

ARTICLE III.—ON THE AGE OF TIMBER TREES,
AND THE PROSPECTS OF A CONTINUOUS SUPPLY
OF TIMBER IN CANADA.—*By John Langton, Esq.,
M. A., President.*

[Read before the Society, 15th January, 1862.]

There are few subjects of greater interest to Canadians generally, and especially to the City of Quebec, than the future prospects of our timber trade, which affords at present employment to so large a portion of the population, and is the staple article of the trade of this port. The questions of the probable duration of our supply of the raw material, and of the best means of preventing the waste of this great source of wealth, are frequently canvassed; but the statistical data upon which to form an opinion are very imperfect, and the most contradictory estimates are made by persons who have the best opportunities of ascertaining the facts. In the meantime we go on practically treating our forests as inexhaustible, and in the face of the yearly increasing distances, to which the lumberers have to go back from all our main streams, we have as yet taken no steps towards preserving what remains to us. Under these cir-

cumstances I need make no apology to a Quebec audience for offering these remarks as a contribution to the subject; and although I am sensible how imperfect they are in many respects, I feel the more emboldened to bring them forward, as they may induce others to pursue the same line of enquiry, and to obtain more comprehensive data, for which the timber yards of Quebec offer such great facilities.

My object in the observations, which I propose submitting to-night, has been to ascertain from the examination of the timber itself the average ages of the trees brought to market, and the rates of growth at different stages in the tree's life, with a view of estimating the extent of country which would be required to keep up a given supply, if the trees were preserved and allowed to renew themselves, as in regular plantations, and in many of the forests of Europe. The rings of exogenous trees, in a temperate climate at least, afford us the necessary indications, and by an inspection of each piece of timber we have an approximate history of its growth. The rings however are extremely irregular. The pith is almost always very much nearer to one side of the tree than the other, and an examination of the stumps *in situ* shews that the greatest luxuriance of growth is on the south side, or in my part of the country generally on the south

east side. There are however often modifications of this tendency, and different trees vary very much both in the direction and in the amount of the deviation, the pith being almost central in some, whilst in others the most luxuriant side has as much as twice the development of the other. In making the measurements we must therefore take them along the mean radius, or take the mean of two opposite semi-diameters. The measurement should not be taken at the butt, if it can be avoided, for the inequalities there are very large, the rings immediately over a main root being often five or six times as wide as the average, especially in old trees ; and the same thing occurs to a less degree in the neighbourhood of a branch. Trees also which grow in exposed situations have extraordinary irregularities. I examined one, which grew in the University Park at Toronto, where the rings in the heart were so close, that they could hardly be counted. The tree at 30 or 40 years old cannot have been as thick as a man's wrist, after which it took a sudden start, with rings of nearly a quarter of an inch each. In the woods, however, the growth is generally much more uniform, and the greatest difference I have observed in a single tree, (excluding the butt) has been between 25 rings in an inch, and eight rings in the same space. In a pine tree it is very rare to find a single ring

prominently developed, which is a frequent and remarkable feature in most kinds of hardwood, indicating I suppose a peculiarly propitious season; and if you do find one, it is commonly confined to one side of the log, the ring thinning off to the average size, or even below it, on the other side, as if these had been a local, rather than a general cause for the unusual development. In a pine tree you will generally find 10 or 15 small rings consecutively, or as many large ones; and although this indication of unusual vigour is to be seen at all ages, it is generally between the 60th and 120th year that it is most noticeable. Individual trees also in the same locality vary very much in the luxuriance of their growth; and I have no doubt, if my opportunities for examination had been more extensive, that different localities would have exhibited equally great variations. The rate of growth of some pines I examined on the Saguenay seemed very much slower indeed than what I had observed in Upper Canada; and I find a record in the Report of the Geological Survey for 1858, of some spruces of astonishingly slow growth, near the head waters of the south branch of the Magdalen, in the district of Gaspé. Mr. Richardson counted 161 rings in one tree, only 4 inches in diameter, and estimated the oldest in a grove, where none was more than twenty feet long and one

foot in diameter, at 600 years. This would give eighty rings to an inch in the one case, and one hundred in the other.

