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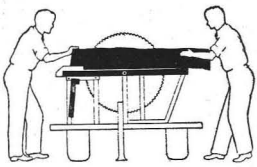

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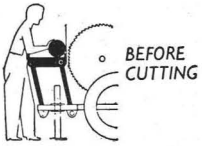

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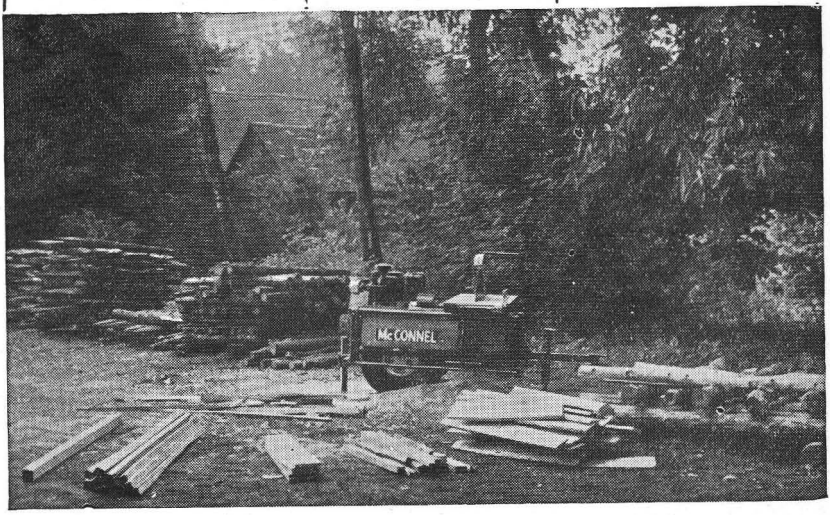

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IRISH FORESTRY

VOLUME XII SUMMER NUMBER 1

THE THINNING OF PLANTATIONS

By W. E. HILEY, O.B.E., M.A.

(Address given to the Thirteenth Annual General Meeting of the Society of Irish Foresters)

OUR outlook on what constitutes a good thinning has changed in recent years. We used to think we could judge whether a thinning was good or not by looking at the result and, as we were mainly influenced by the methods demonstrated by our teachers, we would try to thin so that the remaining trees looked as they had taught us to expect. We had no clear idea of what we were aiming at or how the trees would ultimately turn out.

Our new conceptions are different. Although there are many bad ways of thinning a plantation, there are also many good ways, but each different method will give a different result. You cannot intelligently settle on a method of thinning until you have made up your mind as to the kind of result you want to obtain. You should then direct your thinning towards obtaining that result.

Let me first dispose of the bad ways of thinning. It is clearly wrong to take out the best trees and leave the worst. It may often be wise to remove the biggest trees and keep co-dominants which are straighter or more finely branched, but you must be satisfied that their crowns are sufficiently robust to enable them to become vigorous. In other words, your choice must be qualitatively sound. There are also quantitative limits. You must not, except under conditions which I shall explain later, leave the trees so scattered that they cannot make canopy, or so tight that their crowns become weakened. Particularly with the larches, ash and sycamore, it is necessary to maintain vigorous crowns because, once they become weakened, they have great difficulty in recovering. In some species, particularly Douglas fir, the early thinnings must be reasonably heavy in order to make the individual trees windfirm. On the other hand, in woods which are very dense because thinning has been neglected, special care is required.

It is permissible to adopt methods of " high " thinning, and even " selection " thinning[6] in which the trees removed have a larger mean diameter than those that remain. But I want to-day to speak principally about " low " thinning because it lends itself better to quantitative description. Even with a low thinning it is necessary

to remove " wolves " and badly-shaped dominants, but in general the smaller trees are taken and, if the thinning is heavy, only dominants and co-dominants will be left. The choice which remains to us is quantitative. How many trees to the acre should we leave at each thinning ?

What Should Be Our Aim ?

We know that in plantations which are lightly thinned the trees grow slowly in diameter and have narrow annual rings; if they are thinned heavily the trees grow more rapidly in diameter and have broader annual rings. For instance, if Norway spruce, quality class II, is thinned in accordance with the British Yield Table, it takes about eighty years for the final crop trees to reach a breast height quarter girth of 12 inches. With a heavier thinning, which I shall describe later, it takes them fifty-five years to reach this size; and with Wiedemann's " moderate " thinning,[8] which is widely practised in Germany but is very light by our standards, it takes 110 years. So if we want to grow trees of this size the lengths of the rotation will be anything from fifty-five years to 110 years, according to the way we thin. Which of these thinning grades is it reasonable to choose ?

For myself I should generally choose the treatment which is likely to prove most profitable. I say " generally " because we are rightly influenced by other objectives such as amenity and by our love of beautiful stands, and we must be careful not to let down the quality of the soil. But our main job as foresters is to grow the timber that people want at a price they are willing to pay. In time we shall be growing a large part of the conifers we consume and our main objective should be to produce those kinds of sawn softwood timber which will meet out national needs and will compete on the most favourable terms with imported sawn timber. We need to produce the highest reasonable quality at the lowest reasonable cost. Private growers will naturally follow this objective because it will increase their profits; and it is equally desirable for State forests because economic production helps to maintain a high standard of living.

To achieve this objective we need far more knowledge than we have at present. In particular, we need to know how plantations will respond to different thinning grades, how the quality of the timber will be affected, and how variations in treatment will influence the cost of growing the timber and the price we may expect to get for it. And we must not expect quick answers to these questions. It would take many decades to determine in the forest the results of thinning in different ways but, fortunately, forest science has now reached a stage at which it is possible for us to judge with some confidence the probable result of thinning in a new way. Mathematical calculations can help us both in this and in comparing costs.

Many foresters are allergic to calculations and resent the interference of mathematics in their silvicultural practice. And I should hesitate to impose computations on them were it not that the initial results of such work suggest that economies of outstanding importance can be achieved by changes in our methods. I have already referred to three thinning grades in Norway spruce, quality class II, by which the final crop reached a size of 12 inches b.h.q.g. in fifty-five years, eighty years and 110 years, respectively. If we introduce representative costs of land and operations and representative prices for thinnings, the cost per hoppus foot of growing the final crop works out at about 2*s*. 6*d*., 4*s*. 6*d*. and 19*s*. in the three cases. I hope later in this address to explain how these figures are computed; at present I mention them only as an example. They show how wise we are to escape from the very light thinning practised in Germany. But they also show that by thinning still more heavily than our current practice we can reduce the cost by a further forty per cent. If this can be achieved without seriously impairing quality, it is clearly a matter of the utmost importance.

Calculated Thinning Grades

The Revised British Yield Tables[4] are constructed to conform with a grade of thinning which is generally described as C/D[7]. It is heavier than a C thinning but is lighter than a D thinning. Compared with most German thinnings it is heavy, but in its later stages it is lighter than the Danish model[6] and, for our purposes, we may describe it as a moderate grade. The yield tables include figures of the mean quarter girth of the 100 largest trees at each thinning, and these figures enable us to visualize the pattern of annual ring widths which we may expect to find at breast height in the dominant trees. The number of rings per inch put on in each ten-year period has been calculated and examples from each of the seven species are shewn in Table 1.[3]

It will be seen that in nearly every instance the annual rings near the centre of the tree are fairly broad but that they become narrower and narrower towards the outside. The most striking example of this is European larch in which the latest rings are only about one-thirtieth of an inch wide. The trees have almost stopped growing although at seventy years the second quality has only reached a mean b.h.q.g. of 10 inches. Both the larches call for a very different method of cultivation. Personally, I advocate considerably heavier thinning in early years followed by a reduction to about fifty trees to the acre half-way through the rotation; these widely-spaced trees can then be underplanted to produce a two-storied high forest.

