the executive committee of the Association to accept the invitation, and the annual meeting will therefore be held in the city of Montreal on the 12th and 13th of March next.

The Eastern Canadian Passenger Association, covering Ontario, Quebec and the Maritime Provinces, has already agreed to grant a single fare rate without regard to the number in attendance. Negotiations are being carried on in regard to special rates for the western provinces.

The details of the programme have not yet been worked out, but there will be several interesting papers by leading forestry experts of the Dominion, and invitations are being sent to some of the leading foresters of the United States. It is expected that the Government of the Province of Quebec will be specially represented at the meeting, and provision will be made for giving special consideration to the interests of the French-speaking population of the Province.

It is hoped that there will be a large attendance of the members of the Association, as the forestry movement is at a stage of its development when it particularly needs the stimulus of such meetings and the assistance of its friends.

THE MINING AND SCIENTIFIC PRESS, published in San Francisco, discussing tariff reforms proposed by President Roosevelt, enunciates a new idea in connection with the suggested repeal of the duty on wood pulp imported into the United States from Canada. Starting with the statement that there is enough material in the United States from which wood pulp is manufactured "to serve the needs of the dozen real newspapers that actually guide and illuminate public opinion," it is shown that the cheapening of print paper is in no way likely to contribute to the industrial well-being or intellectual development of the United States since it means chiefly that greater facilities will be afforded for the publication of cheap newspapers and undesirable books. The article closes with these words: "We want fewer papers and a higher standard; less paper and more ideas; less printing and more honesty of purpose. So let the wood stay in the forests of Canada until such time as it can be used to beneficent purpose."

At the beginning of the fiscal year the area of National Forests in the United States was 107,000,000, at its close more than 150,000,000 acres. Nearly the whole of this great area is under the actual administration of the Forest Service. This means that it is being protected against fire, theft, and wasteful exploitation.

WORK OF DOMINION FOREST SERVICE.

The Dominion Forest Service has been fortunate this year in getting through the season with practically no loss by fire. This result is partially due to the late and comparatively wet summer, but is due also to the vigilance of the fire ranging staff as many fires were started which were extinguished by the rangers. The early part of the summer, though cold, was dry and the conditions were favorable for the spread of fires. In British Columbia particularly in the early part of the season several dangerous fires started but by the exertions of the rangers were kept in check and little damage resulted. There has been special difficulty during the present year in the coast district of the railway belt on account of the construction of the Great Northern Railway through the timbered district.

An extension of the protective service was made during the present year by placing three rangers on the Athabasca River and in the Lesser Slave Lake district. The report of the trip made by Mr. Stewart, the former Superintendent of Forestry, through the Mackenzie basin showed that there was valuable timber there which would be an absolute necessity to the future population and which was in serious danger of destruction.

The protection of the forest reserves is being gradually placed in the hands of permanent rangers. On some of the older reserves there have been permanent rangers for some time, but since the reserves have been placed on a permanent basis by the Forest Reserves Act the staff for their administration will require to be placed on a permanent footing, so as to provide adequate protection both from fire and trespass. Several new rangers have recently taken charge of the larger reserves in Manitoba. Unfortunately all the reserves have suffered more or less from fires during the past, but the natural reproduction is generally good, and if fires can be prevented from doing any further destruction the lands can be again re-forested with little assistance from artificial regeneration.

The timber survey of the Riding Mountain Forest Reserve was continued this year in the western end of the reserve and good progress was made. It is hoped in another year to complete this survey and the Department will then be in possession of full information as to the stand of timber, the topography and the general condition of the reserve, the character of the soil, and the rate of growth of the different species of trees, and will be able to lay out scientific plans for their management.

The distribution of stock from the nursery station at Indian

Head was delayed by the late spring and the work had all to be done in a rush, but the trees were got out finally in good condition. Over two million trees were sent out, and it taxed all the resources of the staff to accomplish it. The stock which is growing for the distribution for next spring is making a good showing, and there should be a thrifty well developed lot of young trees then available.

The beautiful and comfortable homes surrounded with trees seen here and there throughout the west are the best evidence of the value of the work which is thus being carried on by the government. No places could be more attractive and homelike, and they are in strong contrast with the houses standing bare and unsheltered on the prairie.

NOTED FORESTERS LATELY DECEASED.

Sir Dietrich Brandis, whose death took place on May 30th last at Bonn, Germany, was perhaps the best known forester of his day among English-speaking peoples. He received a thorough forestry training at Griessen, in Germany, his native country, under Gustave Heyer. From his appointment in 1856 as Superintendent of Forests in the province of Pegu, Burmah, dates the commencement of scientific forestry in India. In 1864 he was appointed the first Inspector General of Forests for India. On his entry into the service he found no organization whatever and no trained foresters available. In 1883 he left the Indian Forest Service thoroughly organized and provided with an efficient force of thoroughly efficient foresters. He was prominently identified with the Cooper's Hill College of Forestry. He was created C.I.E. in 1878 and K.C.I.E. in 1887.

Another well-known forester who has died during the year is Prof. (Dr.) Karl Gayer, formerly Professor at the University of Munich. Dr. Gayer's death took place on March 1st at the age of 85. Dr. Gayer's work on Sylviculture has become classic on that subject, and his work on "Forest Utilization" (*Forstbenutzung*) is also an authority.

FORESTRY IN ALBERTA.

Why the prairies should be treeless is a subject on which many pages have been printed and innumerable theories advanced, but until quite recently it was generally assumed that whatever the reason might be there was no gainsaying the fact that trees would not grow naturally on the prairies of the west. That recurring fires were the chief and, in most districts, the only cause, has long been known to a few observant men, who in travelling across the plains noted that not only near water but among sand-hills where fire could not run and in places where natural fire-guards, such as barren ground and running water, were found, trees thrived and reached a large size. Charred trunks of trees were also often found where no living tree was to be seen. The inevitable conclusion was that if the fire were kept out the prairies would gradually disappear and forest take its place. Experiments made by several departments of the federal and territorial governments, by the Canadian Pacific Railway Company and by individuals have shown that if protected from fire and cared for for a few years as local conditions may make necessary, there is no part of the prairie country which may not be successfully and in most places cheaply re-forested.

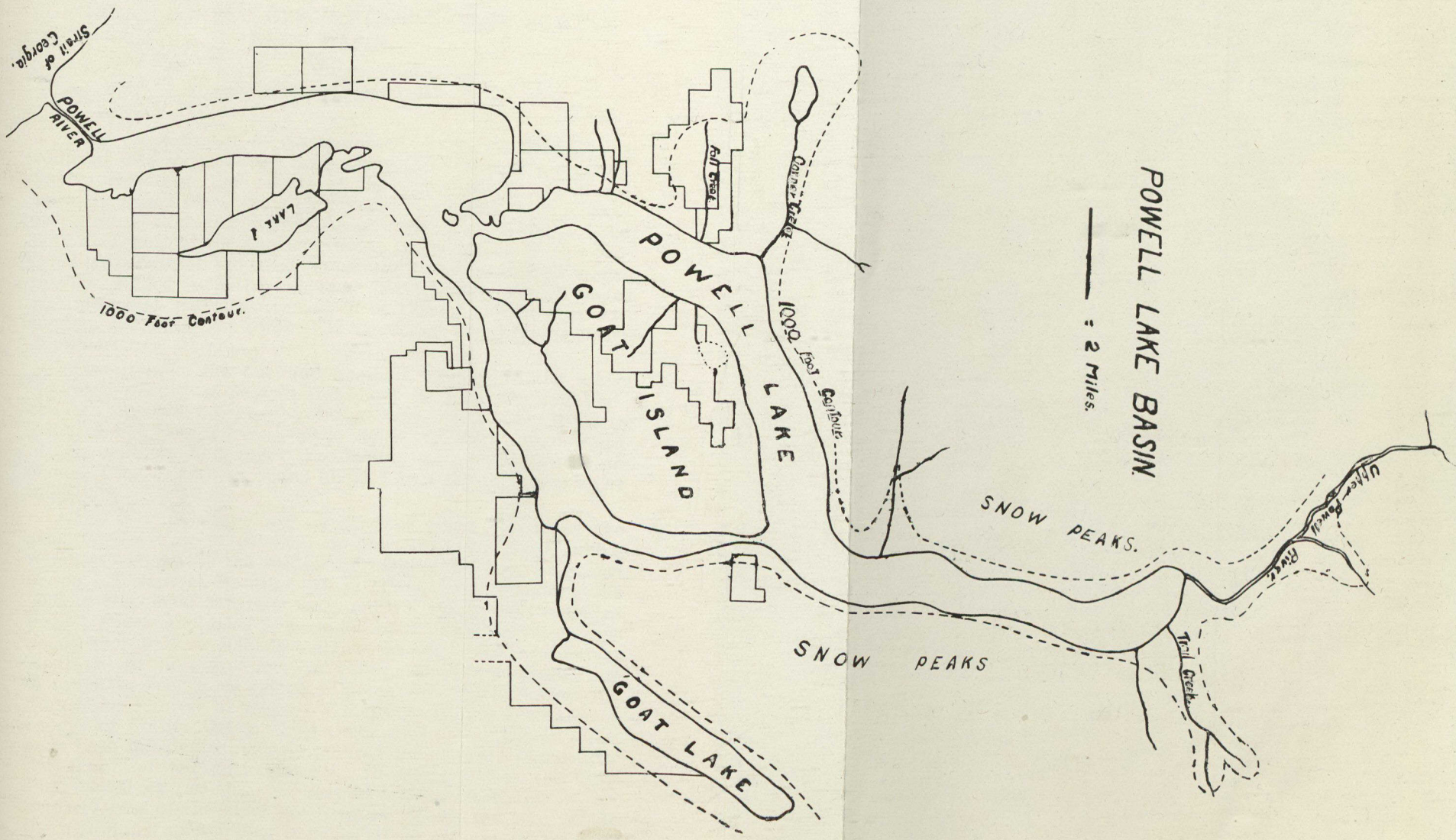
Mr. Arch. Mitchell at the Tenth Annual Convention of the Western Horticultural Society, went into this subject in detail, and showed that during the last decade there had been a complete change in the popular conception of southern Alberta, especially in relation to tree-growing. The effect of the warm chinook winds on growing trees has been entirely misunderstood. It was supposed that these warm winds started the sap running, and as they were often followed by very low temperature, the frost was supposed to destroy the young trees. Mr. Mitchell has shown clearly that the injurious effect of the chinooks is due to the drying out of both soil and trees. The winter of 1905-6 was the worst on record for trees in southern Alberta, but according to Mr. Mitchell the reason of this was that "trees were simply dried out, but where mulches were applied in time or plantations were large enough, i.e., wide enough to protect themselves, there was no more damage than usual."

