

Thinning of Young Conifer Stands.

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*Paper read to open the discussion on this subject at the Summer Meeting in Clonmel, June, 1943.

My contribution to to-night's discussion on the thinning of young conifers will be just an outline of what is known about thinning in general, and the thinning of young conifers in particular. I am sure that my fellow members will have much to add. Although most of those present are familiar with the principles of thinning, I think it will do no harm, and it might help some of the associate members here to-night if I go over some well-trodden ground.

The forester's main object in planting trees and tending woods is to produce timber, not just any kind of timber, but high quality timber that can hold its own in competition with foreign timber, or with other materials. We must remember that or else we will never make a success of timber growing. There is an idea abroad that anything will do, and that we can adopt a take-it or leave-it attitude. I think it won't work out that way, and in any case, it is a poor way of looking at one's job. Now if we are to produce good timber we must know what good timber is like, and also know how it is produced. Good timber for any purpose, let it be building construction, telegraph poles, pulping, veneering or even composition board, is timber free from knots, of regular growth, combining the qualities of strength and good appearance. Now, it is well within our power to produce such material, but it requires skill, and a certain amount of knowledge of the factors governing tree growth.

When the forester plants an area he goes to great pains to establish a good crop, evenly spaced and as close or as thick as economy will allow. He strives in the years following to maintain that density of stocking, knowing that blanks or failures will lead to coarse individuals and delay in the suppression of weeds. His main concern is to have the crop close as early and as regularly as possible. The sooner the crop closes, the sooner the side branches are suppressed; and early suppressing means small knots and early cleaning and eventually a high per cent. of knot-free timber. After the crop closes, the wood forms a dense thicket in which each tree is struggling with its neighbour for light and root space. This struggle for light is extremely useful in that it forces growth into the leading shoots and crown and tends to make the trees tall, straight and clear of branches. However, the struggle tends to become too keen especially in even crops of spruce, larch, Corsican pine and Douglas fir, with the result that the crowns become restricted and the trees generally drawn up, weak and lanky. The foliage of the crown of course, feeds the cam-

bium which produces the wood of the tree. The amount of wood formed is thus dependent on the size of the crown and also on the size of the roots. Restricted crowns and roots mean a small production of wood and this means narrow growth rings especially near the base of the tree. This progressive reduction in the size of the annual ring means a falling off in growth and will lengthen the time required for the production of trees of convertible size. The trees will have a soft open pulpy heart and a close hard outer core and will therefore produce a large percentage of low quality timber.

The idea therefore should be to prevent the formation of soft wide ringed cores in the early stages and to maintain steady or even rapid growth at the later stages.

How can this be done? Take Scots pine. This tree is our main candidate in the race for the lumber market. It must be of good quality, straight, slow-grown and free from knots, if it is to compete with Scandinavian red deal. Scots pine rarely comes away evenly and there are many ugly coarse and crooked trees in evidence by the time the crop is ten years old. These usually dominate, slightly, a better type of tree, with fine branches and good form. It is at this stage that the quality of a crop of Scots pine can be decided. *Pre-thinning*, that is, the removal or heading back of the worst of these wolf trees from young crops of Scots pine in the early thicket stage, is usually necessary if the good trees are to survive into the pole stage. If this pre-thinning is neglected, these better type trees are usually dead or have become so drawn up and whippy as to be beyond help and we must perforce select our final crop from amongst the better shaped 'wolves,' all of which are by now soft and pulpy at the core and well furnished with coarse knots. No amount of late thinning or pruning will produce good quality timber when this happens although a certain amount of pruning may gull a buyer into believing that the timber is clean and good.