With most other species I would aim at more rapid growth than is depicted in the table. On fertile soils we cannot ordinarily avoid very broad annual rings in the extreme centre of a tree, but

TABLE 1. NUMBER OF RINGS PER INCH IN THE 100 LARGEST TREES

(Figures calculated from *Revised Yield Tables for Conifers in Great Britain* after smoothing quarter girths)

Species	Scots pine			Corsican pine			European larch			Japanese larch			Norway spruce			Sitka spruce			Douglas fir		
quality class	I	II	IV	I	II	IV	I	III	V	I	III	V	I	II	IV	I	III	V	I	III	V
Age (years)																					
20-30	8·5	9·4	—	9·2	9·3	—	10·6	11·7	—	9·0	10·3	15·5	8·2	10·0	—	5·4	7·1	8·8	6·0	6· 4	7·3
30-40	8·5	9·4	17·0	9·2	12·0	15·2	13·6	16·2	21·2	11·4	12·2	18·0	8·2	10·0	16·5	7·9	7·9	8·8	8·5	8·3	8·1
40-50	9·4	10·6	17·0	11·7	14·0	16·6	16·2	22·7	28·3	14·9	16·3	21·4	9·4	10·3	16·5	13·8	11·1	10·3	11·0	11·0	11·8
50-60	12·1	12·6	17·0				20·0	30·9	30·1												
60-70	15·4	16·2	17·9				26·1	37·8	35·0												

I would like them to settle down to six to seven rings to the inch (which corresponds with a growth in quarter girth of $\frac{1}{4}$ inch each year) or a few more. This is a narrow enough ring width for strength, but if the rings become much narrower the trees do not pay for keeping. Unfortunately, this will require the adoption of thinning grades which have never been tried out on a sufficient scale to give statistical results. Must we wait for long-term experiments, or can we *calculate* what is likely to happen if we thin more heavily ?

Calculated thinning grades are not new to forestry. The most famous case is Craib's[1] calculated grades for *Pinus radiata* and *Pinus patula* in South Africa, which have been followed with extraordinary precision for fifteen years. We have more evidence to work on than he had, and an important principle, which is now widely recognized, comes to our assistance.

This principle, which S. O. Heiberg calls " Möller's theory ",[6] is that, within certain limits, the volume increment of a plantation is not influenced by the density of stocking. It means in practice that an equal volume production can be obtained on a much lower growing stock than is generally considered necessary.

Now, the volume increment per acre in a plantation in one year is the total volume of the annual rings which are put on in that year by the cambium on all the trees. Let us now think in terms of the total area of the cambium on the main stems of all the trees on an acre, what is called the " bole area " per acre. If half of an evenly growing plantation is left unthinned, while the other half is thinned in such a way that the bole area is reduced to a half, it follows from Möller's principle that, on the average, the trees in the thinned portion must put on rings which are twice the thickness of those put on in the unthinned portion. Perhaps this is too much to expect in the first year, but the volume of wood put on in the five years following the thinning will probably be the same in each case. What this means is that, when the effects of different grades of thinning are compared, the average ring widths will be inversely proportional to the bole areas. This provides a mathematical basis for calculating the effect of a different numerical thinning from that adopted in the yield table.[3]

There is another method of calculation, also based on Möller's principle but without using the bole area,[2] and it is found that with appropriate precautions, these two methods give approximately the same results. It would exhaust your patience if I were to attempt to explain these mathematical methods in greater detail and I will confine myself to describing the result of computations based on the Norway spruce table to which I have already referred.

It was first necessary to extrapolate the British Yield Table to eighty years. There are so many continental yield tables for spruce, some of which are continued to 120 years, that this was fairly easy, and it was possible to continue the same general thinning trend as is

followed in the British Yield Table. In this table 181 trees to the acre are left after thinning at eighty years, and the number of rings per inch at breast height in the 100 largest trees has increased from 10·0 at twenty to thirty years to 17·2 at seventy to eighty years.

We then calculated a new thinning grade designed to give 6·6 rings at twenty to twenty-five years, increasing evenly to 8·2 rings at sixty to sixty-five years. Only 100 trees would then be left after thinning at sixty years. Comparing the two tables shewed that the first gave a final crop of 7,310 h. ft. at eighty years with a mean b.h.q.g. of 11·7 inches, whereas the second gave a final crop of 5,555 h. ft. at fifty-five years with a mean b.h.q.g. of 11·8 inches. In each case the thinnings that would be taken with the final crop are included. So these two rotations, eighty years in the first case and fifty-five in the second, produce trees of about 12 inches b.h.q.g.

You will see that in this calculated table we have not contemplated a thinning grade which is so heavy that the trees produce shockingly broad annual rings. And we need not fear that if the number of trees is reduced to 100 per acre at sixty years they will fail to make canopy. Möller's table reduced them to 100 at sixty-seven years and this is normal Danish practice; but his table allows of very light thinnings in early years, so that the trees have narrow rings in the centre and broader rings further out. The Danes do not like having to prune their trees.

The Cost of Growing Trees

The simplest index of the financial attractiveness of a method of cultivation is the financial yield, or rate of compound interest which is earned on the capital invested in the plantation. Using certain data for costs of operations and a price-size gradient for thinnings and final yield, the financial yield for the moderate thinning with a rotation of eighty years is 3·53 % and is lower with longer rotations. With the heavy thinning, and a rotation of fifty-five years, the financial yield is £4·11 % and it becomes higher with a somewhat longer rotation.

Using the same data, but regarding the price per hoppus foot of the final crop as the unknown in place of the rate of interest, we can work out a figure for the " cost of production." In order to earn compound interest at 4 % a price of 4·52*s*. per hoppus foot is required with moderate thinning, but 2·54*s*. is sufficient with the heavy thinning. If larger trees were required the differences in the cost of production by the two methods would be greater.

The saving which is achieved through heavier thinning is due partly to the higher intermediate receipts which the more extensive thinnings provide, and partly to the shortening of the rotation which prevents compound interest from piling up for so long. Long rotations are very expensive. But, with the thinning grades recommended by the Forestry Commission, very long rotations will be

required to produce trees of timber size on poor soil. Norway spruce quality class II, represents fairly rapid growth and, if we can save 40 % in cost in plantations of this quality, we can save much more in plantations which grow more slowly. So, taking all plantations into account, it is likely that a saving of more than 50 % can be achieved by adopting heavier thinning grades.

Quality of Trees

Apart from obvious defects such as crookedness, scars and rot, high quality consists mainly in three features. The first is size, because nearly always a large tree fetches more per cubic foot than a small tree. Timber merchants who use heavy band-saws like very large trees, even 20 inch q.g. and up, and at present the market in the southern half of Britain is keenest for such trees. But Gordon Jacob[5] tells us that, when mills have been built to deal with the large quantities of conifers which will be available in future decades, trees of 12 inch b.h.q.g. will be far more economical to saw. We may find in time that trees which are too large for the saws which are then employed become difficult to sell.

The next important feature is freedom from knots. One of the benefits of light thinning, especially during early years, is that side branches are killed off while they are still small, and small dead branches fall off more quickly than large dead branches. Nevertheless, artificial pruning is much more effective than natural pruning in securing clean timber. And with heavy thinning artificial pruning is far more economic than with light thinning. We have seen that with Norway spruce, quality class II, trees of 12 inch b.h.q.g. may be produced in fifty-five years rotation with heavy thinning, eighty years with moderate thinning and 110 years with light thinning. If we prune at twenty years at a cost of say, 6*d.* a tree, we receive our return thirty-five years later with heavy thinning, sixty years later with moderate thinning and ninety years later with light thinning. But, at 5 % compound interest, 6*d.* grows to 2*s.* 9*d.* in thirty-five years, to 9*s.* 4*d.* in sixty years and 40*s.* 4*d.* in ninety years. So we are much more likely to see a good return on the cost of pruning with heavy thinning than with moderate or light thinning.

In South Africa and Kenya, where rotations are very short, pruning has become the accepted practice and pays handsomely. Even with our far higher wages it will pay if rotations are reasonably short. So pruning becomes associated with heavy thinning and with this treatment we may expect to produce a large proportion of clear timber in the butt lengths.

Heavy thinning influences knottiness in another way. It encourages the crowns to be bigger and deeper, so that a larger part of each tree becomes almost useless. I doubt whether this seriously detracts from the value of a tree, because even in a tree with a shallower crown, the part below the live branches is extremely knotty.

The third important feature which influences timber quality is the ring width, and in conifers, though not generally in hardwoods, high quality is usually associated with narrow annual rings. This is a very complicated subject, about which the authorities differ, but I can see little merit in the ring width patterns shewn by most species in Table 1. When such trees are sawn up the boards they produce will have broad rings in the middle and narrow rings at the edges whereas boards with even ring widths throughout would be better.

So, comparing the qualities of 12 inch q.g. trees produced by the two thinning regimes we may expect the following differences. The slower grown trees will be taller (because they are older) and will have shorter crowns. If the more heavily thinned trees have been pruned, the bottom one or two logs will have a higher proportion of clear timber, but will have somewhat broader annual rings. The price per hoppus foot may slightly favour the more lightly thinned trees, but the difference in price is likely to be small.

Conclusions

I am sometimes asked why we at Dartington have not made a real working plan. We have a Plan of Operations, but this is little more than a prescription for five or ten years. What we mean by a working plan is a picture of the kind of normal forest we are aiming at when we have something approaching a complete series of age gradations.

