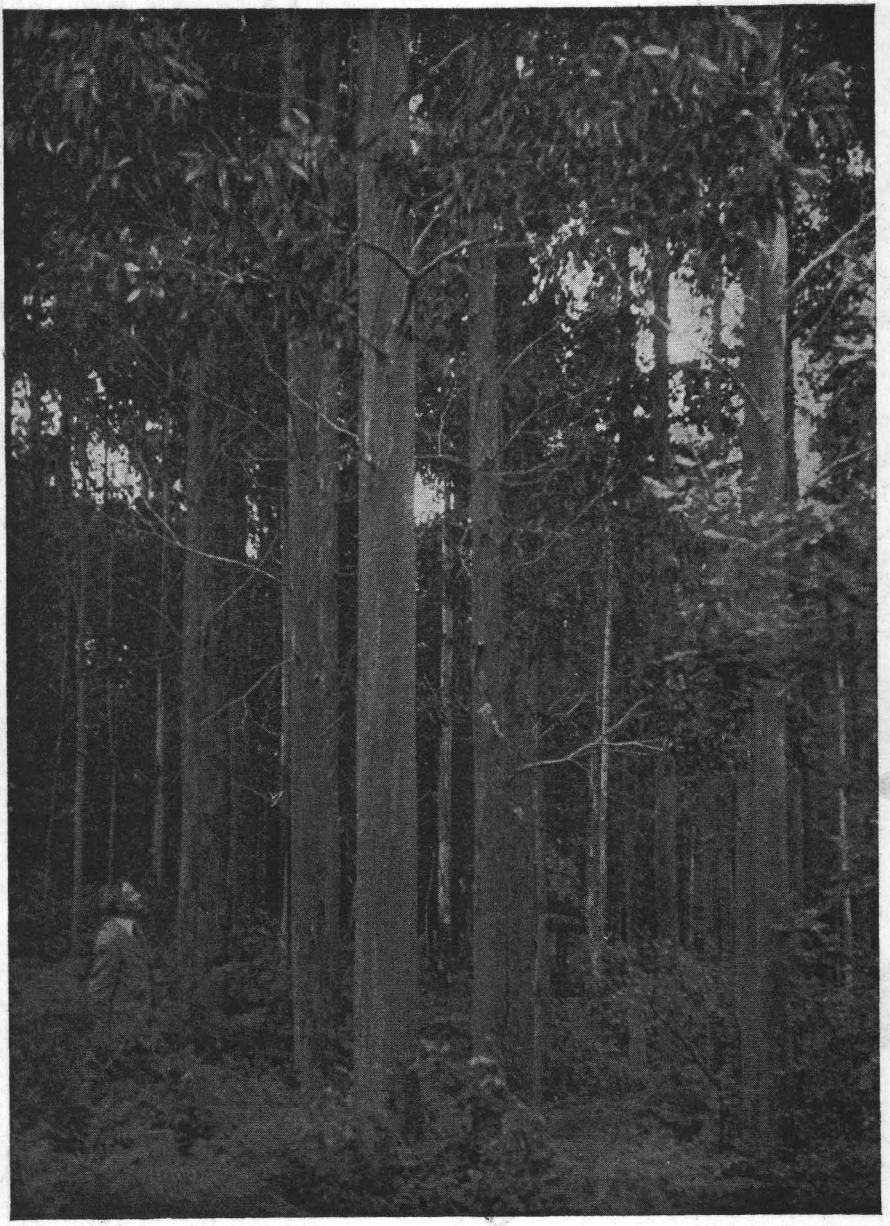
IRISH FORESTRY



Vol. XIII, No. 2. WINTER, 1956 Price 3/-

CONDITIONS OF MEMBERSHIP

(Excerpted from the Constitution)

Article V.—The membership of the Society shall consist of two Orders, namely: Technical and Associate.

TECHNICAL MEMBERS shall be persons desirous of promoting the object and at the time of election resident in Éire, who are employed for their whole time in forestry or any branch of natural science closely connected with forestry, or who have been so employed for at least five years, or who, though not so employed hold a degree or diploma in forestry of a recognised University or College, in all cases subject to the approval of the Council.

TECHNICAL MEMBERSHIP shall be divided into two grades, namely:—

Grade 1—Being Forestry Inspectors; professors, lecturers, graduates or holders of diplomas of Universities or Colleges; Head Foresters, and others of an equivalent status.

Grade 2—Being Foresters, Foreman Foresters and others of an equivalent status, including students at Universities or Colleges, not being restricted to Grade 1.

ASSOCIATE MEMBERS shall be persons desirous of promoting the object but not qualified for technical membership, subject always to the approval of the Council.

Members shall subscribe annually to the Society's funds according to the following scale of subscriptions:—

Technical Members, Grade 1, shall pay	£1	0	0
Technical Members, Grade 2, shall pay		10	0
Associate Members shall pay		15	0

Membership Application Form

I desire to become a member of the Society of Irish Foresters, and enclose Cheque/P.O./M.O. for ....., being subscription for year .....

Full Name .....