With all these causes of irregularity, it may appear difficult to arrive at any reliable standard of growth; but if you take your trees by tens or twenties and then compare the averages, the individual differences disappear, and there is a general uniformity in the results. I have at different times examined some hundreds of trees, and for the county of Peterborough at least, the part of the country in which I lived, the following may be considered the average manner of growth. The average increase of diameter during the first sixty years is about .17 of an inch annually, the rate being almost invariably the least during the second twenty years. During the first twenty years it is often much more rapid, but that rate, as gathered from the rings of a full grown tree, is much less than would be indicated by the present diameter of young saplings. It would appear that the immature wood is compressed by the subsequent additions and even after they have become consolidated, the heart continues to shrink, causing what is called shakiness. There is very little indication of such shrinkage or compression in the later years of a tree's growth. About the sixtieth year there generally commences a decided increase in the width of the rings,

and the annual increase of diameter averages .20 of an inch ; but after the .120th year it usually falls off again, and in the old age of a tree the increase of diameter is less than in its youth. I speak here of the width of the rings when they are converted into true wood, but they remain for several years in the state of sap-wood, during which the rings have not attained their full width. The number of years during which the new additions remain in the condition of sap-wood is very variable. It varies at different ages, the rings of sap-wood being generally much more numerous in an old tree than in a young one ; it varies also very much in different localities, and in different trees under apparently the same circumstances of growth, and even in the same tree. The change from sap wood to true wood is abrupt ; there is no mistaking where the one ends the other commences, but this important change in the character of the material by no means follows the course of the rings. The same year's growth, which in one part of the tree is perfect wood, may remain sapwood for several years in another part. In a full grown tree the growth of the last 15 to 25 years is generally in the immature state of sap-wood.

From these measurements it will appear that the first 80 rings of true wood will give a diameter of about 14 inches, and allowing for the sap-wood, we

may say that, when 100 years old, a pine tree becomes for the first time fit for making merchantable timber. At that age too it has attained, if not its greatest altitude, about the greatest usual length of profitable timber, free from knots and branches, say about 50 feet. We may thus form a table of the annual increase of timber, from the time a tree is fit to be cut for market, till it is about 200 years old, beyond which it is not common to find a tree which is fully available. Some few giants of the forest are still sound throughout at 300 years and even more, but in general they become injured by punk-knots, or red rot, or are hollow at the heart long before that time. Some sound cuts may still be got out of them, and good boards may be taken from the outside after the heart is hollow, but the whole tree can rarely be used after 200 years, and a large proportion become more or less injured after 180 years. You cannot indeed obtain many masts, or the largest description of timber, within the 200 years, and it is almost a pity to cut down a tree of 100 years, which is just at its most vigorous period of growth, but these are about the average limits of profitable growth, and beyond 180, or at most 200 years, the trees, taken altogether, will begin to deteriorate in quality as much as they increase in size.

I have prepared a table upon this principle,

shewing, at different ages, (from 100 to 200), the average diameters of true wood, and the rate at which the solid contents increase, upon the supposition that the effective length of the tree is 50 feet. I give also in another Table the increase in a set of masts brought to Toronto by the Northern Railroad, between their 200th and 300th years. These latter start at their 200th year with a greater average diameter than ordinary trees, and the annual increase of timber is at a much higherrate than is indicated by the former; and even this is very much below what the increase of cubic contents really was, because for comparison, I have calculated it only at 50 feet of effective length, whereas their real length was very much greater. These are, however, unusual examples of growth. The same vigor of constitution which enabled them to attain more than ordinary height, and to preserve their soundness long after the majority of trees begin to decay, caused them also to increase more rapidly in diameter. Such examples are too few to have much effect upon the average of all the trees examined. The general result is, that, in the second century of their growth, pine trees make, with tolerable uniformity, 2.4 cubic feet of timber annually. I suspect however that even this average is beyond that of all the trees in the forest, even in my own neighbourhood,

and further north it is no doubt still less. Although it is my average for all the trees, good and bad, which I have examined, they were to some extent selected before they were brought out of the woods. One lot of very poor sawlogs, which had been taken off land already thoroughly culled for square timber, only indicated an annual growth of less than 1.5 feet, and another set of fair logs, but with few large ones, gave barely 2 cubic feet. The selected masts, taking into account their greater length must have had an increase of 5 cubic feet. It must be borne in mind, that the average increase of 2.4 cubic feet is calculated on the round log, which if the timber is to be squared, would only be equal to an increase of 1.53 per tree; but considering the practice now becoming common of bringing wany timber to market, and the still greater amount of lumber which is cut out of a log in a saw-mill, the available growth may be taken at 1.75.

Taking however 1.5 cubic feet only as the annual growth per tree, and supposing 20 trees above 100 years old to stand on an acre, which is only about one half of what will sometimes be found in a good pine ridge, we get an annual produce of 30 cubic feet per acre: or the natural increase, if properly preserved, of 2,000,000 acres of good pine land, would keep up for ever our present export. Now the quantity of land under license in 1860

was 27,413 square miles, or 17,544,320 acres ; so that, making every allowance for what is swamp, or hardwood, or barren, it is hardly too much to say that, with proper care, the land now in the hands of the lumberers would maintain a constant supply of timber equal to our present export.