The reason why we cannot yet make a working plan is that we do not know what kind of trees we are trying to grow. When the country is producing large quantities of conifers we shall need a new type of mill which is designed for handling them in bulk; and the type of mill will depend on size of tree we decide to grow. It should be possible to work out a size which, when costs of growing and costs of saw-milling have been combined, will produce sawn timber at a price which will compare most favourably with the price of similar imported sawn timber. Next, the cost of growing trees of a given quarter girth will depend on the annual ring widths we are prepared to accept.

So, before we can make working plans we need a considerable volume of research on three matters: first, on the cost of growing trees of various sizes in various ways; second, on the cost of sawing trees of various sizes; and third, on the quality of the sawn timber and the proportion of waste which results from various treatments. Such research has already been undertaken in South Africa where their general forest policy is more advanced than ours. In Britain, where all the important decisions lie ahead of us, the need for such research is urgent.

In the meantime we all have to thin our woods and we should try to do it in such a way as to produce trees of a kind that is wanted as cheaply as possible. I am convinced that most of the thinning

grades recommended by the Forestry Commission are too light, especially in their later stages, but it will take some time to work out fresh ones. The grade we have calculated for Norway spruce, qu. cl. II, maybe expressed numerically in the manner shewn in Table 2, in which the Forestry Commission figures are included for

TABLE 2. *Norway spruce qu. cl. II. Number of trees per acre after thinning*

Age	years	20	30	40	50	60
Top height	feet	32½	46½	59	70	79½
No. of trees F.C. Yield Table		1,200	730	470	325	246
No. of trees calculated Yield Table		690	426	264	163	100

comparison. The same numbers of trees *at the same heights* might be applied to other quality classes of Norway spruce, but they would not give the same ring widths. To achieve this it would be necessary to have more trees, for any given top height, in a higher quality class, and fewer trees in a lower quality class.

Alternative thinning grades for other trees can be worked out and some have already been worked out,[3] but this takes time and we may hope that State resources will become available for the furthering of what I regard as our most promising branch of forest research.

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THE FOREST*

By Forestmeister K. Scherer

LADIES and gentlemen, what is the forest ? An assembly of trees ? Not quite, because a plantation of fruit trees cannot be regarded as forest. The forest is more than a collection of trees; it is a natural form of life, a union of plants and animals comprising long-living trees and short-living plants and animals. Warmth, humidity and light produce, by changing of the constitution of the soil, the elements for the growing of the forest and these factors cannot be altered much by man with all his technical knowledge. High in the air the forest sends its branches, its leaves and blossoms, deep in the soil its roots. Storey over storey the forest builds itself above the surface of the ground. Below this surface is the habitat of fungi; on the surface is lying quietly the carpet of the mosses, interwoven with grasses and ferns, flowers and herbs; above these the bushes and over these again the trees, the crowns of which form a roof. In this way the whole space, from the finest root to the topmost branch of the crown, is filled with life of different kinds and all these plants and animals belong to the forest as a part of its unity. Each part has a certain significance in the frame of the whole. All that air and light, soil and humidity can give, is caught and transformed. All herbs and flowers which die year by year, all waste materials from the trees in the form of leaves and needles, all fruit and dead wood are the raw material whose transformation is carried out by fungi and protozoa. All assimilation of food is nothing other than the transforming of different kinds of matter into new elements.

In this way one helps the other—from life comes death and from death comes life. Out of the unity of the smallest plants and animals in the soil comes the mighty family of tree giants. Great and small lose their significance. Each part is needed; one cannot live without the other. Individuals may perish but the unit remains eternally young and eternally in permanent renewal. Birth and death no longer appear as enemies, one fighting the other, but as necessary complements to one another. In this way the ever enduring forest is founded on birth and death.

And now to the natural construction of the forest. As I said before, soil, light, moisture and warmth are necessary for the growth of the forest, although there are many different influences varying the single factors.

For different parts of the country one finds different climatological conditions and when one combines those with the different soils it can be understood that everywhere the primeval forest and the forest of the present day look different because different trees make different demands on soil and climate and they grow differently, depending on the degree of suitability of these factors. For instance,

* Text of an illustrated lecture delivered before the Spectrum Club, Dublin.

the Scots pine likes dry warmth, the Norway spruce likes to drink a little more and the fir that one finds in the Black Forest in Germany is really a heavy drinker because the optimum rainfall for this species is 1,000 mm. (40 ins.).

The European larch, which comes from the Alps and foothills of those mountains, likes a short sudden Spring. The beech is at its best on limestone soils.

Now for some details of the history of German forests. Long before man settled in my country our wood trees of the present day colonized it following on the last Ice Age after a much earlier tropical forest covered the country in the carboniferous period. In this manner the vegetation came at first as it can still be seen in the high mountains, such as the lichens and mosses, later little bushes, then the light seeded species such as willow, aspen and birch, and much later came the heavy-seeded species such as beech and oak, the seeds of which were transported by water or birds.

One must not imagine those primeval forests as being the same as the forests of to-day, not even as the layman used to imagine the tropical jungle. Rather should one think of a lightly-stocked wood carrying several age classes comprising single trees and groups of trees, and interspersed by patches of bracken, grasses and other herbaceous vegetation. One can tell to-day exactly the species that constituted those early forests because the plots preserved the pollen of the various species in the intervening period. The pollen of each species is different and is easily recognizable under the microscope. Different types of forest developed according to the climate and soil. These, however, disappeared as a result of cultivation and the artificial introduction of other species, mainly conifers from foreign countries. But here and there the remnants of those primeval forests are still recognizable.

With the advent of man in our country nothing changed in the first thousands of years. Our ancestors merely moved through the country as hunters and fishers. The country was so thinly populated that there were no remarkable influences on the forest. Later, when the population became more dense, they converted the most fertile forest soils of the valleys into agricultural fields. an event that was repeated in 1800 in U.S.A. The result is that in Germany to-day only the areas unsuitable for agriculture are covered with forest. It is interesting that up to 1400 A.D. there were not any woods in private hands, the forest belonged to the people, the grazing of the forest for cows and pigs seemed more important than the timber and especially the landlords were more interested in the hunting than in the timber products. In 1500 that changed and, naturally, at first, in the most thickly populated parts of the country. At that time regulations concerning the forests were made. In some parts forest companies were formed and the landlords took as much as they could get, mainly for the purpose of hunting. At about 1650 all

boundaries of properties were fixed. At that time there was anxiety concerning the supplies of timber for fuel and constructional purposes and a regular forest service was formed. From that time onwards the face of the natural forest was changed by the hand of man.

Artificial seeding and planting was carried out, new species were introduced, especially conifers of higher commercial value. Large areas of broad-leaved forest were converted into coniferous forest by the planting of these species. These conifers comprised Scots pine, Norway spruce, European larch and Silver fir. Since 1850 one can speak of a regulated forestry service in all parts of Germany; that means

(1) That the forest was broken up into compartments of approximately forty-five to seventy acres for management and administrative purposes.

(2) Roads for extraction purposes were planned and constructed.

(3) An assessment of the volume of the standing timber was made at regular intervals of twenty years.

(4) Assessment of the annual increase and, depending on this, the fixing of the quantities to be cut annually.

(5) Systematic afforestation of all understocked areas.

(6) Regular thinning of young and middle-aged crops.

The modern forest that one sees is not the product of nature unaided but is the result of the application by man of up-to-date forestry knowledge, the object of which is to extract the greatest amount of wealth from the soil and to ensure a sustained yield of timber, which latter means that the quantity of timber felled each year is not greater than the annual growth of timber in the area treated. Foresters do not think in terms of one or two years as farmers do, but rather in terms of periods of sixty to 120 years, which is the average length of a rotation. For this reason the forester never cuts the trees which he plants.

The changes which are brought about in the natural forest by man have their attendant dangers, especially if, in the German climate, the artificial forest is composed of pure stands of a single coniferous species. The dangers are soil degradation and the vulnerability of such pure crops to attacks by insects and disease. So by the work of man in the formation of new forests the products from the forest soil can be considerably stepped up but the danger that the equilibrium of the powers of nature are upset is very great. The forest is not a timber factory, nor a field of stems, but a living organism reacting very unfavourably to wrong treatment. Often in the modern forest the natural order is disturbed, falsified, interrupted and a human order is introduced so one must watch steadily lest damage should result.

If there is an attack by beetles or caterpillars in the forest sometimes, nowadays, control measures consist of the use of dangerous poisons which kill the offending insects but those poisons kill at the same time, millions of useful insects and again disturb the balance of nature. Therefore, in spite of the advertising by the chemical industries, the use of these poisons in the forest is only resorted to if the existence of the forest is greatly endangered.