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Block Letters

To be forwarded when completed to the Secretary at Albert Agricultural College, Glasnevin, Dublin. For conditions of membership see over.

If you prefer to utilize a Bank Draft, kindly pass this portion of the form to The Secretary, Society of Irish Foresters,

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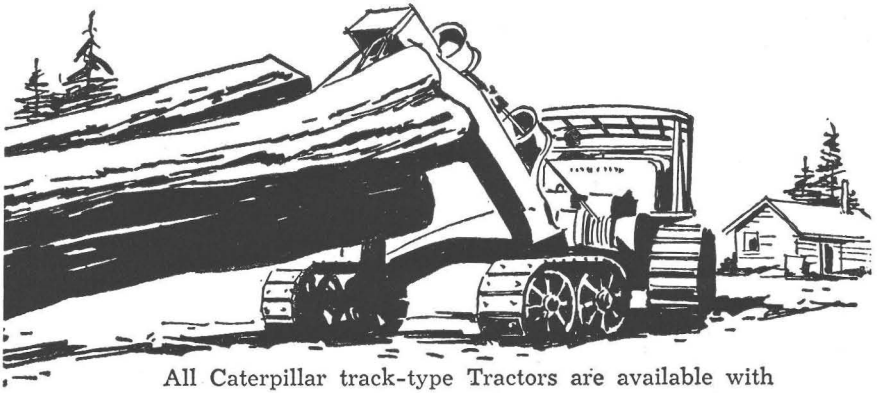

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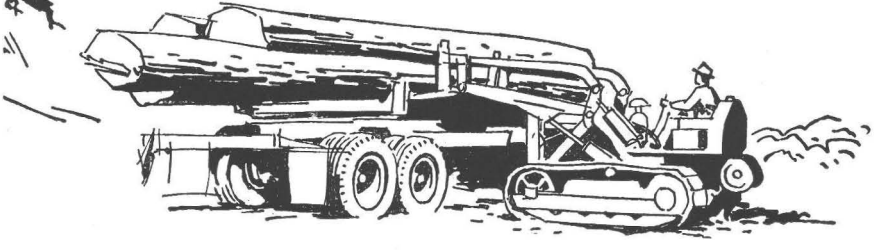

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IRISH FORESTRY

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(The views expressed in the articles and notes in this journal are not necessarily the views of the Editor or of the Society of Irish Foresters.)

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IRISH FORESTRY

VOLUME XIII WINTER NUMBER 2

Editorial

The Journal.

OUR predecessors in Irish forestry accomplished a great deal of creditable work and it is our responsibility not only to maintain the standard of efficiency set by them but to raise it. This we can do by constantly endeavouring to advance our technical knowledge and by applying that knowledge in such a manner that the productivity of our plantations may be increased.

One of the most useful aids to achieving that objective should be the Society's journal, "Irish Forestry." By its means we should be able to keep ourselves informed of modern technical developments and trends. It should be a medium for exchanging views on different aspects of our work and, through contributions from members, should express something of modern forestry thought. Unfortunately, however, maximum use is not made of the journal in these respects. It is a regrettable fact that the procuring of suitable material for publication in it has been a perennial "headache" for successive editors.

It is strange that while we foresters are well known for the cheerfulness with which we impart information on our work to others and while we may spend hours of our leisure together "chopping wood" we are very much inclined to fight shy of going into print. This is a pity because in addition to our having the technical knowledge acquired in the course of our formal forestry education and training we are, as a body, the possessors of a great amount of unusual and useful forestry lore gleaned through first-hand experience and close observation. It is very desirable that this information should not be interred with our bones but that it should be recorded and go to form a corpus of knowledge so that not only our contemporaries but also our successors may derive benefit and inspiration from it.

This journal, being the only periodical in the country devoted entirely to forestry, is the ideal vehicle by which the best ideas of to-day can be presented and by which objective observations can be passed on to the foresters of the future.

It is very desirable that the supplying of matter for publication should not be left to a small band of more or less regular contributors. There is no forester that has not got his own individual views which may be of great value and certainly would be of great interest to his

fellow members. Neither is there any forester who is not well able to express his ideas; all that is needed is the will to make the effort.

Foresters are, therefore, requested to contribute articles or notes on any of the various aspects of forestry with which they are familiar. Among possible subjects which spring to mind are labour saving devices or any aspect of the rationalization of forest work; unusual damage by insects, disease or climatic factors; behaviour of exotic species in different parts of the country; accounts of local forests, their history, composition, the type of work carried out, the problems encountered and the methods employed to solve them. It is well recognised that, very often, small points are of the utmost importance and that by recording what may seem to-day an unimportant observation somebody in the future may be enabled to obtain the answer to some perplexing question.

In forestry no less than in any other business mistakes will be made. These should also be recorded especially if by so doing others may be helped to avoid the same pitfalls.

A few years ago the Society offered to pay for contributions to the journal in the hope of overcoming the shortage of material. Recently the council in reviewing the position decided that as this offer had not influenced the volume of matter submitted for publication and as the idea was not altogether in accord with the spirit of the Society the offer should be withdrawn. It was felt that contributors got more satisfaction from the realization that their efforts played some part in the advancement of forestry than they got from any monetary reward that the Society may have been able to offer. We are confident that in this view all members will concur.