Mr. Mitchell referred in appreciative terms to the work of the Forestry Department. He said:—

"However, it is pleasant to find throughout the drier part of the province that, along with other fallacies of the past, the belief that trees will not grow on the prairie without irrigation

is rapidly dying a natural death. The healthy sign is in a great measure due to the assistance in tree planting afforded to settlers by the Forestry Department at Ottawa, and the object lessons provided by their plantations. The co-operative tree planting scheme is, I presume, well enough understood, but may be briefly stated as a scheme under which the department supplies a few acres of trees to any farmer who cares to apply for them on condition that the plantations will be permanent. The location of every plantation is inspected before plants are granted, and every piece of land intended for a plantation must be well prepared by thorough cultivation. Thorough cultivation is insisted on for two or three years after planting, and the whole system is under the supervision of a staff of five or six inspectors, who have had experience in tree planting. These inspectors pass through the country in the summer, and visit the plantation already set out as well as new ones; and this, in my opinion is one of the most reliable features of the whole system, for the inspector naturally feels himself responsible to a certain degree for the success of the plantations under his charge, and is able to give the farmer many a useful hint as to the care of his trees. The value of this may be estimated when it is realized that the farmer is often completely ignorant of conditions prevailing in the west, and probably has never planted a tree before. In this connection it perhaps should be mentioned that some good work has been done the last four or five winters under the auspices of the Provincial Government. The series of Institute meetings carried on throughout the province have invariably carried a lecturer on Forestry among the speakers, and the ground has been fairly well covered as far north as Red Deer. These lecturers were supplied by the Dominion Forestry Department, and all the aspects of the Forestry question as it effects the prairies and the settlers were discussed, from the growing of a shelter belt to the pruning of a scrubby Manitoba maple, or an apple tree, or the transplanting of a spruce, or a Douglas fir."

Space does not permit of further quotation from Mr. Mitchell's address, but it may be said here that had there been a few more such practical optimists in the Northwest twenty or even ten years ago the new provinces would now be growing their own fruit, and tree planting on every new farm would be undertaken as a matter of course without thought of failure.



POWELL LAKE BASIN

— = 2 Miles

SNOW PEAKS.

SNOW PEAKS

Strait of Georgia.

POWELL RIVER

LAKI 1

1000 Foot Contour.

Fall House

Canoe Camp

GOAT ISLAND

1000 Foot Contour

GOAT LAKE

Trail Creek

Upper Powell River

GENERAL FOREST DESCRIPTION OF THE POWELL LAKE BASIN.

BY H. R. MACMILLAN.

The coast timber of the mainland of British Columbia is confined to a very narrow strip along salt water or projecting farther inland in the valleys of the larger rivers. A liberal estimate would place the area covered by accessible merchantable timber, excluding islands, as less than ten per cent. of the land area west of the Cascade divide. The nature of this forested land, both on the coast proper and on the numerous inlets, may be judged from the following description of Powell Lake, an area which may be assumed to be typical of that strip extending 150 miles north from Vancouver, on which the fir is the dominant tree.

Powell Lake lies one and one-half miles from the north side of the Strait of Georgia and about 80 miles north of Vancouver. As will be seen by the accompanying map it bears NE and SW, has a length of 25 miles and an average width of one and one-half miles, broadening out in the centre to enclose Goat Island, an island about four miles wide and eight miles long.

The lake in shape and method of origin resembles the arms of the sea, so common on the northwest coast, which were grooved out by the descending tongues of ice in the glacial period. Except at its head where the groove containing the lake is prolonged into the long narrow valley of the Upper Powell River, the lake is enclosed by a range of mountains rising from 3000 to 5000 feet above the sea. These peaks are separated by narrow gorge-like valleys nearly all terminating in rough boulder talus slopes or precipitous cascades, varying from 50 to 500 feet in height. Exceptions to this form are the valleys of Corner Creek, Trail Creek and Trout Creek which have been broadened out and reduced to a grade less steep by the action of tributary glaciers. In many places the cliffs along the shore rise sheer for several hundred feet; this is particularly true of the more northern portion of the lake, where the mountains surrounding it being nearer the axis of the Cascade Range are higher and bolder.

The surface of the lake is 150 feet above sea level, a fact which renders Powell River, though 100 feet wide and 3 to 10 feet deep, too swift to be navigable or drivable on account of a series of falls and rapids.

The rock constituting the whole formation is uniformly highly metamorphosed, is nearly all a very micaceous hornblende granite containing very little feldspar and being very porphyritic, often holding dark hornblende portions a foot or more in diameter. The granite is very valuable as building stone and in several exposures contains veins of diorite or quartz, the latter in some instances bearing copper, gold and silver ores which are at present arousing the interest of prospectors.

Powell Lake with its tributary basin lies within the Humid Transition zone, a climatic belt characterized by a large rainfall and an equable temperature. But owing to the many mountains and narrow canyons, the former with their cold peaks, the latter with their local effects on air movements, there are within the area described many complex modifications. The normal rainfall at sea level is about sixty inches, over 50 of which falls in the seven months from October to April. But on the higher peaks at the south end of the lake and reaching lower elevations as the north end is neared precipitation is greatly increased. This may be ascribed to the cold air currents which are continually drifting down from the higher Cascade Mountains, meeting with the moisture-laden winds from the sea.

The temperature is modified to such an extent by the adjacent ocean that, though the lakes sometimes freeze over, the winter frost is not very severe and the summer heat never intense. No records are kept at this point but judging from reports from meteorological stations similarly situated the normal annual mean must be about 45° F. at sea level. The mountain sides and peaks on account of their diverse aspects and elevations differ even more in temperature than they do in precipitation. Thus it is that though Powell Lake is situated within the Humid Transition zone, there are several high valleys whose late snows and peculiar species lead them to be classed with the Canadian zone.

Since this region has first been explored the provincial government has changed its land policy several times so that now lands which have been staked are held under many different titles. The oldest are those known as Crown grants, whereby the government sold land and timber outright for a price approximating \$1.00 per acre. These are comparatively few and only cover an area of three square miles. Next in point of age are the leases, granted by the government when the timber was still thought to be of little value. The applicant applied for a certain acreage, was assigned to an area about three times as large from which he must choose, had his claim surveyed, and for a perpetual lease pays an annual rental of five cents per acre. The area held under lease on Powell Lake is about 39 square miles. The form of timber license now granted is issued

for square miles only, requires an annual rental of \$140.00 per square mile and runs for 21 years. The title is statutory and the property transferable. The area thus held is about 22 square miles and applications are still being made by cruisers in the district. The owners of all these lands, irrespective of the nature of their title, unless it be a Crown grant, are required to pay a royalty of 50 cents per 1000 when the timber is cut. The remainder of the Powell Lake basin is held by the government, making a total land area of 250 square miles.

A disastrous fire which occurred eight years ago, followed by another four years ago destroyed so much of the timber that the most prominent types, burned and unburned, must be credited on an artificial distinction.

The unburned timber is that extending up the lake for five miles from the south end, a few of the valleys above 2000 feet and about ten square miles in the valleys of the Upper Powell and Trail rivers. This unburned area may be divided into four types, fir, cedar, hemlock, balsam and cypress.

The fir type occurs from the level of the lake to an elevation of 2000 feet except where a more moist bottom land type along a stream or on a springy slope favors the development of cedar. Lower in the valleys the soil may be two and three feet deep, a coarse gritty clay with a thick layer of very closely decaying humus but higher on the slopes it becomes shallower, with more frequent exposures of bare rock until where the upper limits of fir are reached there is very little but humus and large patches of rock.

The ground cover is uniformly moss and under a dense stand of fir on a lower slope or valley with frequent fern (*Polystichum munitum*) and maiden-hair fern (*Adiantum pedatum*). On the higher, drier and more sterile soils, under an opener stand the most common herb is bracken fern, (*Pteridium aquilinum*). The underbrush varies from scattered shrubs of red huckleberry (*Vaccinium parvifolium*) under the dense stands to a thick mat of Salal, (*Gaultheria Shallon*) and Oregon grape (*Berberis nervosa*) on the drier soils where light is more plentiful. In such a virgin stand of fir, reproduction is very scant, consisting wholly of suppressed hemlocks, except where in an accidental opening a small group of fir may have sprung up.

The fir type consists of almost pure fir containing on the lower slopes about 5.15 per cent. of cedar and in the cooler and damper sites or at high elevations mingling with hemlock. The stand is everywhere quite mature and growing very slowly. The trees vary in diameter from two to eight feet, averaging about four and one-half, are very clear and straight and reach a height of 175 to 200 feet. The number of board feet per acre according to the B. C. rule varies from 75,000 on the best sites

to almost nothing on the poorest and for the whole fir type would average about 15,000. Since the area forested under this type is about 25 square miles the quantity of fir on Powell Lake would approximate 240,000,000 feet and probably surpasses this figure.

The giant cedar type occurs on the more moist, narrower river bottoms or very springy hillsides. On the former the soil may be quite deep, an alluvial deposit, but on the latter the soil is usually very scant, the substratum being a talus slope through which water continually oozes. On such a site the cedar flourishes to an elevation of 2000 feet with a north exposure on Fall Creek, east of Powell Lake.

As with the fir type, the ground cover is moss and ferns, but the underbrush is more frequently, on the low flats, dense alder, dogwood, (*Cornus occidentalis*), devil's club (*Echinopanax horrida*) and salmonberry (*Rubus spectabilis*), while on the high steep slopes the underbrush is more open or wholly lacking and consists of maple (*Acer circinatum*) and Scouler's willow (*Salix scouleriana*).

The stand is past maturity, decaying at the butt almost as fast as it is growing and many of the trees are dying, as shown by the dead tops. The wood, however, is so resistant to decay that except for the butt log it is quite as valuable as ever and even trees which have been lying on the ground for a century are yet worth sawing.