West Germany has fifty-eight million acres of agricultural and forest area. Of this area 28 % is forest. The greatest concentration is in the province of Hessen, which has 38 % of the total area of German forests. 30 % is State owned, 30 % is corporation forest and 40 % is in the hands of private individuals. The forest provides for the national economy each year 800 million cubic feet of timber. This quantity comprises 60 % construction timber, 20 % mine props and pulpwood, and 20 % fuel.

During the exploitation fellings of 1947 the quantity cut was double the increase in new growth which meant the destruction of part of the producing wood capital. But we can be proud that all areas devastated between 1936 and 1948 have now been replanted and all areas are again in full production.

The timber which is cut annually is valued at £100 million but this is not the only significance of the forest. In addition the game is worth several millions and for the hunting rights hundreds of thousands of pounds go into the coffers of the communities. Berries and fungi are produced in the forest as well as resin. The benefits from the forest which cannot be expressed in terms of money are the amelioration of the climate by the prevention of extremes. It acts as a wind break, it purifies the air which is charged with carbon-dioxide from the industrial areas, it holds the water like a sponge in times of high rainfall and gives back this water through the wells and transpiration through its leaves in dry weather.

For example, Italy had a moderate climate as long as the Appenines were covered with forests, but when they were cut the climate deteriorated to the extremes. Forests prevent soil erosion on steep slopes; therefore whole areas are declared as banned forests especially in the Alps.

In our forests about 200,000 woodcutters are employed. Forestry work, especially woodcutting, is, next to coal mining, the most exacting occupation with regard to calorie consumption. Most of the cutting is done by the piece-work system and by this method the average earnings per man-hour is between two-and-a-half and three shillings.

Ladies and gentlemen, that is our German Forest; tree, bush, moss, lichen, worm, bird and stag, light and shadow, sun and rain, movement and quietness. Although master and friend of all, sometimes man is its enemy. In the interplay of the different inherent

factors and abilities the forest lives and renews itself, unity in multitudes. As soon as any single part gets the upper hand the total life is disturbed and the further existence endangered. It is a quality of nature that anything that suits it breathes beauty, anything that is contrary will be destroyed by it. The work of man must foster the interior growth of the forest. On the difference of the single members of the forest and their harmonious living depends the health of the whole. Equality does not conduce to life, rather does it lead to stagnation and death. That applies not only to trees but to people as well.

ITEMS OF INTEREST

STORMS

The winter storms of 1954-55 have caused enormous losses through wind-throw in the forests of Western Germany. More than 150 million cubic feet of timber was blown or broken in the January gales—this would be approximately one quarter of the calculated annual cut. In one forest property a freak gale in March smashed down close on half a million cubic feet of timber in the course of a few minutes.

A VALUABLE MONARCH

A 500-year-old oak felled in the Spessart in Germany in 1954 measured 56 inches diameter at the butt and had a timber length of 30 ft. It was sold as veneer oak and realized 19,448 marks.

ABSTRACT

By T. CLEAR

VATTNET I SGOGSMARKEN
(Das Wasser des Waldbodens)
av
Tryggve Troedsson

BULLETIN OF THE ROYAL SCHOOL OF FORESTRY
No. 20, 1955

Bulletin No. 20 (1955) of the Royal School of Forestry, Stockholm, Sweden, deals with the water in forest soils. The main text is in Swedish with a German summary. The paper deals with water movements in the forest soil and is mainly concerned with discovering what happens to the precipitation that reaches the forest-floor as rain, snow or dew. How much of the precipitation reaches the ground-water and how much mineral plant food is lost in the percolating waters ?

A detailed study of the surface water, bound water and ground water was carried out in several localities in Sweden and involved many intricate and novel procedures in the collection of water samples from various depths and expressing apparatus for dealing with the bound (imbibed) water. The paper contains descriptions of apparati and water collecting methods, gives numerous chemical analyses and is fully documented. A complete bibliography is provided running to several pages.

The following points abstracted from the German summary are of significance:

1. The quality of the ground water as indicated by the concentration of Ions is influenced more by local geology than by soil type.
2. The Ion concentration in ground water is scarcely influenced by weather factors—snow, rain, drought, etc.
3. The cation content of drainage water varies little from that of the ground water.
4. Very little difference was found in general between the chemical content of surface water and of ground water.
5. Investigations with the Lysimeter showed that very little of the water of precipitation percolated on a broad front to the water-table below.
6. The bound (imbibed) water contained a much higher cation concentration than either the surface water or the ground water.
7. Experiments in fertilization and water movements indicated only a very slow leaching of water-soluble plant food into the ground water below.

It appears from these experiments that there is no general downward movement of water through the soil and no general leaching of Ions as has been generally accepted. The usual channels through which rainfall reaches the water-table are apparently rock outcrops, wet areas where the water content of the soil is high, root channels, impervious underground layers on sloping ground. Rocky ground which induces deep penetration of water is often very productive for that reason.

Since there is very little loss of mineral plant food by downward movement of percolating waters it appears that, theoretically, the manuring of forest soils takes on a very attractive appearance. The author of this valuable paper is of the opinion that on normal mineral soils on level ground a dressing of fertilizers will be effective throughout the whole rotation with little loss by leaching. The importance of waters percolating as ground water on slopes is discussed. These flushing or irrigation waters, are of immense importance to timber production under such conditions. Contour drainage on such ground and the intensive drainage of the flats on sloping terrain may be very wrong and one should be very careful not to overdo this work. The draining of a small marsh or wet hollow on sloping ground may improve the plantability of that portion of the slope, but the leading off of the irrigation water may lower the productivity of more extensive areas.

LETTERS TO THE EDITOR

DUBLIN,
1st November, 1954.

DEAR SIR,

Kindly allow me space in your journal to voice a theory which, in my opinion, is the key to the estimation of lop and top in standing timber.

Strangely enough, the idea was first conceived in 1949 on hearing that a lorry-load of round larch stakes prepared to size and specification, had been rejected by a would-be purchaser. The sole complaint was that the wood in the stakes was too young.

Consideration of the matter showed that stakes of the required sizes could be got in the following ways:

(*a*) As butt lengths from a young stand, e.g., thinnings of a thriving seventeen-year-old Japanese larch stand.
(*b*) As top lengths from a middle-aged stand.
(*c*) As butt lengths from an old lanky densely-crowded neglected stand.

It was at once clear that there is no appreciable difference in the age of the wood in the stakes from (*a*) or (*b*), and that case (*c*) would rarely obtain in normally managed woods.

The incident did, however, give rise to a train of thought which eventually led to the present theory.

It was realized that while many books have been written, and are still being written, on forest mensuration—it is not necessary to mention the old familiar Hoppus—little or nothing has ever been written about lop and top of standing timber. It is very understandable, of course, when one considers that firewood in the past was relatively unimportant compared with commercial timber. For this reason primarily occular estimates were considered adequate. Again, the problem brimmed with complexities which, in the case of hardwoods, were not worth the time or trouble of investigation, and in the case of conifers with their low firewood value, a completely futile business.

To-day, however, in the case of hardwoods, closer utilization along with the advances in the field of wood technology, give the opinion that a mensurational technique other than the " hit or miss " method at present used, is justified. It is certainly justified if it is simple in its application and can be made to coincide with the field work involved in normal mensurational work.

Such a technique is visualized here, but before plunging into its theory the writer wishes to emphasize that no claims can be made for it pending successful experimental work. In fact it may be considered a daring innovation doing violence to the tradition of the profession, but if a successful technique is finally evolved as a result of this theory, it is felt that timber valuers and private woodland owners will have a very useful tool at their disposal.

THE THEORY

Every forester realizes that the growth of individual stems in a stand of timber is dependent on density, other variables being constant, e.g., soil fertility, exposure, etc. In other words the larger the crown the larger the tree, the greater the diameter at timber height and breast height and, of course, the greater the volume. The height variable has been ignored on the assumption that volume reflects the combined influence of height and diameter. Considering also that timber height is fairly constant for a given stand, the writer suspects that there is a mathematical relationship between top diameter and crown wood volume.

This theory is further emphasized by the fact that nature normally supports her structures on an adequate foundation. Has anybody ever seen a tree branch greater in diameter than the parent stem, or even equal to it ? This fact again gives reason to believe that there is a nice balance or ratio between branch diameter and stem diameter at the branching point.

SPECIES VARIATION

This suspected relationship will vary from species to species owing to their different branching characteristics. In fact, the whole theory is based on the belief that the branching characteristics of any species are retained as the crown spreads in growth, irrespective of age. In other words, density, which, of course, can be measured as top diameter, is considered the determining factor alone. If this is true a long spindly old tree in a dense stand could have a crown similar to that of a younger tree, provided the diameters at timber height are equal. A practical example may illustrate this point. Every forester knows that he can get a Christmas tree from the top of a spruce pole similar to one removed at pre-thicket stage.