Our Advertisers.

A special word of appreciation is due to the many firms who have steadfastly supported our Journal by their advertisements during the past years, and in fact without their support it is doubtful if we could have consistently maintained the twice yearly publication of "Irish Forestry" since its foundation.

With these words of thanks we are expressing the appreciation of our members and in particular our councillors past and present, who have frequently paid vocal tribute to our advertisers in private Council sessions.

While many of our loyal advertisers maintain their insertions entirely from motives of support for our Society, our council members, and in particular our Business Editor, are fully conscious of the fact that advertising must pay by way of increased sales for the particular goods or services. Here we feel that our advertisers are getting fair

value, for although "Irish Forestry" has a limited circulation it has a highly selective circulation—reaching a reading public which is 100% interested in forestry and timber or related activities, be they land-owners, timber merchants, nurserymen or practising foresters. Moreover, our Journal circulates to all Government Departments, Public Bodies and important private firms, which collectively have a high purchasing capacity,—a prospect which is further enhanced by the fact that forestry and timber are expanding industries with a vast potential market lying ahead. We ask our members to support to the utmost the firms who are supporting us.

Concerning Eucalypts.

In an article relating to Australian forests which appears elsewhere in this issue mention is made of the fast growth of eucalypts in that country and of some eucalypt species likely to succeed in this part of the world. This is stimulating information.

The eucalypts, whose native habitat is Australia, form an important and versatile genus which owing to their rapidity of growth are worthy of close study in this country.

In an account of the congress of the International Union of Forest Research Organisations held at Oxford last July we can read that a delegate from East Africa reported that in his area *Eucalyptus saligna* had shown a growth of 35 feet in 23 months. It produced fuel in four years and saw-timber for permanent houses in eight to ten years. This rapid growth was, of course, due to a great extent to the fact that the seasons were such that there was no noticeable slowing down in vegetative activity.

The eucalypts are not entirely unknown in this country and some fine specimen trees and trial plots are to be found in private collections and on state forest lands.

At Avondale, Co. Wicklow, small trial plots were laid down by the Forestry Division of the Department of Agriculture and Technical Instruction as far back as 1908 and during the period 1934-37 a further number of plots was laid down in various state forests. Some of these give proof of the suitability of certain species to at least the milder parts of this island and of the rapid growth of many of them—in some plots trees 90 feet high and 10 inches Q.G.B.H. have been produced in 22 years. They also show the eucalypts' adaptability to varying soil conditions and the fact that many are growing satisfactorily on dryish bilberry-heather slopes makes them seem an attractive proposition for large scale planting and prompts the laying down of trial plots on our poorer peat areas.

So far in this country we have scarcely any experience of handling mature eucalypt timber but experience from abroad indicates that we

may expect some trouble from brittle heart, veins and pockets of gum and that during seasoning there may be uneven shrinkage, internal splitting and buckling. These defects are overcome to some extent by quarter-sawing and special methods of drying.

The production of saw-timber need not, however, be the only object in the cultivation of this genus. The timber is also suitable for pulp and is widely used in the cellulose industries in some countries notably in Australia, Spain, the Union of South Africa and Brazil. According to an F.A.O. publication, entitled Eucalypts for Planting, Portugal possesses the oldest eucalypt paper-pulp mill where sulfite pulp has been made from *E. globulus* for 50 years. Other uses are fibreboard, pitprops, fencing material, firewood, charcoal, tannin and essential oils.

It would appear that in most of the countries in which the genus has been introduced foresters have taken advantage of its great rapidity of growth by working their stands on rotations of 7 to 15 years; quantity not quality is, of course, the aim under such management. The eucalypts lend themselves well to such a system as owing to the fact that most species coppice freely no replanting is necessary. Viewed in that light they would seem to be particularly suitable for the private land owner in this country as they would quickly provide a constant supply of rough timber of all types which are needed on a farm such as boards, poles and paling posts.

Up to the present the private planter has had some difficulty in getting seeds of this tree group. This need no longer be an obstacle as in the current F.A.O. Forest Seed Directory there is an offer from the Forestry and Timber Bureau of Canberra, Australia to arrange the supply of small quantities of seed of 118 different species. The price of small packets of any species would be five shillings including cost of freight. Sample packets would contain from $\frac{1}{8}$ to $\frac{1}{4}$ oz. depending on the cost of collection, seed size, purity and viability. The number of seeds per ounce varies considerably according to species—from 500 to 50,000—but the average is given as 3,000.

Of the comparatively small number of species tried in this country the following, all of which are of commercial value, have proved generally hardy: *E. delegatensis* (*gigantea*), *E. dalrympleana, E. viminalis, E. radiata, E. globulus, E. johnstonni* (*muelleri*) and *E. urnigera.* Seeds of all but the last two mentioned are available from the Timber Bureau. *E. delegatensis* is probably the hardiest of all of those tried but it has the disadvantage of not being capable of throwing up coppice shoots.