This type occurs only in small patches along river bottoms except at Fall Creek where there is a wet slope with about two square miles of almost pure cedar running about 12,000 feet to the acre. The trees are three to seven feet in diameter, 150 to 175 feet high, clear for about 30 feet, then very limby and more suited for shingles than anything else. The few firs which occur scattered through the cedar are exceptionally large, fine and clear.

There are also occasional small clumps of western white pine, (*P. monticola*) varying in diameter from 12 to 40 inches and in height from 75 to 150 feet, very straight and clear. Growing throughout the cedar stands, usually as an understory which probably has followed some old fire, are overtopped and suppressed hemlocks two to eight inches in diameter. Altogether there are probably about 30 million feet of cedar on Powell Lake.

The hemlock-balsam type occurs on all the very high valleys which constitute the only unburned timber north of the island in Powell Lake.

These valleys all begin at elevations of 1800 to 2000 feet and are the fan-shaped catchment areas of streams draining into the lake. The valleys of the Upper Powell and Trail rivers,

though of much lower altitude are of the same type. The soil is scant, moist and cold, the snow lies late in the spring and the precipitation is greater than with the previous types.

The ground is thickly covered with moss and underbrush of salmon-berry, currant (*Ribes bracteosum*) and devil's club. Reproduction of this type consists only of patches of suppressed hemlocks and scattered faster-growing balsams, except where openings have been made; in the latter, reproduction is dense and consists of about even proportions of hemlock (*T. heterophylla*) and balsam (*A. grandis*), the latter making the faster growth.

The stands consist of about 60 per cent. hemlock and 40 per cent. balsam, occurring in patches. The trees are growing very slowly, at all ages, and the stands as a rule are very uneven-aged, varying in diameter from eight inches to three and one-half feet and in height from 75 to 150 feet. The timber is clear and straight and would scale about 7000 feet to the acre, though the hemlock is 30% infected by *Trametes pini*.

There are about twenty square miles of this type containing probably about fifty million feet of hemlock and ten million of balsam.

The cypress type is found only in very high, damp valleys, About one square mile of it is found at an elevation of 3100 feet near Corner Creek. There the snow lay from two to six feet deep on June 1st. The stand consists of about 50% each of cypress and black hemlock (*T. Mertensiana*). The cypress only is of any value and is quite sound though very knotty on account of the hardness of its persistent branches. It is 18 by 36 inches in diameter, 75 to 100 feet high and would run 3000 feet to the acre or about two million to the valley.

The hemlock is 6 to 10 inches D. Bh., very branchy and short.

The burned area which has been completely devastated by two fires comprises 75 square miles and includes everything except the forest just described.

Over the whole of it, except that above the snow line, all or nearly all the trees are killed, and all, excepting the few square miles of fir on Goat Island, burned only four years ago, completely destroyed. The small patches of cedar which were killed, though as valuable as ever, are so isolated that they could only be removed at a loss.

Over the whole burned area, however, there is dense reproduction. Wherever there are seed trees within a quarter of a mile and the mineral soil has been exposed a dense stand of fir has already started and is growing very fast. On the bare rocks from which humus has been burned scattered firs are

starting. But where there is humus especially everywhere in moist valleys and on hill tops the reproduction of hemlock is extremely dense, and growing very slowly. Cedar reproduction is very scarce and is usually found in the same situations as the hemlock which it easily exceeds in rate of growth. At the south end of the lake an area of about two square miles has been logged. Many large trees serving as seed trees, are left standing and impassible slash covers the ground but wherever there is room for it a thrifty reproduction of fir has sprung up. At the time when this was logged methods were even more wasteful than now, stumps were left standing eight to ten feet high, only the choicest trees taken, a few logs cut from each and many left lying in the woods because of difficulties in transportation.

There is absolutely no agricultural land here so the forest can only be considered in connection with the two industries of lumbering and mining. Vancouver, the nearest mill town, is about eighty miles away and the towage for booms about 75 cents per M, so it would be quite feasible to tow them there. But there is a fair mill site at the mouth of the Powell River where several thousand horse-power could be generated. A railroad with a 4% grade can be built with very little cost from the sea to the lake, and the logs from most of the valleys put into the water by means of donkey engines. For two or three of the valleys where there are several square miles of timber as that of Goat Lake and the Upper Powell short railroads or chutes might be constructed instead of using donkeys. In this manner the logs can be taken to the mill or to salt water for from \$4.00 to \$6.00 per M. Of course these prices would only apply to the fir and cedar for as yet the market does not make it profitable to attempt to log the hemlock, balsam and cypress.

The mountains contain several fairly good copper veins which are now attracting the interest of prospectors and miners and should a real strike be made a rapid market for Powell Lake timber would be developed.

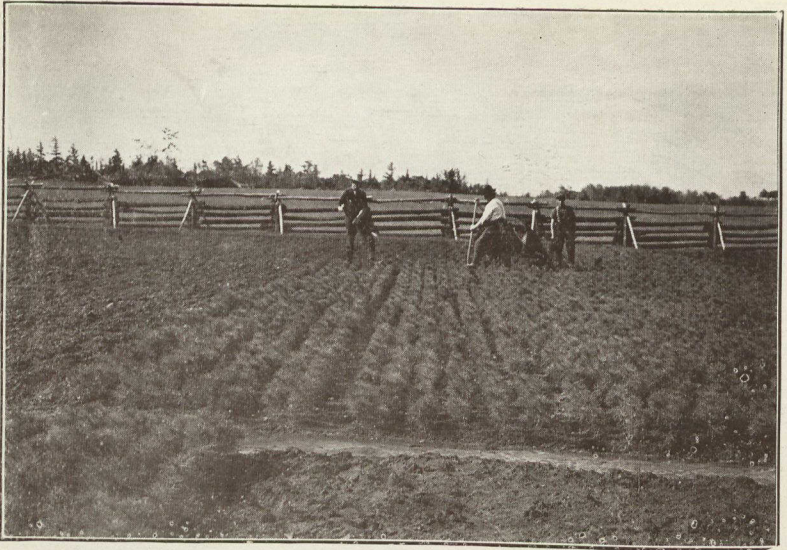


Fig. 1.—Lifting three year old White Pine in Guelph Nursery.



Fig. 2.—Preparing and planting White Pine in waste portion of the woodlot.

PLANTING WASTE LAND.

BY E. J. ZAVITZ.

"Waste Land" is a relative term and depends upon various local conditions. That which might be waste land in one country or state could be profitably managed for annual crops in another. Lands which cannot be tilled and used for agricultural crops, or which are unfit for permanent pasturage can safely be called waste land, and although Ontario is noted for its agricultural wealth and prosperity, there exists in the older portions of the Province a large percentage of this type. It would be very difficult to state just what this percentage is, but it is quite safe to say that there are few farms in Ontario that do not contain some land which the owners have considered unfit for any agricultural purpose, and this is lying idle.

The lands of southern Ontario which are yielding no returns may be divided into two classes; first, small portions of a few acres extent, on good farms, in the form of steep hillsides, or of gravelly or sandy soil, and second, large tracts which are unfenced and unimproved, and are entirely unsuited for profitable tillage. The first class is of direct interest to the farmer, as it forms a part of his own holding. It is the desire of the Government to encourage him to replant the waste land on his own farm, and toward this end something is now being done through the Provincial Department of Agriculture.

The Department, at present, makes planting plans, and furnishes planting material free of cost. To those who do not believe in paternalism on the part of the Government, this may seem an unwise policy. The Department takes the position that this work is of high educational value, and that it is the duty of the state to establish the practicability of planting forest trees on waste land.

The planting material is supplied from nurseries at Guelph in connection with the Ontario Agricultural College. The chief species being used are White Pine, Scotch Pine, Jack Pine, Norway Spruce and European Larch. Of these White Pine is used to the largest extent. The chief deciduous tree used is the Black Locust. Other species grown in the nursery for special cases in planting are White Ash, Tulip, Catalpa, Black Cherry and Manitoba Maple.

Thus far, it has been found more practical to import the evergreens as seedlings, than to grow them from the seed. To give an example: White Pine, at two years of age, the most

expensive evergreen imported, can be laid down at the Guelph Nurseries at a cost of about ninety cents a thousand, when they are imported in large quantities. These two-year-old seedlings are placed in nursery lines for one year, and are then ready for shipping to final planting grounds.

Owing to the cost of collecting seed, and the quality and price of labor in the nursery, it has been found that two-year-old seedlings grown in our own nurseries are much more expensive.

In White Pine planting work the cost of labor varies with the locality and condition of the soil to be planted. The labor runs from \$1.50 to \$2.00 per man. In light sandy soil, two men can frequently plant one acre per day, and in certain cases even more has been accomplished. In clay soils, especially where stony, it requires as many as four men per day to plant one acre. In all planting operations the trees have been spaced about five feet apart each way.

Different methods are adopted in planting to suit various types of soil. In cases of blow sand, it is occasionally necessary to put on an obstruction or covering, to hold the sand until the trees become established. This may be done by placing rows of debris, composed of branches, weeds, marsh hay, or other material between the lines of trees. These rows should run north and south as the prevailing winds in Ontario are westerly. A prospective planter of this type of land even went as far as to completely cover about five acres of land with a cheap grade of hay, costing altogether \$178.00. The material would have covered about fifteen acres, had it been placed in rows, and would have given sufficient protection. The species used for planting in this extreme condition should be Jack Pine, Scotch Pine, and European Larch.

Other types of sandy soils are those on which exists a weed growth varying from a light turf to dense brambles, bracken, etc. In the extreme cases it may be necessary to prepare the grounds by clearing away a portion of the rank growth. This growth is not always a menace but may give valuable protection to the young plants. On these soils White Pine is giving very good results. In a few cases Red Oak and Chestnut have been introduced by dibbling in the nuts. Thus far these species have been planted in spots and strips throughout the evergreen plantation rather than by interspacing. The nuts are placed in the best sites as regards soil conditions.

Planting plans for heavier types of soil on steep hillsides or waste portions of the farm woodlot usually demand more attention in preparation than the lighter soils. In some cases it is possible to run a shallow furrow with the plow which can be used as the planting line thus saving hand labor in removing the sod. In rough conditions it is often necessary to make the



Fig. 3.—Planting three year old White Pine.