FIELD WORK

The experimental work involves the compilation of data in the field and their subsequent analysis.

The date required are:

(*a*) Species.
(*b*) Top diameter.
(*c*) Quantity of lop and top wood.

It would, perhaps, be advisable to get as much data as possible, e.g., timber height, breast height, quarter girth, and stem volume also, in case they are required. Needless to remark, these data can best be got while felling is in progress. The quantity of crown wood will need to be measured accurately. A portable water-tank with an overflow pipe, known as a zylometer, would be more accurate than weighing the timber, possibly. Any improvised tank should suffice for getting the crown volume by displacement of water, provided the displaced water is collected and weighed. It is then a simple

matter to calculate the wood volume. Weighing carried out immediately after felling whem moisture content is at a maximum, might be sufficiently accurate for a preliminary study.

ANALYSIS

This is the final and most important step. The volume or tonnage data collected in the field are plotted by species against the top diameter for each tree measured, using square paper or graph paper. It might be necessary to plot against basal area or other data, depending on the graph pattern.

If there is a relationship it may be very evident, or it may not. There might be no relationship. A linear relationship would be very satisfactory, but this would be too good to be true, indicating that a direct proportion existed.

If any relationship exists it will in all probability be a curvilinear or parabolic one, but until statistical checks are carried out and found satisfactory the equation of the relationship cannot be determined.

Assuming success the next stage is to compile tables directly from the graph or calculate them from the equation. These tables are the answer to the problem.

I believe that this theory should apply equally to trees of firewood quality, the diameter measurement being taken immediately below the first branch whorl.

Mise le meas,

WILLIAM SHINE.

THIRTEENTH ANNUAL GENERAL MEETING

THE Thirteenth Annual General Meeting of the Society was held in Jury's Hotel, Dublin, at 7.30 p.m. on Saturday, 19th March, 1955. The President, Mr. T. McEvoy, was in the chair and there was a large attendance of members.

On the suggestion of the President the minutes of the previous Annual General Meeting, which had already appeared in the Journal, were taken as read and were signed.

The President then called on the Secretary to read the Report of the Council for 1954.

Council's Report for 1954

The first meeting of the Council was held on Monday, 25th January, 1954. Nine members were present. This meeting elected committees to look after financial, editorial and excursion affairs. Arrangements were made for the Annual General Meeting on the 20th March and speakers, including Mr. O'Deirg, Minister for Lands; Mr. A. B. Ross and Mr. O. V. Mooney, were selected to follow Mr. E. G. Richards of the British Forestry Commission, who had been secured as guest speaker. The subject was " Modern Trends in the Utilization of Forest Products."

The Council arranged for a series of day excursions, as follows:

April: To Hollywood Forest.

May: To the estate of Major E. T. T. Lloyd, Roscrea.

July: To Slievenamon State Forest.

September: To the estate of Glaslough, at the invitation of Sir Shane Leslie.

October: To Glenealy State Forest.

The Council agreed to affiliate to the " Trees for Ireland " Association and appointed the Secretary as representative on the Council of the Association.

The second meeting of the Council was held on Monday, 15th March. Nine members attended. The main business at this meeting was the Annual Excursion, which was to be held by arrangement with the British Forestry Commission in the Lake District. The Conservator concerned requested a preliminary visit by a member of the Society to go over the proposed route of the excursion. The Council requested the Secretary to make this visit and to go into the questions of hotel accommodation and transport. The Council also decided to award a travelship, valued at £15 and confined to members of ten years' standing.

A further meeting was held on May 24th. The main item on the agenda was the excursion to Windermere. The Convenor reported everything in order. He also reported that a travelship of £15 had been donated by Messrs. Irish Forest Products, Ltd., and that the prizes had been drawn and awarded by the committee appointed.

Further meetings of the Council were held on Monday, 18th October and on December 10th.

Membership

At the end of 1954 paid-up members numbered 48 Grade I, 40 Grade II and 94 Associate. Income from membership subscriptions amounted to £178 5*s*. 0*d*. as against £152 in 1953, so that our effective membership improved considerably. The amount in arrears for 1954 against enrolled members was £48 as against £65 in 1953, so there is an improvement there also. The Council feels that the Society deserves more support from technical members. The Society is offering a very excellent service both in the matter of journals and excursions, and the membership rates are the lowest in Europe.

Journal

Two issues of the journal appeared and have been widely circulated to countries outside Ireland. Requests for copies have come from Sweden, Norway, Japan, Germany, Russia, Jugo Slavia, Rome, U.S.A.

Excursions

Successful day excursions were held in many venues during the year in Wicklow, Offaly, South Tipperary, Monaghan. 1954 was the most successful year so far for excursions. In a year remarkable for its unfavourable weather the Society's excursions were favoured with excellent weather on every outing. The Council wishes to acknowledge its indebtedness to the Minister for Lands and the officials of the Forestry Division and the private woodland owners for the facilities provided for members on the day excursions held during the year. The Council is particularly grateful to Major and Mrs. E. T. T. Lloyd for the very excellent hospitality enjoyed by members on the occasion of the visit to Gloster, Brosna, Offaly.

The Annual Excursion to Windermere was an outstanding event in the life of the Society. The Society is indeed indebted to the officers of the Forestry Commission concerned with the arrangements, in particular Mr. Barrington, Mr. Chard and Mr. Crosland. The award of a travelship of £15 by Messrs. Irish Forest Products for the excursion is also gratefully acknowledged.

The adoption of the Council's Report and the Financial Statement was proposed by Mr. M. Cosgrave and seconded by Mr. T. Hannan. Mr. E. O Dalaigh also spoke and the motion was unanimously agreed to.

The President, in accordance with the custom of the Society, then delivered his address, reviewing matters of forestry interest.

PRESIDENT'S ADDRESS

The world situation continues satisfactory. The impetus towards large-scale afforestation in these islands came originally from the two long drawn-out world wars with their shortages of essential raw materials, their transport difficulties, their economic blockades and attrition. It is difficult to conceive of a repetition of this pattern of warfare in an atomic age and consequently there is now less tendency to stress the case for forestry as an insurance policy against war risks. On the other hand there is now a greater realization of the value of timber as a basic and highly adaptable raw material and of the importance of fullest use of the world's natural resources, especially in land. On these sound foundations forestry is achieving a growing and permanent importance in natural economic planning and capital development in countries all over the world.

For years after actual hostilities ceased in 1945 the world timber industry lived in fear of a catastrophic slump in timber prices and stumpage values. The expected has not happened and there is now growing confidence that international prices will hold a reasonable level. The great coniferous exporting areas, Scandinavia and the American Pacific coast, have established high living standards (with corresponding costs) and a return to a price level corresponding to the inter-war " slumping " period is unlikely. There remains, of course, the Russian bogey but it is doubtful if substantial Russian surpluses are likely to be available for European consumption. Other factors which favour the market are increase in world population and improved living standards in undeveloped countries, greater adaptability of processed timber and gradual exhaustion of virgin forests. On the whole the outlook seems set fair for timber producers.

At home, too, the outlook is favourable. In 1939 it would have been difficult to foresee that the exiguous home timber reserves should carry us through six years of war, cut off from imports, and several years of restricted imports; and that now, in spite of all, Ireland should have a higher annual output than pre-war, with more firms, far more capital and modern equipment, engaged in the timber trade. The contribution of young thinnings from the State plantations came along at a crucial moment to make up for the dwindling supply from exhausted private woodlands. Already these new and growing sources have encouraged industrial development of a most valuable type in the manufacture of wall-board for constructional use, and of paper pulp. The value to the State of conversion of low-grade thinnings to such highly processed products at home is in welcome contrast with our export of hardwood in the log before the war. Another encouraging sign is the building up of a useful export trade in wall-board and cardboard in recent years. In progressing towards the goal of forest policy, national self-sufficiency, it is possible that surpluses beyond home requirements of low grade and small size thinnings may become available and an export market for these in processed form may be very desirable.

There have been other successful ventures into the export market also; high-class hardwood strip flooring comes to mind and the rather surprising opening of a market for Irish flush-panel doors in Eastern Canada. There has been a remarkable development of kilns also for the conversion and rapid seasoning of native timber following the lead given by the Forestry Division in this direction. In summary, there is a new confidence in the timber industry, new technical developments in accordance with the changes in supply and demand, and a readiness to invest capital in a big way in the industry.