Orders for eucalpt seeds should be sent to:

Mr. G. J. Rodgers,
Director General,
Forestry and Timber Bureau,
Canberra A.C.T.

Eucalypts need special nursery treatment owing to the fact that they are very frost tender during the first year or two and also that bare-rooted plants do not survive planting out very well. For the benefit of any interested readers a short note on this subject appears in this issue.

Visiting foresters envy us this climate of ours which makes possible the successful cultivation of so many exotic species. The cultivation of eucalypts could well be one of the most rewarding ways of turning this natural advantage to better account. In view of the gap that exists in this country between production and requirements of wood and its derivatives the project seems particularly desirable.

Some considerations in connection with the Thinning of Conifers in Ireland.

By P. F. O'KELLY

IN modern scientific forestry thinning is of paramount importance but unfortunately our experience of it is limited to 15 or 20 years in scattered small blocks up and down the country. Furthermore our climate is exceptionally favourable to species from the North American continent and Japan and, wisely or otherwise, we have used a lot of these exotics—*Picea sitchensis, Pinus Contorta, Pseudotsuga taxifolia* and *Larix leptolepis* being the species mostly used—so that thinning techniques in Britain, which would approximate more closely to conditions here than would those on the European continent, may not always suit especially in the South of Ireland. One has only to glance at crops of *Picea sitchensis* and *Pinus contorta* in the South to realise that the rotation for either species on the evidence to date will, in certain places, be considerably shorter than was anticipated.

Analysis of the Problem.

Forest capital consists of the land plus the trees growing on the land plus improvement, engineering and protective works but mainly it consists of the land plus the trees. The trees are the means by which the interest is got from the capital (land and trees) and in a forest the interest is the annual increment in wood which the land and the trees produce. Thus if the productive capacity of the land is impaired or if the crop is handled in such a way that the trees which are an integral part of the capital cannot assimilate the full timber producing capacity of the land then the capital is *ipso facto* reduced and with it a consequent reduction of the rate per cent. (the annual increment) it yields.

Good thinning increases the value of the crop and improves its quality; it gives an intermediate yield which offsets to some extent the cost of thinning; it insures that the interest on the capital—the annual increment—is added to the capital in the most advantageous manner possible—in other words the productive capacity of the land is apportioned to exactly the right number of good stems.

Thinning is the most important aspect of management because good practice in establishment and maintenance can be negatived for quite a number of years by injudicious thinning; a vigorous stand that is successively thinned too lightly or a near stagnant one that is thinned too heavily may be damaged for many years to come resulting in an unnecessary lengthening of the rotation which represents a considerable increase in the charges on the stand. As an example let us assume that an area of land is acquired for afforestation at a cost of £500 (including

the price paid for the land and the fees for transfer of title) and that establishment costs another £500—a total outlay of £1,000. If this sum is borrowed at 5% compound interest and if the crop can be harvested in 45 years then the charges on the stand (excluding the summarised future value of maintenance costs) will be £8,985. If, for one reason or another, the crop is not harvested until it reaches its 50th year then the charges will be £11,467. In other words a lengthening of the rotation for a period of 5 years puts an extra £2,482 on to the charges on the crop.

This idea of shortening the rotation is fraught with danger if it is carried too far; it represents the viewpoint of the economist who will try to have short rotations and thus realise a quick return on the capital invested. Forestry is, however, a long term policy so the forester must never lose sight of the fact that the land is in fact the most important part of the capital of forestry. He must endeavour to improve it from one rotation to another until its optimum in productiveness is reached. If he should do anything that would impair the productive capacity of the land he is faced with the prospect of diminishing returns. For this reason a shortening of the rotation should be in conformity with good silvicultural practice and then and only then would it be permissible.

We must also bear in mind that our resources are not unlimited and that imports of timber represent a big drain on these resources so that if we decide that logs of a given size—say an average log measuring 30 feet by 12½ inches Q.G. mid. from each stem in the final crop—will meet the nation's requirements for lumber the sooner we can produce them the better. If, by systematic thinning as against hit or miss methods, we can harvest a crop as little as 3 or 4 years earlier we will be able to show a big reduction in carrying costs and a lessening of imports.

Thinning.

Before a decision regarding the degree of severity of any particular thinning is reached the following factors always should be taken into account as then there is less liklihood that any bad mistakes will be made.

1. Windfirmness of the species.
2. Powers of recovery of crown.
3. Suitability of one species as compared with another or others in mixed woods, either from the silvicultural or economic viewpoint or from both.

1. Windfirmness of a species will have a direct bearing on the severity of a thinning and in the case of shallow rooting species on wet or soft sites it will dictate early and rather heavy thinnings on the assumption that attack is the best method of defence as against a supine policy of a little and often which must be adopted if the stand is

allowed to go to the point where a heavy thinning might result in extensive windthrow.

2. Power of recovery of crown where it is poor in light demanding species may dictate heavier early thinnings than volume and stocking would indicate. It will also affect policy with regard to the various stands in a particular thinning cycle—those stands with species in which the power of recovery of crown is poor receiving attention first. If crowns have dwindled considerably a policy of *festina lente* will have to be adopted.