Having allowed the crop to pass through the thicket stage and started the cleaning process well on its way, the forester's main efforts are directed towards maintaining substantial well-balanced crowns on those trees selected, tentatively at first, for the final crop. This he achieves by cutting and removing, for sale if possible, all those trees that unduly interfere with the proper crown development of the final crop and in addition those which have ceased to be useful. In the beginning the thinning is aimed rather at the encouragement of as large a number of stems as possible so that the crop may be even and the suppression of side branches maintained. This is achieved by concentrating on freeing the main body of the dominant trees of the crop from the danger of suppression by a few over-assertive individuals. In addition, of course, all dead dying and suppressed trees are removed as a matter of routine. There seems to be no unanimity about the advisability of removing this latter material. Some authorities say it is a waste of time and money to cut out stuff that can do no harm, others say that it can possibly do harm by providing a breeding ground for bark beetles and other pests and there one is left! To the average forester these dead and dying trees provide a very useful and necessary, in my opinion, outlet during critical thinning operations. He has the satisfaction of marking at least something with which high authorities will not be able to find fault. He calls it a light thinning and sometimes has the satisfaction of making a little profit on the sale of this material.

The modern tendency in thinning is to make it as heavy as possible from the beginning. This applies especially to spruce, larch and Corsican pine. While spruce may not appear to suffer as much as larch from early overcrowding, it is widely recognised in Denmark that lack of early thinning in spruce results in undue length of bole to crown which causes swaying and rupturing of roots and thus increases the incidence of butt rot. The market for spruce thinnings created by the opening of pulp factories has encouraged this tendency as it is now financially sound to thin heavily in young spruce. The type of thinning

favoured is a heavy low thinning that is, all dying suppressed and sub-dominant trees are removed as well as some trees from dominant groups. This allows an increasing quantity of sunlight to reach the forest floor and in this way undue raw humus formation is avoided. The utilization of heavy thinning in the control of disease is also illustrated by what has come to be known in Great Britain as "the Novar principle." European larch suffering from canker is treated under this system as follows: All the cankered stems are cut out leaving only 300 to 500 trees to the acre and then under planting with Thuja, Tsuga, A. grandis, Douglas fir or beech. The result is, that due to the increased air and light the larch grows rapidly, throws off the effects of the disease and the undercrop comes away well under the partial shade, keeps the ground clean and later, when the larch is finally removed the undercrop forms the new crop.

Hearing all this, one is bound to ask when should I begin to thin? How much should be removed? And when shall I need to thin again? It is like dodging the issue to say that every crop must be treated on its own merits. Vigorous full crops of Japanese larch, Corsican pine and European larch will probably need attention from 15 years onwards, every three years up to 30 years and every 5 years after that. Sitka and Norway spruce on good quality soil will be yielding poles when crops on poor sites are still in the grass and being beaten up. The condition of each stand should be the main basis for judgement. Additional aids are the comparison of representative plots with appropriate yield tables to find out the quality class and then the number of stems per acre at the ages of 20, 25, 30 years and so on given in the yield tables.

Another way of knowing whether a crop is in need of thinning is to consider the nature of the crowns of the dominant trees. If they are generally small, less than $\frac{1}{4}$ of the total length of the tree, thinning is needed. Then there are the many "rules of thumb" or traditional prescriptions for thinnings, such as early, little and often, which is a good safety first rule for anyone built that way. Another rule relating to the condition of the forest floor is "Green in the distance, brown underfoot" which of course refers to the scattered clumps of wood sorrel, mosses and ferns which come in under a fairly dense but not over crowded canopy of pine, spruce or Jap. larch, and seem to form a sward at some distance away but underfoot, there is brown carpet of needles.

Another method of deciding on the grade of thinning to be followed is to demarcate a plot of say $\frac{1}{4}$ acre and classify the trees on the plot according to their position in the canopy into (1) dominant (2) co-dominant (3) sub-dominant (4) suppressed (5) dying and dead diseased trees and then to further sub-divide each class according to the quality of stem, uniformity and vigour of crown and so on. A thinning can then be marked which is high or low, light, medium or heavy and carried out and if found appropriate can be applied to the rest of the stand. This is the best way of giving instructions as to the nature of the thinning to be carried out, there can be no misunderstanding directions, so illustrated.