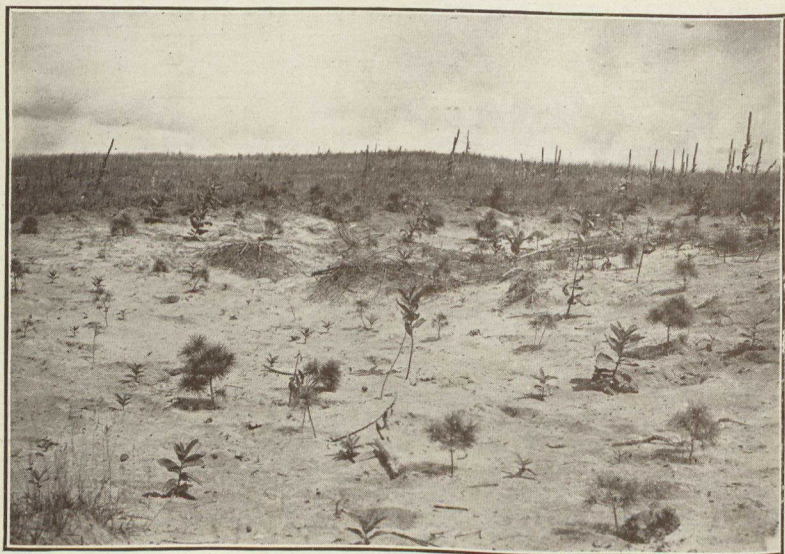


Fig. 4.—Waste sand land planted with White Pine.

individual planting spot by cutting away the turf with the mattock and loosening the soil with the pick. On these soils White Pine is being used to the largest extent although in some favorable locations some of the more valuable hardwoods are being introduced as White Ash, Tulip, Black Cherry and White Elm. The amount of waste land in Ontario made of small holdings would aggregate an enormous acreage but the handling of these lands must ever be in the hands of the individual, thus no definite policy can be assured.

Another class of unproductive land in the Province is that composed of larger areas. These lands may be found throughout the older portions of the country varying from one thousand acres up to fifty thousand acres in extent. It may be surprising to learn that in the southwestern portion of Ontario—that portion lying west of Toronto and south of Muskoka—there exists in the neighborhood of one hundred and fifty square miles of land lying in blocks of from three thousand acres to thirty thousand acres. The reforestation and proper management of these lands are of vital importance to the agricultural interests of this part of the Province. The Department of Agriculture is studying this problem and it is expected that some definite policy will follow as a result.

RE-FORESTATION IN THE NORTHWEST.

At the Convention of the Associated Boards of Trades of Western Canada held at Prince Albert last June, the question of re-forestation in the Northwest was discussed, and the following resolution adopted —

WHEREAS, to a large extent the provinces of Manitoba, Saskatchewan and Alberta are comprised of prairies largely devoid of building timber; and,

WHEREAS, in the settlement and development of such territory an enormous quantity of lumber is necessarily required; and,

WHEREAS, the prices of that lumber which have been prevailing for the last several years have been an indication of the great value of the timber areas; and,

WHEREAS, along the eastern slope of the Rocky Mountains and elsewhere throughout the said provinces there is a very great area of land that would be more valuable for the cultivation of timber than for any other purpose, especially having in view the very great area of arable land elsewhere situated in the said provinces; and,

WHEREAS, in this timber area it is found that the growth of jack pine, spruce and other merchantable trees is exceedingly rapid where timber is protected from fire; and,

WHEREAS, much of this territory is interspersed with rivers and creeks which, with proper use, would form a natural protection against fire; and,

WHEREAS, in the absence of protection against forest fires in the past, an enormous area has been completely denuded of exceedingly valuable timber naturally growing thereon; and,

WHEREAS, the expense of providing fire rangers who could adequately protect the said areas from fire, would be comparatively small and would be absolutely trifling in comparison to the timber that would be secured by such protection; and,

WHEREAS, the climatic benefits of those matters incident to the conservation of the water supply and the prevention of destruction by floods to be obtained by reason of forests is of very great value;

THEREFORE, in the opinion of this Convention, it is highly essential that some concerted action should be taken for the re-forestation of tracts of land suitable or expedient to be used, and it is therefore recommended, .

1. That roadways should be cut out at regular and convenient distances throughout such timber area.
2. That during the spring and fall, at least, an active and adequate corps of fire rangers should be provided, whose duty it should be to patrol incessantly the timber areas to prevent forest fires;
3. That in addition to the natural re-forestation of such areas, active steps should be taken to promote the extension of timber therein.

Action has already been taken by both federal and provincial governments on these lines, but as was emphasized by Governor Tweedie in his St. John address, so much depends upon the interest taken by the public in forest preservation and re-forestation, that the support of such organizations as the Associated Boards of Trade of Western Canada will greatly facilitate the work of those who have charge of experimental forestry operations in the Northwest.

FORESTRY FROM A COMMERCIAL STANDPOINT.*

BY F. W. RANE, STATE FORESTER, MASS.

There are few if any problems of greater moment and more economic importance to the State of Massachusetts at the present hour than that of forestry.

Doubtless there are those present who have known this forest patient when she was healthy, vigorous and strong; how beautiful primeval forests dotted this good old Bay State in those days and how year by year they have succumbed to our mad rush of uneconomic commercialism until today finds us in a sadly depleted and unrational condition viewed from the standpoint of modern forest management. It is always easy to point out mistakes after they have happened, but experience, though a dear teacher, is nevertheless extremely effective. Year by year the primeval forest growth was cut and harvested; second growth, inferior but valuable, has followed where conditions have been favorable; this has in turn been utilized as soon as it reached merchantable size. Demand for forest products have been increasing in greater and greater proportion as we have been developing the State and nation, while the products themselves have likewise been approaching exhaustion. Our people have looked upon the forest products as inexhaustible, thinking naturally that though Massachusetts should be depleted there are plenty of other States at our very doors with indefinite supplies. Many of our country-loving and far-sighted citizens have time and again in the past predicted our present calamity, but the commercial era has absorbed us and the successful business man of America has been the admired of admirers. Æsthetics in a new country are as nothing compared with commercial activities when the bases of the commodities dealt in are free gifts and cost only for the marketing. The balance finally comes with the nation's development.

From the substantial old-time saw-mill, formerly so common upon our streams, now only relics of bygone days, our evolution has developed to the portable mill. Instead of taking the logs to the mill, we now take the mill to the logs. While it is easy to comprehend this change of milling operations and the economy therein, the effect upon forestry itself and the

*Address delivered before the Massachusetts Horticultural Society February 23, 1907. So much of what Professor Rane says is applicable to the older parts of Canada that advantage is taken of his permission to publish his address here.

country community has changed most remarkably. When logs were taken to the mills most farmers employed their teams and labor during the winter months in getting out lumber for home consumption but sold enough to make the effort and time profitable. The old-fashioned method was also not to cut clean, but to take only the larger and mature trees. This practice did not destroy the forest but replacement followed rapidly. Our present method is to sell the stumpage and, as the purchaser finds he is able to market every vestige of the product, the forest area is stripped of vegetation. In earlier days this extreme of clearing was done only when the land was to be used for agricultural purposes. Where the larger growth only was taken out in the past, in twenty years or so the same land could be cut over again at a profit; under the present practice it will require a period nearly or quite twice as long for similar results. Again even the cutting clear practice was not so productive of ill results until it came into such common usage. When only here and there a tract was cut the surrounding growth reseeded it, today the reseeded factor is also cut, leaving great areas where nature is unable to assist as formerly. The white pine for example will reestablish itself whenever the conditions are favorable, when as in earlier times the ill-shaped and limbed specimens contained no commercial value they were allowed to remain standing. These trees make our best seed trees, hence were responsible for reforesting the land with this species. Today even these seed trees have value, no matter how pronged or crooked they will make box-boards, pails, tubs, matches, etc., and bring prices of from \$14 to \$16 a thousand when delivered. The results of this practice are, as we find them, altogether too common. Portable mills are operating at the present on wood lots that in earlier times could not be used commercially. Where the diameters of trees were thought of in terms of feet, we have simply changed the feet to inches for present practical usage. The commercial pine tree of today hardly reaches the seed producing age before it is harvested.

What is true of white pine is equally true of many other of our forest trees. Our pulp companies chew up practically everything of the spruce and even balsam fir, which a few years ago was considered practically worthless, but which at present is of equal value in limited amounts. Hemlock was little thought of for joists and general framing material in buildings not long since, but our carpenters now are not so particular. The American larch, commonly called tamarack or hackmatack, found growing in low, moist situations, was valueless until railroad ties and telegraph poles grew scarce, and then they found immediate value, now having largely disappeared. Hickory, commonly called walnut in New England, was the only wood

thought suitable for tools, axe handles, whiffle-trees, etc., but go on the market and see what are being substituted in its place. Of course our tools do not last as long as formerly. Were there time it could be shown that each and every kind of wood has special qualities that adapt it for specific usefulness. The more we advance in the commercial, industrial and manufactures we continue to discover new economic uses for all of our raw materials and products. There is not a species of wood grown at present but has a recognized standard of value. The time has come when simply the growing of cordwood in most sections of Massachusetts is a promising crop; particularly is this true where the burning of brick is an important industry.

We as a Commonwealth are at an extremely interesting stage at the present time as regards our forestry problem. It is not only true of Massachusetts but of New England, and for that matter the whole country to a greater or less extent.

As long as the prices of forest products remained low we laughed at the idea of forest depletion. Experience is a wise teacher and although the histories of older countries point out very clearly the mistakes they have made, their errors are seldom heeded in a new country until many of the same experiences have resulted.

When our forefathers came to these shores, New England was a vast wilderness, a primeval forest. We are told of the magnificent forests and how individual trees reached great proportions throughout this whole section. Even the decaying stumps still extant remind us that but yesterday in point of time these monarchs of the forest which have been growing for centuries were with us. Tomorrow a forest tree producing over a thousand feet board measure will be a veritable curiosity. We country-loving and public-spirited people are extremely anxious that the nation reserve certain portions of the White Mountains and the southern Appalachian range, that coming generations may enjoy, take pride in, and benefit therefrom. A birthright for them as small as this is a pittance compared with the vast and almost endless expanse of virgin forest areas that was ours.