3. Preference for one species over another or others in reasonably well stocked mixed stands will have to be decided on and *ceteris paribus* the species to which preference is given will be kept.

So much for these safeguards. The salient point is that a crop requires to be thinned and we want to treat it in the best manner possible. We want to apportion the productive capacity of the soil (the mean annual increment) to the exact number of good stems that can *readily* assimilate that capacity and at the same time keep up or improve the productiveness of the soil itself. For those whose experience of thinning is limited and oftentimes too for those with fairly extensive experience there is some doubt about the severity of a thinning. Is it too heavy or too light? If the various stands in the thinning cycle are nearly all in the one age group and if the quality class does not vary considerably it is not too bad but where the stands vary both in age and quality class it is more difficult to manage them because thinning technique must vary to suit each stand.

First Thinnings.

In Ireland most of the regeneration is artificial and planting is done in straight lines at a particular spacing usually from 4′ × 4′ to 6′ × 6′ spacing. Crops are mostly coniferous either pure or mixed so that it would not be absolutely beyond the bounds of possibility that one could find an even-aged, pure coniferous stand fully stocked and uniform in regard to height, girth and crown spread.

In other sciences it is not unusual to make use of suppositions and to arrive at a result by the process known as *reductio ad absurdum* so it might be worth a trial in this case.

Let us assume then that such a stand could be found and that in addition to the above it was a vigorous stand planted in straight lines at a 5′ × 5′ spacing. Now if a 5′ × 5′ spacing was sufficient for the crop up to the pruning stage an extra 2 ft. spacing could not be deemed excessive to carry the crop through the period from pruning to just before second thinning. Assume that the spacing is increased by 2 ft. either way to 7′ × 7′. Such a spacing would represent a reduction of

the original stocking of 1742 to 889 stems per acre standing after T1. In other words roughly half the crop would be removed.

Now if such a hypothetical stand did exist how could it be thinned? We could represent a portion of the stand diagramatically thus :

. . . .
. . . .
. . . .
. . . .
. . . .
. . . .

and we could proceed to thin it as follows (x's represent the stems removed in thinning). Remember that every stem in the stand is supposed to be uniform and straight.

x . x . x . x . x
. x . x . x . x .
x . x . x . x . x
. x . x . x . x .
x . x . x . x . x
. x . x . x . x .

Note that exactly half the crop is removed and that the spacing is 10 ft. × 5 ft. with the stems staggered in the lines. Also that the stocking after thinning is roughly the same as that given by a 7 ft. × 7 ft. spacing and that it is in fact a line thinning and that the lines taken out run diagonally.

Now let us get back to reality to see how the results arrived at in the hypothetical case compare with it. From experience we know that the average stocking of normal coniferous stands at the pruning stage will be roughly $\frac{7}{8}$ of the original stocking at initiation; deaths and "misses" will account for $\frac{1}{8}$ of the original number of trees planted. Normally weeding will reduce the stocking of the stand by a further $\frac{1}{8}$ so that we arrive at first thinning with something less than $\frac{1}{4}$ of the original stocking being removed. Now a first thinning at the rate of 1 in 4 is about normal so that the stocking after T1 is generally something greater than half the original number. But mark that I am speaking of vigorous crops in which the spacing is not greater than 6 ft. × 6ft. or less than $4\frac{1}{2}$ ft. × $4\frac{1}{2}$ ft. Therefore the hypothetical case does in fact approximate pretty closely to the result we get in reality.

Now it is not unusual to find young even-aged, fairly uniform, vigorous crops that are reasonably well stocked. Such crops, provided the original spacing was not greater than 6 ft. × 6 ft., can be thinned successfully and easily by a variation of the method used in the hypothetical case above.

Take three lines at a time and proceed as follows. Mark the centre

stem of the first three stems and the outside stems of the next three stems as shown in the following illustration.

.	x	.
x	.	x
.	x	.
x	.	x
.	x	.
x	.	x
.	x	.

Continue to do so until you find that a good centre stem is being marked leaving two inferior outside stems or, *vice versa,* two good outside stems are being marked leaving an inferior centre stem. Then mark the inferior stems and let the good stems stand. The following diagram will illustrate what should be done in such cases. (G represents good stems P represents inferior stems and stems with * thus are marked for removal).

G*	G	P*
G	P*	G
P*	P	P*
G	G*	G
G	G*	G
P*	P	P*
G	G*	G
G	P*	G
P*	G	P*

In the fifth set of threes the two outside stems should be marked for removal according to the rule but the centre stem is taken instead and you continue after that according to the rule until the next variation is met with.

From observations I have found that a vigorous dominant stem or a group of 2 or 3 dominant stems will usually have an equal number or more inferior stems in their immediate vicinity so that a thinning carried out by this method will rarely result in bad spacing. After a little practice it will be found that weeding and first thinning can be done together which is an important thing if staff is inexperienced and the area to be gone over is large. By this method most of the rubbishy stems except those required for ground cover in fairly large openings are removed.

Second and Subsequent Thinnings.