Another view of the question may be taken which is quite independent of my estimate of the annual increase, and which is based only upon the ages at which trees may be brought to market. If all the trees above the age of 100, standing on a lot of land were cut down, taking care not to injure the young trees, and if the land were carefully preserved, in from 80 to 100 years hence there would be as much merchantable timber standing on the lot again, as when it was first lumbered over. This would not probably be the exact manner, in which the timber could be taken to the greatest advantage, as the annual increase is rather greater in the later than in the earlier years, and you might make more and better timber by not cutting any tree till it was 150 years or upwards, unless it shewed signs of incipient decay ; but it will serve as an illustration of the natural increase. Allowing then on the average only four trees per acre, at the very low average of 70 feet, 200,000 acres would yield our annual consumption of from 50 to 60,000,000, and the 17,500,000 of acres now

under license would keep it up for nearly 100 years, at the end of which time the land first lumbered over would have produced a fresh crop.

It is rarely indeed that our timber lands are so treated as to give any opportunity of testing the rate, at which timber is restored by its natural growth ; but it is astonishing how quickly land will recover itself, or rather what efforts it makes to do so in spite of our bad treatment. I know myself a small lot of land of only 64 acres, which from its convenient situation on the river Otonabee, has been lumbered over repeatedly for the last 30 years. It has been thought each time to be completely denuded, but the next comer has found something still left. I procured the statistics of the produce from a gentleman living in its immediate neighbourhood, Colonel Strickland ; and it appears that, besides having square timber made on it twice to the amount of 20,000 feet, no less than 8 parties have at intervals still found it worth their while to take saw logs off it, to the number of 7425 in all ; and this although from its situation it has been constantly resorted to for boom timber and framing timber, by which the young trees, which should now have been fit for another crop of logs, have been destroyed.

In older countries more care is taken of the timber, and a more systematic method of reaping

the harvest is adopted, but it is very difficult to find any accurate statistics. With regard to the district which supplies the Memel and Konigsberg timber we have some reliable data, which shew us what we might do with a better system. The timber shipped from these ports is brought down from the interior by the Nicme and comes principally from Volhynia. The area of the timber producing country is estimated by Mr. Quinn, in his late report at 27,000 square miles or 17,280,000 acres, almost exactly the same area, as that now under license in Canada; but so far from its being a wilderness, like our back country, it exports a large quantity of grain, and supports a population of nearly two millions. The amount of timber produced does not indeed nearly equal that from Canada, but it has been maintained without any very material diminution for years, because the timber lands are carefully preserved, and are lumbered upon over and over again. It is a great pity that we know so little of the means taken on the Baltic to preserve the timber, especially in the South of Norway, where a still more limited area continues to supply the markets of Europe with the best description of timber. This is a most important subject, to which I believe the Woods and Forest Branch of the Crown Lands Department is now directing its attention, and it is to be hoped

that the result may be the adoption of regulations, which may prevent the wanton destruction of timber now going on in Canada. In the meantime it may be useful to point out what are the principal causes of the present waste, and what remedies, or palliatives at least, it may be possible to apply.

The principal causes of the destruction of timber are the following :

1st. The progress of settlement, which not only consigns the younger trees at least to the log heap, but materially increases the danger from fires in the woods.

2nd. The destructive fires which sometimes destroy thousands, and even hundreds of thousands of acres, not only killing the trees already merchantable, but rendering a succeeding crop impossible for a couple of centuries. The vicinity of settlements generally bears the blame of these fires, but the carelessness of the lumberers themselves is often the cause of them.

3d. The practice of squaring timber, by which fully 20 per cent of the best part of the tree is left on the ground in the shape of chips. This cannot be altogether avoided. The increased quantity of sawn lumber produced, and the admission of wany timber into the European markets, will make a material reduction in the loss from this cause.

J

4th. A very large loss, the amount of which it is difficult to estimate, is occasioned by the square timber manufacturer only using the best part of the best trees. Many a tree is cut down, which would make excellent sawlogs, or even timber in short lengths, which, being found unfit for his purpose, is left to rot on the ground, or only a portion of it is taken. The loss from this cause alone can hardly fall short of 10 or 15 per cent. It has been proposed to check this waste by charging duty upon every tree cut down, whether it be used or not, as is done in the Prussian forests; but this, though it might increase the amount of duties a little, would be only a very partial remedy for the evil.

5th. The destruction of small trees, which a few more years would render available, is a serious detriment to the future prospects of the lumber trade. The merchantable timber is all that a lumberer looks at, and the rising generation of trees is to him of no account whatever. In Norway I understand that it is forbidden to cut any tree under a given size for any purpose, and something of the kind might be attempted here, but I am afraid with very small results under our present organization. It is clear however, that if we are to expect our timber districts to bear us a second and third crop, the possibility of which it is the principal aim of the

present paper to show, something must be done to protect the young trees, which are to form the basis of our future supply.

The most effective remedies for these evils appear to me to be two.