The future will undoubtedly bring difficulties in equating supply and industrial capacity in our expanding market but the long-term prospects for the Irish timber producers are bright.

The work of afforestation of bare land, and of tending existing plantations, proceeds apace. This winter the State is planting 13,500 acres. The current estimates provide a record sum of close on £1½ millions for forestry. There are now 165 State forests, many of the newer ones being in western counties on peat lands. Early results in these are promising, as members may hope to see for themselves in the coming Study Tour. Success on western peats could lead to a vast change in the economy of our undeveloped areas and new techniques give reasonable hope of success in many cases where failure seemed inevitable in the past.

Altogether we can look back on a good year without any serious forest fire.

LECTURE.

After a short interval the meeting reassembled to hear Mr. Hiley's address on " The Thinning of Plantations " which appears in this issue.

VOTE OF THANKS AND DISCUSSION ON MR. HILEY'S PAPER.

Dr. J. O'Donovan, Parliamentary Secretary to the Government, proposing the vote of thanks to Mr. Hiley for his very interesting and instructive paper, said that forestry was a contentious subject here and the role of pioneer was an unenviable one. When you had something new to propose the first reaction of the people was one of ridicule, then anger, but finally they listened. He was, he said, very interested in the lecturer's suggestion that the age of maturity of the tree could be reduced and he could appreciate what a reduction in the rotation meant in forest economics. In a programme of national afforestation there were social and climatic considerations which you could not control but, nevertheless, you had to keep your feet on the ground and keep the economic side of timber growing to the forefront. A rate of interest of 4 % was adopted here some years ago for our Commercial Accounts, but he recognized that the fixing

of a rate of interest for forestry was very difficult and he did not think the final figure had yet been decided on. The Forestry Vote for the current year was, he remarked, close to the £2,000,000 mark, which was very considerable.

There was, he thought, a tendency in the country to concentrate too much on " area planted " and there was the possibility that the money spent in planting the poorer lands might have been better spent elsewhere. He admitted, however, that at present the accent was on planting. As an economist he recognized that long-term investments can be carried on better during a term of inflation than during a time of stable prices. We were still in a period of inflation and we could take consolation from the fact that there was not likely to be any shortage of money for the next decade or so. Forestry, however, could not neglect or overlook the commercial aspect, especially with regard to thinnings and the suggestion that planned thinning could reduce the rotation was very significant.

Mr. T. O'Brien, Secretary to the Department of Lands, seconding the vote of thanks, said that the Society was to be complimented on securing Mr. Hiley as guest speaker.

Forestry has become very much a live subject here and because of its vast potential of produce and labourer it will remain so. Our aim here is to be self-sufficient, to produce all our own timber requirements. Land was the basic commodity and the greatest single difficulty we had to face was land acquisition. Up to the present the State had acquired some 300,000 acres, of which around 240,000 acres were classed as plantable.

As well as new plantings, maintenance of existing crops was also essential and in this maintenance thinning plays a significant part. It is a most important operation and is the sole means of controlling growth and development—all trees cannot reach a final crop. Thinning was necessary and must be carried out to ensure the proper development of the crop, even if no market for the thinnings was available.

MR. SHARKEY

Annually, at this time of year, we meet together to hear a talk on some matter of forestry interest, and this year we have been privileged with a lecture which has been among the best ever given here. That Mr. Hiley is an expert on the subject needs no emphasis from any of us, and his very interesting and instructive talk on a controversial subject comes as a timely stimulation—I mean controversial on the point as to how we should thin, not as to whether we should thin at all. As soon as we plant we commit ourselves to thinning.

Our lecture last year was on utilization—this year on the thinning of plantations—quite significant subjects which indicate

that Irish forestry is coming of age so that the scope of our problems has widened beyond that of planting and establishment of successful plantations.

In the matter of thinning one can identify three schools or grades of thought in Ireland. First of all we have those who are long converted to the idea of heavy thinning. We should explain that " heavy " here is used in a comparative sense, as otherwise it might connote a certain reckless approach to thinning which is not intended—in fact I would say that " heavy " here is synonymous with " correct " thinning, as distinct from " light " thinning, which we associate with under-thinning. Those who favour the heavy thinning approach are our forestry " progressives," or, to flatter them—our more " enlightened " foresters who lead the way. They follow Mr. Hiley's line of reasoning at a surprisingly close range.

Then we have the older school, or remnants of it, who follow the " early and often " thinning policy, who at all costs " play safe." Their ranks are being gradually depleted, as the younger foresters follow their more courageous leaders, and lastly, we probably have a third shade of thought which would follow a line of sheer expediency, and if it came to that, would not thin at all.

In Ireland we are not short of opinions and where thinning of plantations is concerned opinions will differ. We have, of course, the disadvantage that as yet we have not lived through a full rotation of any State-planted species. There must surely, however, be the right or ideal thinning approach for each species grown in each of our many different soil conditions in our own special social-cum-economic background. It is only by careful thought and research by men such as Mr. Hiley that we can arrive at that ideal approach to thinning which suits us best from every angle here in Ireland.

One must pause a moment to consider the inevitable pitfalls which the over-simplification of thinning methods may provide. One is tempted to ask where does heavy thinning end and partial clearance commence. All the bad examples of our under-stocked poor quality private woodlands are not always the result of neglected thinning, but very often are the result of over-thinning when financial considerations were the only ones brought to bear by the owner. Neither is it desirable that our approach to thinning should follow a line of regimentation. Foresters would rejoice at a certain degree of standardization, but sylvicultural principles can never be ignored, especially in Ireland where there is such a diversity of soil types and site conditions.

Mr. Hiley, no doubt, is fully convinced that his approach to thinning suits the interests of his own estate or of the institution which he manages, and that it fits in with the interests of forestry in England. How would it affect us here in Ireland ?

First of all we must ask ourselves the important question: " What do we want ? " Heretofore the ideal in forestry would seem to have been the growing of the " perfect " tree and classical stand of timber. Now Mr. Hiley has himself defined the forester's prime job as being the growing of timber so that the cost of production per cubic foot, including the purchase of land, the planting, tending, harvesting and finally, converting, will compete in price and quality with imported timber. That the role of thinning in the final cost of production is of major importance has been convincingly shown by Mr. Hiley, as indeed the extremes in thinning methods can finally prove the success or failure of forestry as a commercial enterprise.

The first thing we want in Ireland is commercial timber—by this I mean medium-sized logs of 12″ to 18″ diameter or approximately 10″ to 15″ quarter-girth. Timely and heavy thinning undoubtedly ushers in our forestry crop to a state of commercial usefulness on a much shorter rotation. In Ireland we can hardly afford the luxury of a long rotation. It may be that as we eventually get well into the handling of commercial timber, when large areas of our forests have reached commercial maturity, that we can then consider growing some of our forestry crops on long rotation, placing more emphasis on quality. Every day the need for getting on to the commercial log is increasing. The smaller log, from 6″ to 9″ or 10″ diameter which heretofore has been finding a use as boxwood, is coming into a lean time, as the timber-box trade is being challenged by substitutes in hardboard and cardboard. The only consolation here is that these substitutes are mostly based on timber itself. The trend is all the time towards the processing and production of synthetic timber, and reduction of saw-bench outlets for the smaller logs. By getting on to the medium-sized log from which constructional timber can be produced, our timber merchants will be gaining gradual experience in the handling and converting of our home-grown timber. Light thinning, except where there are special circumstances, can have little to recommend it from the economic viewpoint. Any of us can go out to-day into plantations up to thirty or forty years old where spruce which has been under-thinned is as yet only yielding low-valued pulpwood, whereas the properly thinned plantation is beginning to yield small commercial timber of a much higher value. Another important point is that heavy thinning enables the forester to keep up with the ever-increasing inflow of plantations in the thinning stage. Can he afford to spend time going over the mountainside every two years ? Nor is it economic for the forest staff to handle thinnings otherwise than in bulk, so that every unit of effort gives the maximum output.

All this ties up with the question of markets. There is little encouragement to thin properly if the produce must lie and decay on the mountainside. Here we have the vicious circle—which comes first—raw material or industrialization ? Planning comes first, and

with proper planning and understanding between the forestry authorities and those interested in industrial development, industries to use the thinnings will come in time, and in fact to a surprising extent, are here already.