In T1 we got rid of all inferior, deformed stems together with some of the better stems leaving us, insofar as it was possible to do so, with a crop of good stems spaced in such a way that the annual increment was apportioned to them as evenly as possible. How are we to set about marking the second or any subsequent thinning?

Is there any rough and ready method of making a quick and at the same time a reasonably safe assessment of the condition of a given crop —whether it needs to be thinned and if it does what should the stocking be after it is thinned? There is but the method cannot be used in crops whose total average height does not exceer 40 ft. In such crops the following relationships will generally hold good. It will be found to be somewhat inaccurate in respect of certain species like *Pinus contorta* and *Larix leptolepis* but it has this advantage that it errs on the safe side so that it will never lead to too drastic a thinning in any species.

$$\frac{\text{Total Height}}{4} = \text{Crown length}$$

$$\frac{\text{Total Ht. called inches}}{8} = \text{Q.G. B.H.}$$

$$\text{Q.G. B.H. called feet} \times 1\tfrac{1}{2} = \text{Spacing.}$$

Thus if a stand of sitka spruce, to take an example at random, had an average total height of 56 feet a rough and ready evaluation of its present condition can be made quickly by comparing it with the results given by the foregoing formulae. If its average Q.G.B.H. is 7 inches or thereabouts (allow $\frac{1}{2}$ to $\frac{3}{4}''$ either way) and the stocking per acre is 395 stems (allow 50 stems either way) (7 ft. $\times$ $1\frac{1}{2}$ = $10\frac{1}{2}$ ft. spacing) then the crop is fairly normal and does not urgently need to be thinned. If the stocking was much less than 395 it would indicate that the stand had been thinned rather heavily. If the stocking exceeded 395 stems per acre by 100 or more stems it would mean that a thinning was due.

To reiterate, the above formulae are just a rough and ready though safe guide for crops whose average total height is not less than 40 feet.

Now whether we continue to thin by hit or miss methods or to conform in a general way with the foregoing rough guide we are still in doubt. In the case of *Pinus contorta* or *Larix leptolepis* we may be thinning too lightly and thereby lengthening the rotation unnecessarily or in the case of *Pinus silvestris* we may be thinning too heavily thereby reducing the quality of the timber and possibly the fertility of the soil.

In my spare time I have been toying with the idea of formulating some method by which we would be able to say that a particular thinning is exactly right—that this is the type of thinning that will give us a final crop in the shortest time without impairing fertility—in other words the perfect thinning.

We all know that nature has an unhappy knack of upsetting most of our forecasts and calculations but generally we can forecast with the prospect of a reasonable amount of accuracy for the period between one thinning and another provided that the cycle is not unduly long.

In each and every stand there is at least one concrete result—a result which the soil plus the trees growing on it have combined to produce—the actual volume of the stand. The stand may be quality class I by comparison with yield tables or it may be stagnant due to inhibitory growth factors, the crowns of the trees may be much too small or the stocking too great in other words be the stand a good one or a bad one the total volume is the measure of the actual performance of this combination of land and trees to date. And total volume, to risk giving a definition, is the sum total of annual increments from initiation to date.

If volume is the sum of the increments how is increment put on? Increment is put on in two ways. Height increment by the elongation of the growing tip of the tree and girth increment at the cambium layer by a succession of concentric, expanding rings just under the bark. Thus we have two concrete results of the performance of each individual tree in the stand—Average annual height increment $\frac{\text{(Total Height)}}{\text{Age}}$ and Average annual girth increment $\frac{\text{(Total basal diameter)}}{\text{Age}}$

As well as this we have a ready made record of year by year girth increments in the form of annual rings. So that we have three concrete results on which to base our calculations namely the mean annual increment, height increment and girth increment. Furthermore we can assume that fertility will not decrease in the immediate future and that a good thinning, assuming the stand to be in a reasonably normal condition, will result in an *increase* in girth increment of the individual stems and possibly in height increment also. So that if we assume that height increment will not increase we must, perforce, agree that the girth increment per stem will because a greater circumference automatically gives a bigger girth increment even if there is no increase in the width of the annual rings. So that if the soil has been capable of producing a given number of rings to the inch on an average since initiation it should continue to do so after a good thinning.

Therefore we should now be in a position to find out the number of trees that can readily assimilate the productive capacity of the soil if the spacing of the stems is reasonably well attended to during thinning.

The following formula subject to the condition specified below should give the ideal stocking per acre after thinning and thereby indicate the severity of the thinning.

The average of the mean annual increments $\div$

$$\frac{\left\{\begin{matrix}\text{Forecast total volume} \\ \text{(true measure)}\end{matrix}\right\} - \left\{\begin{matrix}\text{Present total volume} \\ \text{(true measure)}\end{matrix}\right\}}{\text{Estimated number of years in the cycle}}$$

The number of years in the cycle will be governed by the vigour of the stand and will vary from $2\frac{1}{2}$ to 5 years. The forecast volume will be governed by the height increment and the girth increment over a period equal to the length of time for which the forecast is made. Thus if we say that we decide to forecast volume 4 years hence we base this forecast on the figures given by the actual performance of the average stem over the past four years.