Viewing the subject as a whole therefore, we must recognize that the time is ripe for action and public concern. To accomplish results much thoughtful study and definite systematic planning must be done in order that there will be no obstructions in the way. Education and example are our tools to work with.

"Forestry is the science and art of forming and cultivating forests; the management of growing timber." Forestry, therefore, as the title of my address indicates, is concerned with the economic production of merchantable wood and timber.

Forestry should rightfully be thought of as a commercial industry. The forest products of a country should be one of her greatest assets, just as much as that of any other crop agriculturally speaking, and even more to be relied upon than our income from mining, for, with proper management, the investment will be permanent, inexhaustible, and hence fundamental to the nation's life and prosperity.

Lumbering is as important to successful forestry as is the digging of potatoes or the harvesting of any crop when it is ripe. The same essentials of culture also must be understood in getting maximum returns in the one case as in the other.

Forestry and commercial forestry are synonymous terms. Forestry in its true sense, when managed properly, will utilize our three million acres of land in Massachusetts at present seen scattered in every section known as waste land, abandoned pastures, sprout lands, barrens, plains, etc., returning them to forest culture. The same culture that will return saw logs to our mills, make work for our country folk in winter, replenish our town treasuries, repaint the old red schoolhouse, pay the sexton to again ring the church bell, make better roads, and, in short, return the former substantial livelihood of country life, will also conserve moisture, protect and enrich the soil, give an equitable climate, and return to Massachusetts and New England the natural beauty we all so much would love to see.

If commercial forestry will do this, the æsthetic man who now and then sets out a shade tree and spends more time criticising the practical lumberman can employ his time to better advantage.

Our portable mill operators who are to be found in nearly every country town are generally speaking our best and most public-spirited citizens, and as a matter of fact the leaders of the communities. These men also are the most approachable men in the world and willing to foster and further every reasonable and commendable project. These men I am confident will be the men of the future to be relied upon to do things in forestry. The fact that forest products are valuable and likely to increase rather than diminish, it being an easy matter to demonstrate even at present prices that reforestation and better forestry management will pay, gives life and interest to the undertaking.

Go into any rural section, or city for that matter, in Massachusetts today and discuss modern forestry intelligently beginning with the collecting of the seed, time of year to gather them, when to plant, how to care for the seedling, distance apart to set for results, when to thin and whether to prune, number of years to maturity, the kind of soils for different species, probable returns upon the investment, etc., and there is little trouble in interesting our people.

For the rest of my time today I want to give some forestry data likely to be of interest. Any data given upon forestry is, generally speaking, only suggestive, but if the basis of estimating is also given, comparative adaptations can be made where conditions vary.

In giving the following estimates, I have taken precaution to be conservative. It is better it is thought to give the data as it really exists, although the picture may not be as attractive. The rate of interest, the price of land, and the assessed valuation upon the increment growth are all variable and elastic factors for basing computations.

PROFITS FROM WOODLAND UNDER PRESENT
CONDITIONS IN MASSACHUSETTS.

Term of years forty. Taxes and valuation figured at 4 per cent compound interest. Average price of woodland free of growth estimated at \$6 per acre. As the trees grow an addition of \$5 per acre every ten years is allowed as follows:

First 10 years, \$6.00; Second 10 years, \$11.00
Third 10 years, 16.00; Fourth 10 years, 21.00

The average tax rate throughout the state is \$17 per thousand.

Second growth white pine, chestnut, and sprout hardwood growth are those we are most familiar with.

(1) SPROUT HARDWOOD GROWTH.

In sprout hardwood growth it is generally considered that a cord per year can be obtained in average conditions on an acre. Therefore forty years equals forty cords. Stumpage value \$50 to \$80, depending on locality and proximity to market.

INVESTMENT AT END OF FORTY YEARS.

Compound interest of valuation \$6 for forty years	\$22.81
Taxes with interest—	
First ten years	\$ 3.97
Second ten years	4.48
Third ten years	4.83
Fourth ten years	4.29
	17.57
Total cost	\$40.38

Profit \$10 to \$40 in forty years per acre or 25 cents to \$1 an acre per year.

(2) CHESTNUT GROWTH.

Can expect about 100 good telephone poles or 300 ties with 15 cords of wood, total net approximate value of \$100. Investment at end of forty years same as for sprout hardwood growth \$40. This leaves a net profit of \$60 per acre in forty years, or \$1.50 a year per acre average.

(3) SECOND GROWTH WHITE PINE (NATURAL REPRODUCTION).

From actual measurements this growth was found to yield on an acre 25 cords of white pine and 15 cords of hardwood. A cord in terms of lumber meaning a thousand board feet. White pine is worth \$5 per cord and hardwood \$1. Total 40 cords equals \$140. Deducting \$40, the investment which is the same as for sprout hardwood growth and chestnut, leaves a net return of \$100 an acre in forty years or a net income of \$2.50 a year per acre.

(4) NATURAL PASTURES (SO CALLED).

There are in Massachusetts over 1,000,000 acres of pasture lands. Assuming that all cattle and sheep are pastured at the average rental, statistics show that these lands do not average \$1.50 a year per acre. If from this sum we subtract \$1 a year, the amount allowed for taxes on valuation, and compound interest on valuation, the same amount as allowed in the case of forestry lands, the net income for an acre per year is only 50 cents. This shows that there are thousands of acres of pasture lands in Massachusetts that rightfully and economically should be turned over to forestry.

Time was when this State was a great producer of grazing animals that were raised at a profit. Conditions now are vastly changed and if we have learned anything in scientific agriculture in recent times it is that concentration on smaller areas and a more definite rotation of crops make the successful farmer. This same logic and philosophy turn over acres upon acres of lands of our farms at present in an unproductive and unprofitable stage to an industry with not only great possibilities commercially, but improving a condition at present greatly needed.

(5) WHITE PINE PLANTED (NURSERY STOCK).

White pine seedlings set 6 x 6 feet require 1210 per acre. Two-year seedlings are worth \$5.00 per 1000.

Compound interest on valuation \$11 for 40 years.....	\$41.81
Compound int. 1210 seedlings, at \$5.....	\$6.05
Compound int. transplanting 1210 seedlings.....	4.95

Total.....	<u>\$11.00</u>
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\$11 at interest for 40 years.....	52.80
Taxes with interest—	
First 10 years.....	\$6.63
Second 10 years.....	7.15
Third 10 years.....	6.34
Fourth 10 years.....	6.33
	26.45

Total cost..... \$121.06

Product at end forty years forty cords, or 40,000 B. M. feet at \$5, equals \$200, leaving a net profit of \$78.94, or \$1.97 a year per acre.

These figures are based upon the maximum cost of seedlings and planting, also the valuation of pasture land at \$11.00 instead of waste lands, as considered under (1), (2) and (3) at \$6.00.

(6) WHITE PINE PLANTED (HOME GROWN OR NATIVE SEEDLINGS)

Compound interest on valuation (\$6) for 40 years.....	\$22.81
Initial outlay for seedlings and planting \$5 per acre, plus interest for 40 years.....	29.00
Taxes, with interest 40 years.....	17.57
	\$59.38

Returns at end of forty years, forty cords, or 40,000 B. M. feet at \$5, equals \$200. Subtracting cost, \$69.38, leaves the net profits in 40 years, \$130.62, or an average of \$3.26 a year per acre.

Reducing the whole to tabular form we have the following:

1. Under favorable natural conditions of reforestation; returns per acre in forty years and average an acre each year—

Growth—	Per Acre in 40 Years.	Aver. an Acre Each Year.
Hardwood.....	\$0.00 to \$40.00	\$0.00 to \$1.00
Chestnut	60.00	1.50
Second growth white pine ..	100.00	2.50

From pasture land, valuation \$11, average \$0.50 an acre per year.

2. Where trees are planted; returns per acre in forty years and average return an acre each year:

White Pine—	Per Acre in 40 Years.	Aver. an Acre Each Year.
Valuation \$11.		
Seedlings, planting	\$70.00	\$1.75
Valuation \$6.		
Seedlings, planting, \$5.	130.62	3.26

From these calculations it is shown that even under present conditions forestry can be practised commercially with a reasonable profit. As a long time investment the returns must be considered as offering exceptional opportunities. The rate of interest under each example cited per year for the principle first used at the end of the forty year period is in each case as follows:

(1) 0 to 16%	(2) 25%	(3) 41%
(4) 4%	(5) 9%	(6) 29%

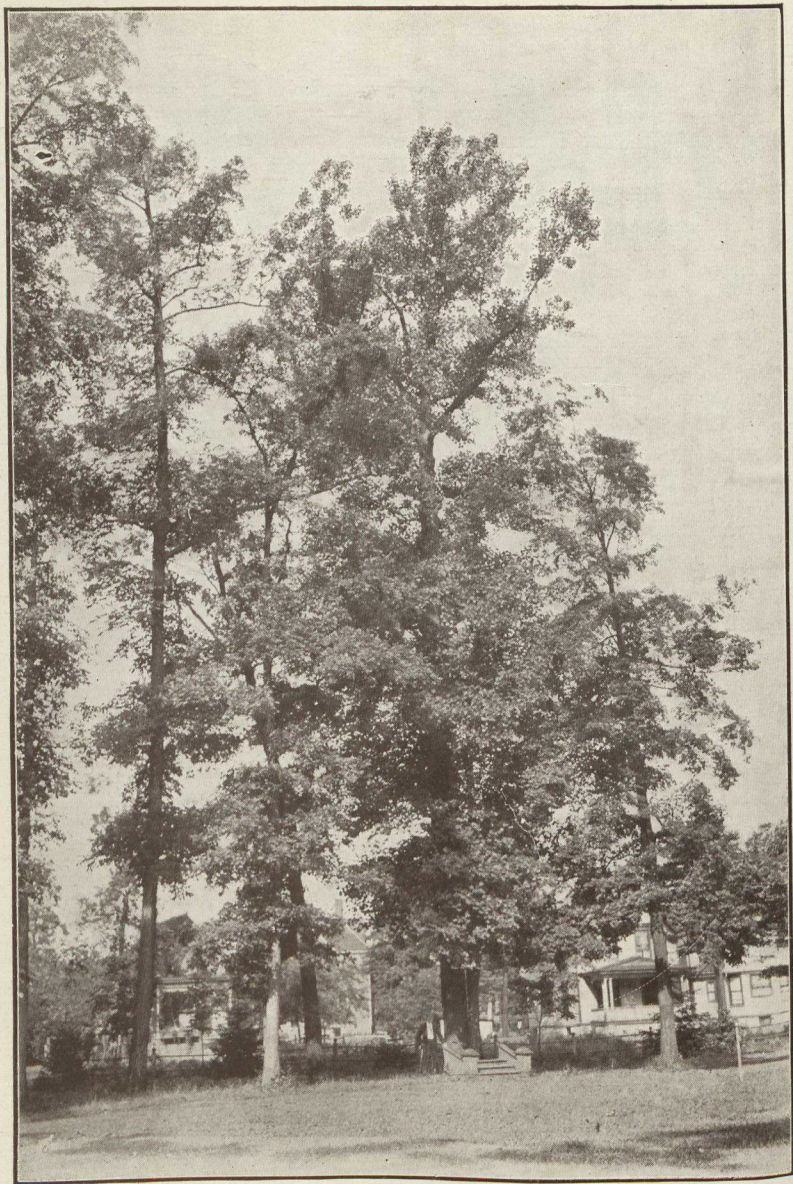
No matter how attractive we may make it the fact still remains that few people are willing to make long time investments and wait for their fruition. The time is coming, however, when far-sighted business men will recognize this source of investment as a safe and profitable one. The State of Massachusetts it is believed can well afford to make a beginning in this direction by purchasing at low cost much of our cheap lands, and restocking them as forest reserves. Not only can they be made a valuable asset in the future to the Commonwealth but to serve as examples of forestry methods.