What of quality and size of log ? In fact this is of great importance, as, if we are to ignore quality and think only of quantity our main aims will be sorely defeated. First of all, what quality do we want ? I should say that we do not want classical quality. We do, however, want good quality which will compete with imported constructional timber. It is probable that we will always have to import some of this slower-grown close-grained joinery timber, but this will not be of much significance. I disagree with Mr. Hiley in giving first place to the size of the tree as a quality factor. The prevalence of knots is a far more important factor. The sawn scantling will not easily show what size of log it came from, but it will show its knot-ridden birth-marks. Pruning would, therefore, seem to be an essential associate of heavy thinning. In fact a medium sized log would seem to have many attractions in contrast to the over-sized log. It is easier to fell, to extract and to handle in the sawmills. Moreover, it lends itself more obligingly to the development of mass producing semi-automatic machinery which must be used to convert our timber if we are to compete in price with the foreign product. I think the bandmills in England which use heavy timber depend mostly on hardwoods.

We are glad to hear Mr. Hiley refer to Mr. Gordon Jacob. In fact I am a fan of Mr. Jacob's and I am pleased to say that during the past three years I have visited his mills in North Wales five times. This man is keeping apace with the growing trees in his ideas and methods of converting timber, and I agree with him in his liking for the graded medium-sized log.

To-night's lecture was indeed an important one. The thinning of our plantations is every day coming into more prominence, and each year the acreage thinned increases—during 1954 approximately 9,000 acres were dealt with. At present in Ireland we have 108,000 acres of plantations aged between five and twenty-five years, of which 36,000 acres is between fifteen and twenty years. There is much work to be done and it is only by planning and foresight that the best results will be achieved.

It is, indeed, a great pleasure to be associated with this lecture, and with the vote of thanks to Mr. Hiley.

MR. MOONEY

To follow Mr. Hiley, and Mr. Sharkey, the progressive and the realists, the businessmen and the economists, all of them true foresters but none of them State foresters, presents for me, at least, somewhat of a predicament. Indeed I am a little uneasy

when I consider what adjective might be appropriately applied to my own case under the circumstances. As a State forester, and I do not limit that term to this side of the Irish Sea, I feel that it might be expected of me vehemently to refute a good part of Mr. Hiley's main thesis and maybe, if I was a State forester on the other side of the Channel I might do so as a matter of principle, but having heard the line of thought and opinion expressed by Mr. Hiley I cannot say but that my own experiences in our Irish forests have led me anywhere but to similar conclusions—so I will have to leave principle to the British foresters and another day.

Most of us here have been reared in the old European school of thought the origin of which lay mostly in traditional German orthodoxy which, in turn, was based on the study and experience of the slow-growing conifers S.P., N.S. and S.F. in the continental and the comparatively dry climates of northern Europe. With this as the core of our outlook we have mainly had to deal with the much faster growing and altogether more vigorous development of the Western American conifers and Japanese larch which so far have grown most effectively in our climate.

I believe that experience of results in light thinnings and the keeping of the ground heavily stocked in some, fortunately, small areas of our older stands has already forced foresters here to march in step with Mr. Hiley's ideas in thinning practice. Foresters here have learned the lesson of how the life of their crop may be imperiled by wind-throw. Such mistakes will not be repeated.

It is difficult to prove this assertion in the absence of proper authentic sample plot or stand data from our forests but we are definitely passing beyond the " little and often " rule of thinning if only for practical reasons.

We have some little experience of dealing with stands which are very heavily stocked and neglected but some very successful and daring thinnings have been done in these stands, particularly S.S., J.L. and D.F., without the much-feared retaliation from wind. I have in mind some S.S. stands which, between twenty-five and thirty years, were reduced from their original stocking to some 600 p.a. The resultant effect of such thinnings on the crown development and vigour of the crop, particularly in D.F. and S.S., have been so clear-cut that the experience gained will undoubtedly be applied to the early stages of the much bigger areas of conifer crops arising out of the plantings of the 1930's.

Most foresters are sound qualitative thinners and can be expected to pay due attention to silvicultural needs of the crop, but it seems time that we came away from the state of " your guess is as good as mine " and took definite steps to ensure, by means of numerical thinnings, that we are not frittering away the economic increment of the crop by hesitancy and over-caution.

I am glad to hear Mr. Hiley remind us that our job as foresters is to grow timber, a simple truism, which it seems to me has often become obscured in the indefinite fogs of silvicultural opinion. With young uprising forests as we have, our main object should be to get to the small and medium saw-log as soon as possible, to assess our potential and give the mills of commerce opportunity to gear to the type of timber being produced, the fixing of ultimate rotations may depend on the assessment of growing stock and future supplies, together with the factual adaptiveness of the timber trade. Eventually we must agree that, subject to the over-riding dictates of sound silviculture, we may finally have to adapt ourselves as far as possible to the eventually evolved needs of commercial sawmilling and pulping peculiar to the needs of the country.

The idea of numerical thinning may have quite a few difficulties for foresters in practical application but the very fact that a forester could compare his thinnings with the accepted number of stems per acre to be removed should lead him away from the oft-heard complaint that " I went as hard as I could at the time but I had to go back into it again in two years and take as many again out."

With regard to the British Forestry Commission 1953 Yield Tables, I cannot see us here making much advance on the degree of thinning in E.L. or S.P. gables which, for instance, cite 335 S.P. per acre at forty years and E.L. 159 stems per acre at the same age. We are, however, developing some very openly stocked young S.P. stands, due to the expedient removal of E.L. from fifty-fifty mixtures, having practically pure S.P. at 20/25 years of age and as little as 300-400 stems per acre on the ground at that stage. I am hopeful that some exceptionally well-developed S.P. stands will arise out of this unforeseen turn of events for E.L. is seldom being retained in our once fashionable S.P./E.L. mixtures.

On the other hand I think we might possibly follow Mr. Hiley beyond the British Forestry Commission Yield Tables in their thinning grades for J.L., S.S., D.F. and other fast-growing Western American species.

I have several incidences in mind where S.S. crops have been reduced to 500 stems per acre at twenty-three years and less in third quality in ordinary uninfluenced qualitative silvicultural thinnings without conscious endeavour to meet Dr. Craib half-way. The B.F.C. Yield Tables give 750 stems per acre as the stocking for twenty-three year old third quality S.S.

Our D.F. here has shown remarkably quick reaction to heavy thinning and even with stands where thinning has been neglected foresters are finding that such thinnings seldom result in any remarkable wind damage.

We have talked a good deal about conifers but before passing along I would like to direct attention to the economic potentialities of the commonplace ash.

This tree, if handled properly and thinned heavily, allowing full-crown development after the good undivided first length has been made, will give a very favourable financial reward at twenty years and onwards. Well-grown ash should bid well to outshine many fast-growing conifers as an economic proposition. Strangely, the value and vitality of ash is at its highest in the early years, i.e., between twenty and thirty years in well-grown stands. I refer to trees of from say 4″ Q.G.B.H. to 10″ Q.G.B.H. or thereabouts which may be used generally for tool handles and sports goods and in particular here, of course, as hurleys. *Proper thinning* is, however, the operative word with ash and it seems to me that it can hardly be effectively grown at stocking heavier than some 100 stems per acre at twenty years. The many and varied other uses for ash in bigger sizes are well known and it is certainly an all-round tree. I do think this point is worth a few moments' meditation for all foresters.

Whilst supporting Mr. Hiley's thesis on the subject of heavy thinnings in general, I think that to myself, silvicultural considerations should always be borne heavily in mind.

For instance, one may see now and again a tendency to very heavy first thinnings of S.S. opening up the ground to the sky in young stands which may only just have overcome their first check and are putting on leaders of 2′ or more. Might this not lead to another check ? It certainly does lead to a tremendous crop of adventitious shoot clusters and one is led to wonder what effect those will have on the timber strength in the eventual boards which may be sawn from such trees. Opinions differ considerably on the problem of green pruning which is raised by such severe first thinnings.

It seems to me that we should be in a hurry and that we have a perfect right to be so, in order that by bold and effective thinnings we may get on to the timber eventualities of our forestry endeavours and find out all the sooner the proper line of general policy. To prolong rotations in quest of possible uneconomic quality trees appears illogical in our case and uneconomic in the face of the facts and figures and not clearly justified on the basis of good silviculture.

I think, although for most of us this is the first time meeting Mr. Hiley, that in forestry we have known him and honoured him for many years. Hiley's *Forest Economics* may have provoked some unkindly thoughts of the author from some, as it certainly did from me, in the student days, but that did not prevent it, with others of his works, being outstanding text and reference books.

In latter years Mr. Hiley has, by writing and endeavour, kept foresters thinking and going forward just as he has told us to-night of his beliefs which, in the not far distant future, may be accepted forestry practice.

To me it is a great honour to speak with Mr. Hiley and I would like to join most heartily in thanking him for coming amongst us and stirring our thoughts and imaginations in this new and all-important part of forestry practice.