Theoretically the formula is correct but the accuracy of the results it will give will depend on the accuracy of the figures used. For this reason the *average of the mean annual increments* for the various species and the various quality classes will have to be ascertained and compiled into table form. For recognition and classification purposes in the field these tables should also give height increment, diameter increment, age and volume. The relative form factor should also be given in the tables. Since all volume must be calculated to give true cubic contents a table of basal areas in square feet to 3 or 4 places of decimals should be appended. Under no circumstances should volume be estimated either by the "square of quarter girth" measurement or by the "die square" measurement. The form factor used to estimate present total volume should be used also for estimating the forecast total volume as no appreciable variation in the value of the form factor could be envisaged for the short period between one thinning and another except perhaps in young crops.

As an example let us assume that we are about to thin a stand of sitka spruce classified as quality class II from the tables; that the average of the mean annual increments is given as 260 cubic feet per acre, the height increment of the average stem has been $2\frac{1}{4}$ feet per annum, and diameter increment 8 rings per inch or $\frac{1}{4}''$ per annum; the relative form factor is given as 0.42 and the cycle is to be 4 years. (The length of the cycle will be ascertained by an examination of the annual rings; a reduction in the width of the rings below the average since the last thinning indicating the length of the most suitable cycle). If present height is 34 feet and present basal diameter is 5" then the forecast height will be 43 feet and forecast diameter will be 6".

$$\begin{aligned}
\text{Present total volume} &= \text{Height} \times \text{basal area} \times \text{form factor.} \\
&= 34 \times 0.13632 \times 0.42 \\
&= 1.9463 \text{ cubic feet} \\
\text{Forecast total volume} &= 43 \times 0.1963 \times 0.42 \\
&= 3.5451 \text{ cubic feet} \\
\therefore \text{ Difference} &= 1.5988 \\
\text{Divide by length of cycle (4 years)} &= 0.3997 \\
\therefore \text{ Stocking after thinning} &= \frac{260}{0.3997} = 650
\end{aligned}$$

Unfortunately I have had no opportunity of finding out how

accurate the above formula is in practice but the results it gives for a given height and basal diameter appear to be somewhat similar to the stocking given in Revised Yield Tables for Conifers in Great Britain.

Considerations affecting costs.

Thinning—and by this I mean the severing, brashing and extraction of the stems to suitable loading sites—is, along with road making, the most expensive operation in forestry. But there is this difference that whereas the cost of the road is a charge on the forest as a whole and it is normally spread over 4 rotations the cost of thinning is charged against the individual stand to the end of the rotation. Any means of reducing the cost of thinning, therefore, should not be neglected.

Accessibility is a factor that affects both the sale and the price received for thinnings. A prospective customer will buy more readily and pay more for material that is both accessible and easily loaded. In first thinnings the value of the material removed is rather low; in fact it had little or no sale value until the wood pulp mills began to operate. But the cost of the first thinning, because it must be carried right through to the end of the rotation, will increase the carrying charges on the crop considerably. Therefore any outlay within reason that would effect a sale of this type of material is justified.

If the thinning of norway spruce stands is done from mid November to mid December an extra return can usually be got from the sale of Christmas trees from selected tops. At any other time of the year this material is either unsaleable or its value as brushwood is very low.

If extraction is done to ride lines the cost of extraction is considerably increased. Extraction lanes can be cut out in young crops by removing one line of trees every 44 yards and if the thinnings are piled in convenient lots along these lanes the shorter draw will effect a considerable saving.

Each lot of poles should rest on two or three short lengths of timber. This makes for ease in handling the poles as well as preventing decay from being in direct contact with the soil. Lots should be "faced" in the direction in which the poles will be taken out—that is butt ends should face the direction in which they will be removed.

It is not necessary to snag very light inferior poles unless there is a ready sale for them as bean stakes etc. Neither is it wise to snag any pole past a certain point except perhaps in the case of scaffolding poles. Tops should be cut off when the diameter is $2\frac{1}{2}''$ or $3''$ as it is both a waste of time and money to continue snagging beyond this point.

The men employed to carry out the thinning should work in squads of two or four, preferably four, and they should fell and snag only as many stems as they can drag out before they finish work for that day. If the men employed at severing the stems know that they will not have to snag them and carry them out they usually fell them this way

and that so that butts face the wrong way and oftentimes they throw the poles across one another so that snagging is difficult and extraction more troublesome with a consequent rise in costs.

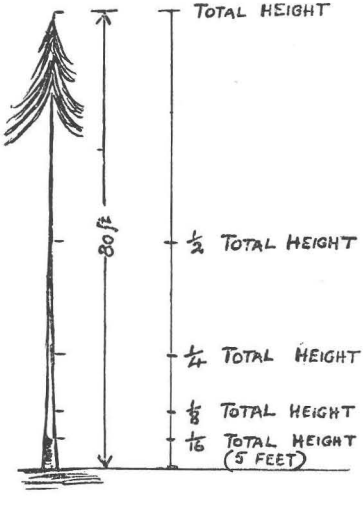
Small suppressed living stems need not be cut out inasmuch as they are "out of the running" as far as the canopy is concerned and they also afford a certain amount of soil protection. Besides the cost of cutting and extracting them would not be recouped by the amount their sale would realise.