Forest fires are a great menace to practising modern forestry in Massachusetts and are undoubtedly one of the greatest drawbacks to forestry undertakings. Our present laws regulating this problem are not effective enough. We have bills before the present General Court of Massachusetts looking toward an improvement in this direction.

The laws relative to the taxation of forest lands are in no way systematized or deduced to securing the best results. It is to be hoped that some simple, practical and expedient forest taxation laws may be formulated at an early time.

The greatest of all needs, however, and we must come back to it as the foundation upon which our whole forestry structure must stand for success, is a well defined educational system by which our people may be taught not only to recognize the importance of forestry but how to get best results from a practical knowledge of the theory and practice combined.

In conclusion I would say let us be wise and farsighted. The Massachusetts and New England of the future will be what you and I make it. History repeats itself. In the Old World the rise and fall of the Roman Empire had its associations with commercial forestry. Spain, once the country of equitable climatic conditions and beautiful meadows, the native country of the merino sheep and a progressive and prosperous agriculture, has cut down her forests, denuded her mountains, and what is her present condition? We are told that in Biblical times certain valleys in Palestine were so fertile that they sustained and nourished great flocks and herds; figuratively speaking, these valleys flowed with milk and honey. In those days the



Tulip Tree as an ornamental tree. Height 144 feet,
diameter 40 inches.

cedar of Lebanon and other forest trees were found in all their glory. What sort of a country is Palestine today? Travellers tell us it is dangerous to travel without a guide the country is so parched, dry and desolate.

What do we propose for the future of this nation or, for that matter, Massachusetts? If we are public spirited as I believe we are, and have a love for our country and Commonwealth we will awake to our responsibility ere it is too late.

Instead of following the example of countries like those mentioned let us emulate the example of Germany, where modern forestry is practised successfully. Then and only then can we feel proud in believing we have done our full duty toward the forest interests of our native land.

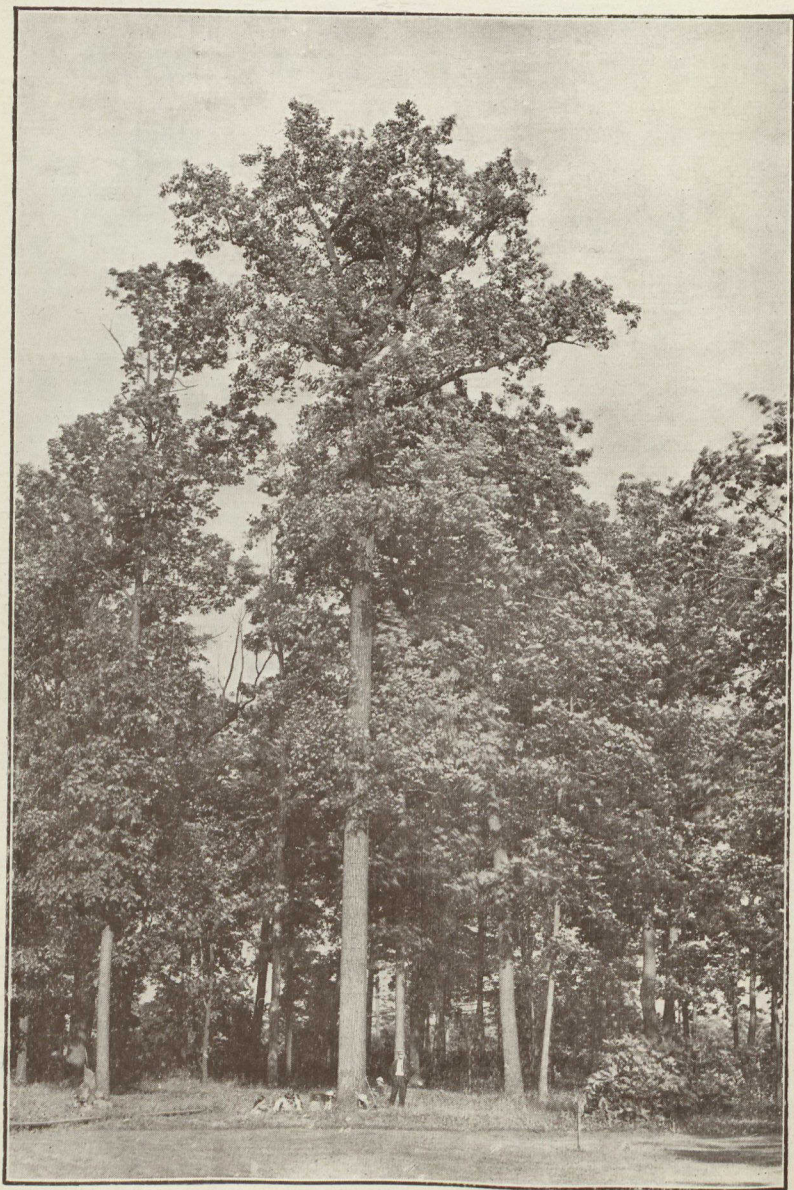
While the usefulness of ants has long been recognized in Europe they are sometimes in Canada looked upon as injurious to the forest. It is always in sickly trees that they construct their galleries and nests, and the damage they do by eating sweet fruits or burrowing into planting mounds is trifling in comparison to the good they effect. Schlich says: They attack and kill numerous insects and larvæ, especially small caterpillars, and clean the forest of many dead insects. In utilizing other insects they show extraordinary ability for creatures so low in the animal kingdom. Some ants living in hollow trees carry the larvæ of a beetle, *Cetonia aurata*, L., into their nests as these larvæ chew up the wood into small pieces for them. Plant-lice are also kept in ants' nests as the ants use the honey-dew which exudes from them to feed their young, milking them like cows. Trees at the foot of which there are ant-heaps remain uninjured during wide-spread devastation by caterpillars, like oases in the desert, and the fruit cultivators in the province of Mantua place in the spring of every year a colony of ants at the foot of their fruit trees to secure them against insect attacks.

THE TULIP-TREE (LIRIODENDRON TULIPIFERA).

The Tulip-tree, or as it is more generally called "White-wood," or "Yellow Poplar," is indigenous in western Ontario between Niagara and Windsor, where, however, it is gradually disappearing, no attempt at re-planting being made except where it is used as an ornamental tree. In its natural habitat the Tulip-tree might well be planted for economic purposes; as a shade tree it is excelled by few indigenous Canadian species, and its large brilliantly-coloured flowers make it one of the most attractive of ornamental trees for lawns and streets. In the United States it is occasionally found more than 200 feet in height and ten feet in diameter, but in Canada it seldom attains 150 feet. Its wood is light, soft and tough, but not strong, and is in great demand for all purposes when a light, white wood is essential. Boxes, toys, small woodenware, wagon boxes and shingles are among the many articles manufactured from "whitewood." In the United States the pulp for postal cards is made from its wood.

The Tulip-tree is produced almost entirely from seed. These are produced abundantly nearly every year, though only from 5 to 10 per cent. are fertile. It is advisable to plant in the fall; germination will then take place the following spring. If sown in the spring the seeds have a tendency to lie in the ground a year before germination. The use of nursery-grown seedlings or transplants is recommended for establishing plantations of yellow poplar. Sowing in the permanent site is occasionally successful.

To grow nursery stock the seed should be sown thickly in drills, in light, rich, sandy soil and covered to a depth of one-half inch. It is especially important that the soil be kept evenly moist. More water should be supplied during the germinating period than later. It may be found necessary to provide partial protection on hot, sunny days during the first season, especially in the south. Seedlings may grow in the nursery for one or two years, but should not remain longer, because of the strongly developed taproot and few lateral roots, which make transplanting difficult. Transplanting 1-year old seedlings into nursery rows will stimulate the development of fibrous roots and insure vigorous plants, but this operation is not generally advisable, because of the added expense. If seedlings are left for more than one year in the seed-bed they should be cut back to the ground before being moved. Vigorous sprouts will then replace the stems.



Tulip Tree. Forest type. Height 130 feet, trunk 60 feet,
diameter 28 inches.

Seedlings reach suitable planting size in one year, and should be transferred to the field very early in the spring, before the buds start. They should be spaced 6 feet apart each way. No preparation of the whole site prior to planting is needed, except where there is a tough sod. In this case the ground must be broken and the grass turned under if possible; otherwise the sod should be removed from a small area where a tree is to be placed.

Yellow poplar is not well adapted for planting in pure stands, but should be mixed with other deciduous species. Unless the other trees in the mixture are slow-growing it must be given a start, so that it will not be overtopped. If the plantation is in a sheltered valley or rich bottomland, yellow poplar may be planted as the predominant tree of the mixture. In more exposed situations the species with which it is planted should be in excess, to provide protection from high winds and frost.