MR. MCGLYNN

It is, indeed, comforting to hear an authority like Mr. Hiley state that " there are many good ways of thinning plantations." He has, of course, stressed the point that each different method gives a different result and his figures in support of his statements are convincing.

All good foresters are naturally anxious to establish good plantations and to produce large quantities of timber; but their methods of approach to this problem may differ.

To-night the emphasis is very definitely on early and heavy thinning of plantations and the production of medium-size saw-logs which are economical to grow, to handle and to convert.

Irish foresters appear to be falling into line—whether by accident or design. Not so much by accident ! The idea, I think, has received careful consideration. Most of our plantations are on rather exposed sites, at fairly high elevation, and to make our trees wind-firm we have learned that it is necessary to thin them early and encourage the growth of well-balanced stems. The light thinning methods of our predecessors, as pointed out by Mr. Mooney, have at least taught us a lesson.

How heavily can we afford to thin ? Mr. Hiley says we must not expect a quick answer to the question.

Most, if not all timber producing countries have their own ideas—methods—and standards which meet their own peculiar requirements. The treatment recommended by Dr. Craib for fast growing P.I. and *P. patula* in South Africa appears to be coming into favour even with some of our Irish foresters. Green pruning and wide spacing of these pines may be producing the article required in South Africa in an extraordinary short time—but we have little evidence that we can apply these methods to the trees which we are trying to grow here.

I am in favour of artificial pruning of dead branches to a height of about 22″ on final crop trees where they are between 4″ and 6″ diameter, but I am not at all in favour of creating conditions which make green pruning necessary. It is desirable to produce a fair percentage of high quality timber if we are ever to make it popular on the home market—and artificial pruning is necessary and should pay—costly though it may be. Many countries approaching self-sufficiency in timber have rigid grading systems with a considerable difference between the price of the high and low-grade timber—it should then be economical to grow high-grade timber. In this

country, too, we like good quality materials—we are prepared to pay a much higher price for high quality imported timber even when sufficient native timber of a reputedly inferior quality is available. In future, as in the past, I believe that there will be a ready market for good quality timber and I would not like to see quantity being emphasized at the expense of quality.

With proper silviculture I believe that the trees we are trying to grow will continue to put on an economic increment for a much longer period than thirty years and even fifty-five years. Is the timber put on in the later years of the life of a mature tree superior in quality to that laid on in the middle stage—assuming the ring width to be equal ? There are, I know, many factors in favour of a short rotation—but there are some against as well. There is the problem of building up reserves for an emergency. There is also the cost and difficulty of establishing two crops instead of one—to quote but a few.

Taking all these important points raised to-night into consideration, I believe we should proceed cautiously, have a long-term plan, giving us at least an idea of what we are striving to achieve; study the various methods of thinning applied by ourselves and others; apply the methods which we consider most suitable; record our mistakes and successes so that our work will not be in vain and make it easier for foresters in future to choose the best method of thinning their plantations when they are faced with their problems—in a different world.

STATEMENT OF ACCOUNTS FOR YEAR ENDED 31st DECEMBER, 1954

Income	£ s. d.	£ s. d.
To Balance from last Account	211 15 7	
Less Amount due to Secretary ..	4 19 10	
		206 15 9
„ Subscriptions received:		
1 1st Grade Tech. 1952	1 0 0	
14 „ „ „ 1953	14 0 0	
47 „ „ „ 1954	46 10 0	
1 „ „ „ 1955	1 0 0	
1 „ „ „ 1956	1 0 0	
4 2nd „ „ 1952	2 0 0	
10 „ „ „ 1953	5 0 0	
40 „ „ „ 1954	20 0 0	
1 „ „ „ 1955	10 0	
3 Associate 1952	2 5 0	
15 „ 1953	10 15 0	
94 „ 1954	70 10 0	
5 „ 1955	3 15 0	
		178 5 0
„ Interest on Investments		6 5 0
„ Journals sold and Advertisements		41 14 10
		£433 0 7

Expenditure	£ s. d.	£ s. d.
By Stationery and Printing		37 5 10
„ Printing of Journals ..		132 3 6
„ Postages		21 7 0
„ Expenses *re* Meetings		10 18 4
„ Bank Charges and Cheque Books		1 5 2
„ Excursion Expenses ..		28 18 3
„ Honorarium to Secretary		15 0 0
„ Balance		
In Bank on Current A/c.	220 17 11	
Less Amount due to Secretary ..	34 15 5	
		186 2 6
		£433 0 7

I have examined the above Account, have compared same with vouchers and certify it to be correct, the balance to credit being £186 2*s.* 6*d.* which is on current account at the Ulster Bank, Ltd. There is also a holding of £200 Dublin Corporation 5 % Redeemable Stock 1968/73. Credit has not been taken for Subscriptions for 1951, £1; for 1952, £5 10*s.* 0*d.*; for 1953, £23; and for 1954, £48 5*s.* 0*d.*; which were outstanding at 31st December, 1954.

D. M. CRAIG, *Hon. Auditor*,
85 Harcourt Street, Dublin.

5th February, 1955.

LIST OF MEMBERS, JUNE, 1955

Allman, David, Chair Hill, Bansha.

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Bogue, Maurice, Linen Hall, Drogheda.

Bayley, Major C. J., Lynduff, Woodenbridge, Wicklow.

Boyd-Rochfort, Mrs. Iris, Middleton Park, Castletowngeoghegan, Co. Westmeath.

Bayley, Major E. A. T., Ballyarthur, Woodenbridge.

Beresford Barrett, H., Crocknaraw, Moyard, Co. Galway. ..

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Browne, Brigadier Dominick Andrew S., Breaghwy, Castlebar, Co. Mayo.

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Bryan, Major A. Loftus, Upton Hotel, Kilmuckridge, Gorey, Co. Wexford.

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Conway, Joseph, Cresslough, Letterkenny, Co. Donegal.

Coolattin Estate Co., Coolattin, Shillelagh, Co. Wicklow.

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Campbell, Sean, Aughrim, Co. Wicklow.
Cremin, Kevin, Toherbeg, Roundwood, Wicklow.
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Condon, Liam, 29 Blackrock, Mallow, Co. Cork.
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Desmond, Andrew, c/o Ardee Hotel, Aughrim, Co. Wicklow.
Desmond, John, c/o Mr. Blighe, Killeagh, Co. Cork.
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Egan, D. J., Cappoquin, Co. Waterford.
Enright, Thomas, Newcastle, Ballymahon, Longford.
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Gray, Miss Winifred E., Noam, Thurles, Co. Tipperary.
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Haughton, Alan B., Lichfield, Ballintemple, Cork.
Hunt, Thomas, P.D., c/o Mr. Leonard, Cong, Co. Mayo.
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Moore, Patrick J., c/o Mr. Silke, Ballygar, Co. Roscommon.
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McCartan, Patrick, Cloncormack, Hollymount, Co. Mayo.
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O'Neill, Thomas, Glen of Imaal, Dunlavin, Co. Wicklow.
O'Carroll, Joseph, Forestry Office, Rathdrum.
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O'Rahilly, Aodogan, Moreen, Clondalkin, Co. Dublin.
O'Farrell, Roderic More, Kildangan, Co. Kildare.
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O'Neill, P., c/o Knockatallon P.O., Co. Monaghan.
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Ross, Andrew B., 80 St. Alban's Park, Ballsbridge.
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Ryan, R. C. F. (Captain), Inch, Thurles.
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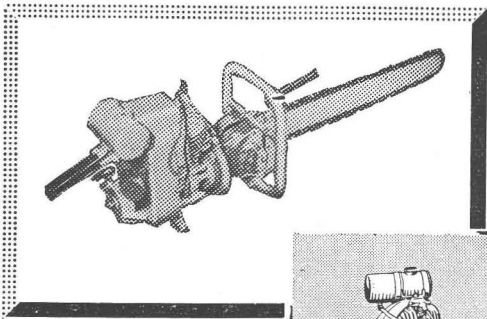
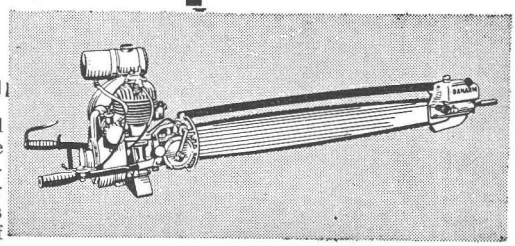


Left : Danarm 'Whipper' lightweight successor to the 'Tornado,' with centrifugal clutch and swivelling gearbox. Standard blade 22½ins.

Below : The Danarm 'Two Man' saw. Cutting capacities up to 7 feet.



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