The thinning of young conifer stands will be of growing importance as time goes on. Nearly 100,000 acres of conifers have been planted in the last twenty years and consequently the vast majority of thinning will, for the present and near future, be in young pole coniferous crops. The acreage to be dealt with will increase rapidly since every plantation entering the thinning stage will need attention every third year or so. We will shortly have a much bigger thinning programme than planting programme and every effort should be made to increase our knowledge and skill in this vital field of forestry work. One of the best incentives to proper thinning is the finding of profitable means of disposing of the culled material. The variety and description of material derived from thinnings are unlimited and it is important that the local or general demand for such material be fully exploited. Local demands may be for fencing material, wireless poles,

rough gates, shelters for machinery in the farmyard, pergola work and rustic work, drying trestles for hay, turf and fruit trees stakes. Only recently a farmer asked me about light poles for drying pea haulms. Of course, the local demand is somewhat limited in sparsely populated districts but it should be possible to create some general demand. Pulp manufacture suggests itself for Norway and Sitka spruce, Contorta pine and other white woods such as Abies and Tsuga. Small thinnings are expensive to handle and yield low grade pulp and the industry may have to be subsidised in the initial stages. Small plants consuming 150 tons of timber a day are working successfully in Europe and taking material for a radius of 50 miles, while a haulage of 300 miles is by no means rare in Germany and Sweden where gas-producer lorries also consume large quantities of timber.

In Denmark this problem of utilization has been tackled in a business-like manner. Small mills are working up small produce into potato-sprouting boxes, fish boxes, fruit boxes, week-end huts, tool sheds, military huts. In younger plantations charcoal is prepared in portable kilns and finds a ready market for inclusion in cattle and hen foods, and different industries. As a result of an intense campaign for the use of special wood stoves in country districts, the demand for fuel wood rose beyond power to supply.

In 1935 after a series of experiments on the preparation of a fibre board from low grade mountain pine scrub, a factory was set up to manufacture fibre boards and isolation plates. The industry had to be subsidized at first largely due to the need for research in connection with the material. After 3 years, however, the factory was producing a board equal in respect of price and quality to any foreign plate.

Unless good prices can be realised for the produce of early thinning it must usually be done at a loss. A good deal of this loss could be avoided especially in spruce and pine by concentrating on high thinning and letting the small suppressed trees die on their feet. In this way a smaller number of poles will yield a much better return and the benefits to the final crop may be better than those achieved by a heavy low thinning. However, in the craze for early returns a new type of thinning called commercial thinning is coming into vogue. The idea is to cash in on thinnings even at the expense of the final crop. This might be financially sound but it is bad long term forestry. The business of the state forester is to grow good crops of commercial timber which can meet the country's requirements in time of need. But to explain this commercial thinning, the idea appears to be that if at certain times there is a demand for certain dimensions of poles, say, 5"-8" Q.G. we go through our plantations and cull as many of these as possible without destroying the future crop. This may be all right on a private estate where there is a good man in charge, but in state forestry, I may be pardoned for saying, there is a danger that if the decree goes forth the quarter-girth tape will govern the thinning operation and young stands may be combed every other year of merchantable poles, with the result that there will be no final crop of any use. It can be argued with good reason, of course, that at present we are passing through an emergency and that any thinnings of serviceable size should be felled while the market holds, by so doing we serve the nation and the forest best. But bad forestry like bad farming will not pay in the long run. Our duty is to the forest and no emergency should excuse bad forestry. Short rotations and financial thinning savour very much of the get-rich-quick wheat farming that destroyed much of the land of America, Canada, South Africa. Forestry is a building up process, better crops with each generation, long rotations, increased soil fertility. Quick returns are got only by cutting into capital reserves, be it timber or soil fertility and this country has been eating into its forest capital long enough. Let us keep to sound thinning principles and have patience about returns. The forester will eventually be judged by the trees he has left, not by those he has removed, so let us hope the woods of the future will be monuments to the present generation of pioneer foresters.