Any moderately shade-enduring hardwood may be planted with yellow poplar, or mixture with white pine and Norway spruce should also prove suitable.

Yellow poplar will rarely be planted on tillable land, so that cultivation in most cases will be impossible. Ordinarily young trees will not be choked out by grass or weeds because of their rapid growth. When field sowing of the seed is practised, however, it may be necessary to check the weeds for the first two or three years.

No grazing should be allowed in the plantation and fires should be absolutely kept out, since the yellow poplar, even when mature, is very easily injured by fire.

The illustrations which accompany this article are from photographs made by Mr. H. N. Topley, photographer to the Geological Survey of Canada.

GROWING OF WIND BREAKS AND SHELTER BELTS ON THE WESTERN PLAINS.*

BY JOHN CALDWELL, VIRDEN, MAN.

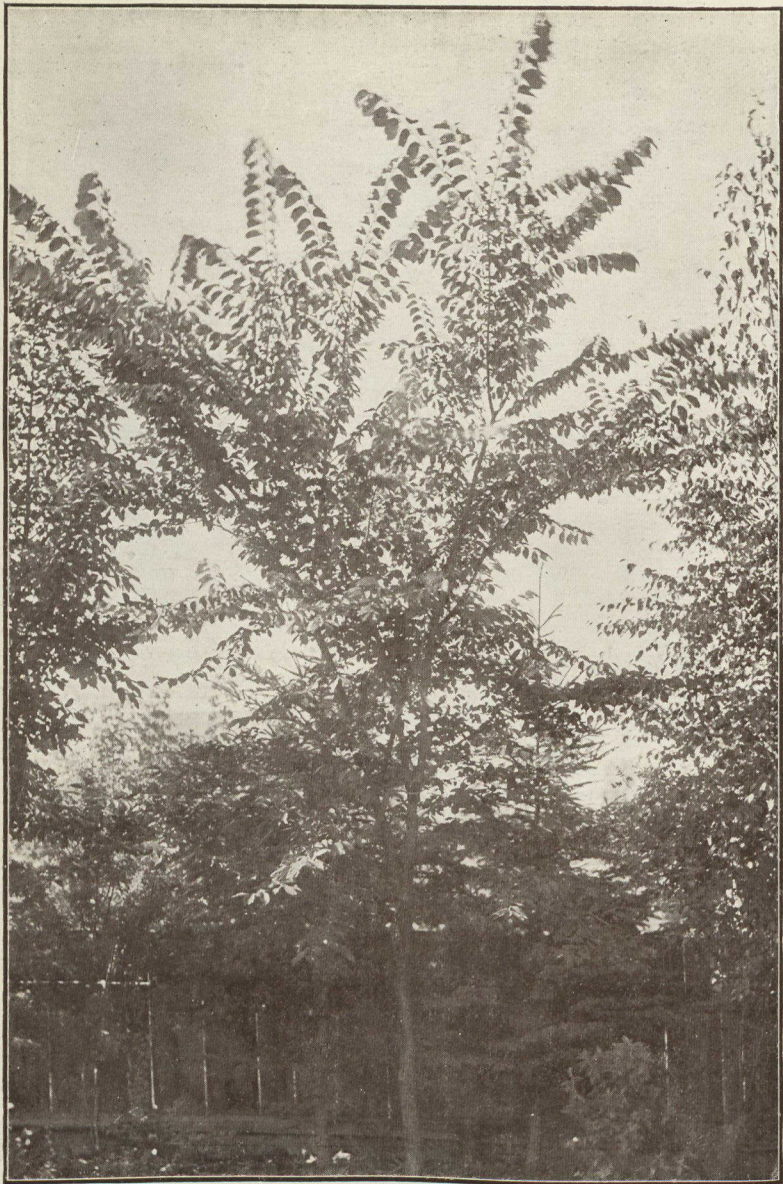
The present unusually severe winter, coupled with a great shortage of fuel, will surely bring the question of tree planting for shelter and fuel purposes very vividly before the minds of our western farmers.

Since the plan of co-operation between the Dominion Government and the farmers was started six years ago, about nine million of trees have been set out, and according to reports from inspectors, about eighty-five per cent. are growing. In almost every settled district we find beautiful plantations which show beyond doubt that the growing of a variety of trees for shelter, fuel and fencing is a very simple matter.

The one great requisite which we insist upon as far as possible is that the land be in a high state of cultivation before planting. We also find that a large proportion of farmers applying for trees are possessed of quite a variety of erroneous ideas as how to go about the work. A great many would plant far too close to their buildings; some too far away; some would plant their trees too close; others would take trees as large as possible, and a great many knowing that the trees are free of cost, would take far more than they could find time to look after.

These are some of the reasons why farmers in the early days met with so little success in growing shade and shelter trees, and these also are some of the reasons why it is very necessary to have inspectors on the road. Their advice is very much appreciated by the farmers, and without that advice we would surely have a great many failures. In giving instructions to the farmers we insist on the land being in a good state of cultivation, summer fallow is the best; breaking and back-setting if well done, and with an extra ploughing finished up the fall before planting is all right; but we refuse trees to be planted on stubble land, ploughed either fall or spring. Plant the trees 75 to 100 yards from the buildings, and 4 x 4 feet, or 3 x 5 feet apart. Plant no crop between the rows, and do as much work as possible with a horse and cultivator. It is also a good plan to soak the trees in water two or three days before planting; and if any man is calculating to grow a crop of weeds on the same ground with the trees, he had better never begin.

*Reprinted from the Report of the Western Horticultural Society.



This native Elm Tree was planted in the month of May, 1900. It was then 12 inches high. On September the 1st, 1907, it was 20 feet, 4 inches high. Width across at 17 feet from ground, 13 feet. One foot from ground the trunk was 12 inches in circumference. At 4 feet the trunk was $10\frac{1}{4}$ inches in circumference. Photo taken at Swan River, Mar., September 1st, 1907.

The variety of trees planted up to date have been mostly Native Maple, Native Green Ash, and Cottonwood from North Dakota; and along with a few Elm, Willows and Poplar. I find the farmers crying for fast growers, but the Forestry branch will insist upon some degree of permanency, which can only be supplied with hardwood trees such as elm and ash. The farmer who would plant a break of all Russian Poplar would likely have a fine break in twelve or fourteen years, but the man who was on that farm twenty or twenty-five years from then, when the poplars were rotting and dying off, would say, what a foolish farmer that was not to have a variety of trees. I think it would be quite a mistake to plant a break of any one variety, as we do not know the day that any particular variety may become afflicted with disease and the whole break wiped out. I like the Russian Poplar, they do a great deal better in the West than in Eastern Manitoba, but I like them in their proper place and in proper proportions. The Russian Poplar does best when planted as cuttings, or trees one year old. When large trees are handled, they do not do so well.

Now I want to give you a short chapter on Willows. I have grown a good many thousands of the different varieties, and I believe them to be among the most useful trees for shelter, fuel, and fencing. Very few willows have been sent out so far by the Forestry branch, but I think the sooner we get into a large stock the better. The leading varieties are the Russian Golden Willow, the Russian Laurel, the French Laurel, and the American White Willow. A few of the main points in favor of the willows are: they are hardy and fast growers; they throw out a great many branches, and are among the very best for shade and shelter; they leaf out early in spring, and hold their foliage late in the fall; they make wood of very fair quality, and will grow up faster than before, after being cut down. How valuable they are for posts, I am not prepared to say, but I feel sure they are a long way better than our Native Poplar. Another great point is, that when a farmer gets a good start with willows, he can take thousands of cuttings from his own plantations and extend as fast as he wants to, especially after having received instructions as to the handling of cuttings.

This last summer it was impossible to secure Maple seed in the Northwest as the crop was almost a total failure. That is another reason why I would advise the Forestry branch to grow a heavy stock of willows, as the crop of cuttings from the hedges would never fail. The cost of growing cuttings in large plantations is less than 75c. per 1,000, or about the same as maple seeding. The cost of rooting these willow cuttings is about \$2.50 to \$3.00 per 1,000. That is about the cost of importing cottonwood seedlings from Dakota.

Hedges for producing cuttings should always be kept in hedge form so that cuttings may be secured from the ground, and always cut the hedge back severely whether the cuttings are wanted or not, so as to produce an abundance of one year old wood. As soon as we have to climb a tree to secure cuttings, the cost would be very much increased. Two year old wood is best where only a few are wanted, but when growing probably half a million, take the one year wood every time, and send them out rooted, as farmers planting cuttings would lose too many.

Wood for cuttings from both willows and poplar may be cut either fall or spring, but I would favor the spring as soon as the sap is in the limbs. I have devoted quite a space to willows because I believe they have not received the attention they deserve for all round usefulness among the farmers, they rank among the very best. Golden Willows which I planted at Virden fourteen years ago are now about 35 feet high and measuring six to eight inches in diameter two feet from the ground. I know some American White Willows near Virden fifty feet high.

Farmers, so far, in planting trees, have devoted their time to shade and shelter, but any man may, by planting five acres of good land, have the final question in his own hands in twelve or fifteen years, and no doubt as time goes on more attention will be given to the planting of these wood lots.

Among the fungi injurious to trees the genus *Trametes* referred to in Mr. MacMillan's paper is one of the most harmful. It attacks almost all kinds of coniferous trees, and in woods where they occur the infected trees should be cut down and the fungi as far as possible destroyed. The wood of the diseased trees may be utilized before the decay has gone too far as it is at first frequently confined to the upper part of a tree.

FOREST NURSERIES AND NURSERY METHODS IN EUROPE.

BY WILLIAM E. FOX.

This is a reprint from the report of the New York Forest, Fish and Game Commission giving the results of observations made by Col. Fox, Chairmap of the Commission. In his introductory remarks he makes the following statement:—

In the management of American forests the time has come when it would seem evident to all interested in the work that the future timber supply in many localities is dependant on reforestation. But natural reforestation is unsatisfactory from the forester's point of view. In results it falls short, by far, of the maximum in quantity and quality of merchantable timber which a given area can be made to yield through proper methods of sylvicultural work.