1st. First to discourage indiscriminate settlement in the timber districts. Where the land is of such a quality as to support an agricultural population, by all means let the settlement proceed as rapidly as possible, for with all my respect for timber, I value a man more than a great many trees. But a very large portion of our back country never can maintain a healthy settlement. The cheapness of the land, and ignorance of what can be profitably worked, together with the facility of access by the new roads opened by Government and by the lumberers, attract some, and others are induced to make a temporary settlement on account of the employment to be obtained in the shanties, and sometimes to make a profit by the trees themselves. They destroy much, and the lumberer who has a license over the land, when he finds the settlers approaching, has to scramble for anything he can get, before it passes out of his hands, to the destruction of any well organized plan of making the most of his limits. I am convinced that a large portion of the new settlements in the back country, lying north of Lake Ontario,

between the Ottawa and Lake Huron, will prove utterly worthless as the site of an agricultural population, but the attempt to form one will in the meantime have destroyed a mine of future wealth for Canada. The new lands ought to be classified, and only such as are really good should be open for indiscriminate settlement, and the rest ought to be reserved for lumbering purposes.

2nd. What ought to be the policy with regard to these latter lands? Certainly not the policy which has hitherto been pursued. At present a license is issued renewable from year to year at a moderate rent at first, but the rent rising rapidly if the license is not occupied, and the license lapses immediately upon the land being sold. I cannot imagine a system more completely calculated to denude the country of timber. Every license holder has an immediate interest in making everything he can off his limits, as rapidly as possible, utterly regardless of what may become of it ten years hence. It is true, that the necessities of the trade often compel him to look forward for some years, but he does this in spite of discouragement, and under every disadvantage. He may have invested a large capital in mills, which will be useless without a supply of logs, and he is obliged to undertake expensive works on the streams to make his limits available, to open roads, and to establish farms for

his supplies ; but he does this without any certainty if being able to keep his limits even at an increasing rent. We complain of him as improvident, but our own legislation makes him so. The true remedy is to give facilities to him for acquiring a property in the land. I have very little faith in restrictive regulations as to cutting timber. They may succeed in a country like Russia, but in Canada we could not organize the machinery for carrying them out effectually. But I have the greatest confidence in individuals, even improvident lumbermen, looking after their own interests. You will not find a farmer, however lazy, who will break down a branch of his own apple tree as the easiest way of gathering the fruit ; though it is just the plan that would suggest itself to a party of marauding soldiers, who held the country this year and never expected to see it again ; but our legislation has made the bulk of lumberers into a band of marauders, whom we have perversely excluded from all hope in the future.

The principal objections to giving the lumberers a property in the land have been, the fear that the trade should get into the hands of a few men of large capital, and become a monopoly, and the dislike to discourage settlement. I do not entertain any fears in either direction. A business which requires a large capital naturally falls in to comparatively few hands, and such is the case at present. The capitalists

may not be the owners of the limits, but they provide the advances, by which alone the smaller lumberers can carry on their business, and these are as much in their power, though employed much less usefully to themselves and to the country, as if they were their paid servants and agents. The men who have any capital, being taught provident habits, would turn it to better account; and I do not think the country would be the loser if there were fewer adventurers, who, having obtained some advances, and a nominal right to a few hundred acres, run in debt to the settlers for provisions, steal what timber they can lay their hands on, and having handed over their raft to the party who made the advances, return to the woods as penniless as before, and try their fortune the next year in another neighbourhood, where they are not yet known. Nor do I think that the settlement of the country would be retarded. A lumberer wants men and horses and cattle for his work, and hay and oats and provisions without too great a distance to haul them; and he does not want to keep any land fit for settlement lying idle on his hands. It is just as much his interest to get the hardwood land settled, as it is to preserve the timber land, which is generally unfit for permanent occupation. The only way to make our immense back country permanently productive is to raise up a class of men, whose interest

it is to make the most of it, just as the individual enterprise of our farmers is turning to account the more fertile lands on the front.

Table of average growth of pine trees from 100 to 200.

Age of Tree.	Diameter of solid wood in inches.	Cubic contents of round tree at 50 feet length in feet.	Annual increase of Diameter.	Annual increase of cubic contents.
100 ..	14.30 ..	55.76 ..	}214 1.919
120 ..	18.58 ..	94.14 ..		
140 ..	23.00 ..	144.26 ..		
160 ..	26.64 ..	193.54 ..		
180 ..	30.12 ..	247.40 ..		
200 ..	33.02 ..	297.34 ..		
Average....	24.18 ..	109.54187 2.416

Table of selected masts from 200 to 300.

200....	37.76...	388.80	}180....	...3.88
220....	41.36...	466.50		
250...	44.14...	531.30		
260....	47.48...	614.70		
280....	49.70...	672.50		
300....	51.64...	726.10		
Average..	45.35...	566.60.....	.. .139....	...3.38