The highly satisfactory results attained from planted forests in Europe, where this practice has been followed for two centuries or more, justifies clearly the adoption of this system in America. The New Forest in England was "afforested" by order of William the Conqueror, in 1079, and since then reforestation has been practised from time to time in European countries, until cultivated forests are now the rule rather than the exception. Throughout Germany, France, Belgium and Italy most of the wooded areas show high forests of a density and regularity that indicate plainly their artificial growth. For these and other reasons the planting of forests is engaging the attention of American foresters today. It is no new idea.

A planted forest, like the primitive one, is grown from seed, but in the former the dissemination is under intelligent control. This may be done by broadcast sowing, by the seed-spot method, or by the intermediate process of raising small seedlings in garden or nursery beds; and, large areas of trees are propagated from wind-sown seeds, skilfully directed and managed.

Broadcast sowing may be a desirable method under certain conditions—where economy is necessary, where a supply of seedling plants cannot be obtained conveniently, or where a rocky, uneven surface, covered with a scrubby growth, compels its use. But it has the disadvantages of uncertainty, irregularity and the subsequent expense of filling in the blanks where seeds failed to germinate. As the planting of seedlings at regular intervals gives the forester better control of his future work, this plan is in general use abroad. It necessitates, however,

the establishment of nurseries for the propagation of the young plants.

An outline of the methods employed in the nurseries in different European countries is then given:—

In Italy the Government has nurseries aggregating an area of 150 acres which are maintained at a cost of \$41,000 per annum and produce 8,900,000 plants.

The nursery, or piantonaio, at this place covers about thirteen acres, and has an altitude of 2,910 feet above the sea. The ground, which has a gentle slope to the northeast, is laid out in terraces so as to afford a level situation for the beds. The exposure is favorable, as it furnishes protection from late frosts and the rapid evaporation caused by south winds. Although not closely surrounded on all sides by high forests, there is a dense tree growth near by of various age classes. Owing to the altitude the natural soil is thin and poor, but the entire surface of the nursery is deeply covered with rich, friable earth composed largely of humus mixed with fertilizers. It has the appearance of a fine loam with no black earth in it aside from that brought from the forest near by, and with enough clay and sand to give it a light color.

The beds for conifers are four feet wide, and of various lengths to suit the terraces, most of the beds being about thirty feet long. The greater part of the area is occupied by transplants, and seed beds needing comparatively small space.

In preparing the seed beds the seeds are planted in rows running across the beds. Formerly the seeds were sown broadcast in these beds, but this was abandoned because, as claimed by the forester in charge, by sowing in rows a much smaller amount of seed is used, the plants grow stronger and more even in size, are more easily weeded, and can be taken up with less work and injury to the roots.

The seedlings are taken from the seed beds when two years old and transplanted into the long beds, where they remain two or three years more. The transplants are then four or five years old, from twelve to eighteen inches high, and are ready for transfer to the grounds where the final planting for the future forest is made. The Italian foresters seldom use two-year-old seedlings in their fieldwork, preferring to wait for the four-year-old transplants on account of the advantages which the latter have in size, hardiness and better root system.

The principal species growing in the Camaldoli nursery are: Silver fir, Norway spruce, longleaf pine, stone pine, Austrian pine, larch, beech, chestnut and sycamore maple.

No lath frames are used for shade. Protection from heat and drought is obtained when necessary by using pine brush,

which is stuck into the ground on the sunny side of the beds. Screens of thatched straw are also used for the same purpose. Unlike other nurseries in Europe, small trees, twenty-five feet in height, or thereabouts, are standing at intervals of twenty five feet throughout the greater part of the area, and their moving shade contributes to the refreshment and protection of the tender plants. An ample supply of water for irrigation is obtained from a small, artificial lake situated on the side of a hill just above the nursery. The work of preparing, planting and weeding the beds is done almost wholly by women at daily wages of about thirty cents each. One woman will set out about 1,200 seedlings in the transplant beds in a day, a day's work being counted as ten hours. Hence the cost of transplants is only one-fourth of that in American nurseries.

In France the forests are managed mostly under the Selection System and for the formation of a coppice growth hence the need of nurseries is not so great as in one where clean cutting is the rule. One of the best is at Xettes in the French Vosges.

The entire area is devoted to the propagation of conifers—spruce and fir. To maintain the regular annual output nine seed beds are made, each about sixteen feet long, and enclosed in frames of wide boards placed on edge. These seed beds are covered with wire screens to protect them from the depredation of birds, and the screens are allowed to remain in place until August, or until the germination has advanced far enough to permit their removal.

The seedlings, when two years old, are transplanted into the long beds, where they remain two years more. The beds containing these transplants are four feet wide and extend from the central walk to the side of the inclosure. The seedlings are placed in longitudinal rows, the latter being eight inches apart. The natural soil is a rich loam, mixed with humus, to which fertilizers have been added each year after the removal of the plants. As a result the four-year-old transplants when taken up are strong, thrifty, and from fourteen to eighteen inches in height, with a well-developed root system.

Belgium also has nurseries of small extent but interesting and well managed.

The various states of Germany have developed their nurseries as they have increased the areas of planting. In Saxony about 800 acres are planted up with seeds and 6,100 acres are planted up with the plants.

Col. Fox summarizes the methods followed in general as follows:—

In locating a nursery no great importance is attached to the question of exposure or slope, the site being selected with

reference to reasons that are more essential in connection with the management of the revier. Neither is the altitude taken into consideration, as nurseries may be found everywhere, from the low countries at sea level up to the mountain forests of the Apennines or Vosges 3,000 feet above tide. The location may be determined by the nearness of water, which may be needed for sprinkling the beds in time of drought, or for irrigation. But the use of water is avoided as far as possible on account of the extra expense, and because, as claimed by some, that when once resorted to it must be continued.

Square or rectangular enclosures are generally made in order to secure a better ground plan, regularity in the form of the beds, and to economize in fencing.

In nearly every instance the enclosure is closely surrounded by a high forest that furnishes climatic protection to a great extent, although in a few localities the foresters deem the shade from the trees as somewhat a detriment. All use carefully prepared or screened earth free from gravel, stones and roots to which a liberal addition of compost or mineral fertilizers is made each year.

In making the ground plan long beds are preferred, with the rows of transplants running lengthwise. But in many nurseries the seed beds are planted with crossrows to facilitate weeding. The broadcast method for sowing seed beds, however, seems to be a favorite one. Where this is practised the seeds are distributed thickly and as evenly as possible over the surface of the bed, after which the top earth is raked over carefully and smoothly to cover the seeds. Another method consists in spreading a very thin layer of rich, fine earth over the seeds instead of raking them under; and it is claimed that a more even catch is thus secured.

In order that the ground may obtain the highest degree of fertility the forester often suspends operations in his nursery at intervals of four or five years, and, after the plants have been taken up, allows the ground to lie fallow one season, as the exposure to rain, frost and snow has a recuperative effect on the soil. Good results are further obtained by using the ground one season for an agricultural crop, in the cultivation of which manure is used; and there is in addition a beneficial working or division of the soil.

The size and number of the nurseries under any one management is proportioned to the area of the plantations to be made. If two-year-old seedlings are to be used in the fieldwork, set out at spaces of four feet each way. The nurseries for this purpose have, as a general rule, a combined area equal to one per cent., or less, of that of the planting grounds. Schlich says one-half of one per cent. But if four-year-old transplants are to be used

the nurseries must necessarily have a larger area, one which in their aggregate will be equivalent to four per cent. of that of the plantations. This percentage, however, applies to coniferous species only. Broad-leaf plants, which are usually set out at wider spaces, require a much larger percentage of area for their propagation. An enclosure of two acres, after setting apart enough ground for seed beds, will furnish each year about 138,000 four-year-old transplants of coniferous species, the number varying somewhat according to the space allotted to paths and roadways.

A nursery may be permanent or temporary as forest conditions may require. The latter is made in some instances merely to supply plants for some particular locality, after which being no longer necessary, it is abandoned. If the plot will not be needed again for many years it is allowed to grow up to a young forest, some of the taller and more promising transplants being left in the beds at proper intervals for this purpose.

In most nurseries screens are used for protection against heat and frost and for protection against birds; and the beds are covered during the winter with moss or litter to prevent the seedlings from heaving. But the practice in these respects varies with the species and according to the climate or soil.

The Forest Department of the Cape of Good Hope has induced the Government to provide a large fund for afforestation on the principle of a loan. It is commented on by the Chief Conservator in his report as follows:—

For the Forest Department the event of first importance during the year under review has been the recognition of the principle of afforestation by means of money raised under loan. This is as it should be, especially when it is realized that much of the work to be done is for the benefit of the State in years to come, and it is only right that the money expended thereon should fall as lightly as possible on the present generation.

The practical recognition of this principle culminated during the 1906 Session in the inclusion in the Loan Bill for that year, of an item of 82,000 for the prosecution of Plantation Extension, Work at the following plantations, viz.:—Tokai, Kluitjes Kraal, Fort Cunynghame and Concordia, and for the completion of the Port Elizabeth Drift Sands Reclamation Scheme.

This method is without doubt the more sound, as well as the more economic one. Under the system previously wholly followed, namely, that of planting under yearly provision, voted on the Estimates, no continuity of work at any one plantation is guaranteed, for the funds so provided are liable to expansion or reduction as the financial barometer of the country goes up or down, and consequently work carried out under these conditions is always more costly than if carried out under

a system whereby a definite amount is set aside to be expended over a given number of years.

I trust that the principle recognized in 1906, and the loan sums then provided will be but the forerunners of others having for their object the afforestation of much of the waste, and at the present time comparatively worthless, land of the country.

In regard to grazing leases he has the following to say:—

A further event has been the introduction of the principle of leasing, for periods of one year, for grazing purposes, of tracts of grass land, within Forest Reserves. Under the old system it was the practice to issue grazing permits at tariff rates for a limited number of cattle in respect to each area. By this method it was generally found that three and four times the number of cattle for which the permits were issued were depastured, and the work imposed on the Forest Staff in separating and impounding the trespassing cattle from those permitted to graze, was out of all proportion to the revenue received in respect thereto. Under the present system all available pasture land is leased by public auction or informal tender, and the scheme is found to jointly benefit the lessee and the revenue, besides removing from the department the onus of policing and adjudicating on grazing disputes in the various areas. By this means, and in many other ways the practical usefulness of the Forest Estate is being vastly increased.

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