The removal of very large stems—almost wolf stems—in an otherwise uniform crop is not recommended if they carry a straight bole for 20-25 feet or more. The adjoining suppressed stems may not recover after the removal of the large stem and even if they did their total value as lumber would be much less than that of the large stem for many years to come.

If the rate of thinning were much too heavy—besides being potentially harmful to fertility—it may represent an added expense which will have to be borne by the crop at compound interest to maturity.

Estimation.

In estimating the height of a tree without the aid of an hypsometer I have found the following method to be reliable. Stand back from the tree at a distance from which you can view the whole length of the stem without raising or lowering your head. Then visually divide the tree in half and having made a mental note of the half way mark on



the stem divide the lower half in two and continue to do so until you reach a height that can be measured (normally heights will not exceed 120 feet so that more than 4 divisions of the stem will not be needed to get a height that can be measured). This height multiplied by the inverse of the fraction that represents it will give total height.

Five feet is a height that can be measured so you multiply $5 \times 16/1$ to get the total height.

Stocking per acre can be estimated from sample plots—the triangular 1/10 acre plot is easy to count—but any other one of the well known methods may be used.

Spacing.

A fairly uniform spacing of the stems that will remain after the thinning is important insofar as it gives each stem a chance to benefit from the increased growing space resulting from a decrease in the stocking. Of course it would be foolish to sacrifice quality for exact spacing so that at all times one is obliged to leave small groups in places but nevertheless even spacing should be aimed at where possible.

Marking the Thinning.

Tne marks on the stems to be removed should be easily seen from a distance of 20-25 feet and the marks should be made on the sides of the trees in the direction in which the thinning is being marked. Thus if you mark from East to West all the marks should be on the Western side of the stems. This is so because in thinning a decision in respect of the trees to be marked in a particular group will be influenced to a degree by the trees already marked in the adjoining groups and those that will be marked further on if one is to avoid either irregular spacing or a too severe opening of the canopy.

In marking a first or second thinning it is advisable to have a helper to mark the trees. He should be both lively and intelligent and have a good memory for marking the trees pointed out to him because besides being a waste of time it is very distracting to have to turn back and point out the trees a second time.

It requires a good deal of concentration to mark a good thinning and for this reason one should never carry on a conversation while marking. Neither should one try to count the trees being marked.

It is inadvisable too to continue to mark thinnings after one gets tired and there is nothing that tires the man marking the thinning more quickly than to stand at the base of a clump of trees looking up into their crowns in an endeavour to reach a decision. Instead make a provisional selection from a distance of 10-12 yards then walk up to the clump or group and having ascertained that the boles of the trees that will remain are straight see if the crowns of the group justify your

provisional selection. Then if all is well mark the doomed stems quickly. If unable to reach a decision pass on and in all probability inspiration will come on the return journey.

When marking on a steep slope start at the lower side,follow the contour of the ground while marking and of course, mark the trees on the upper side. This allows felling to be started on top of the hill and to proceed downward on a broad front the trees being thrown up hill to reduce damage and facilitate extraction.

Can the practice of marking the trees to form the final crop be recommended? Yes, but with this reservation; it should not be attempted until after the third thinning and it should include as many more trees as will form the final crop so as to obviate the danger of mechanical or other damage to the selected stems. It has this to recommend it that one need not be too well versed in thinning to remove the more obvious of the stems as time goes on.

If extraction lanes are being marked the stems to be removed should be marked on both sides and the lines flanking the lane should not be marked until the thinning is done because there is a danger that one may mark them too heavily.

Costs.

The cost of thinning will vary with the volume per acre being removed, the size of the trees and the degree of difficulty of working on the terrain but a good average figure is 25 man-days per acre. Assuming for estimation purposes that the number of working days in any year is 250 then one man will deal with 10 acres of thinning annually.

The operation of thinning is sub-divided further into the following

(1) Severing, de-branching and cross cutting.

(2) Extraction and piling in lots.

For light thinnings in which the poles do not exceed 2 cubic feet and where they are dragged to extraction lanes at 44 yards apart the cost will generally work out as follows

$\frac{5}{8}$ of total cost of thinning = cost of severing and de-branching.

$\frac{3}{8}$ of total cost of thinning = cost of extraction and piling.

Conclusion.

Thinning is a laborious job of work when you consider that you must walk anything from $1\frac{1}{2}$—2 miles to mark an average acre of thinning. The ground generally is uneven and as often as not there is a dense growth of briars etc. on the floor of the stand. Unfortunately you cannot keep your eyes on the ground and on the canopy at the same time because they are "poles" apart with the result that you will

stumble often enough and possibly get an occasional fall which is not always followed by an ejaculation such as "Goodness me." And it may yet come to pass that foresters will make a contribution to the list of occupational diseases; like "housemaid's knee" they may add yet another known as "forester's neck". But joking apart if we have to thin, and thin we must for success, then if it is worth doing at all it is worth doing well.

A note on Peat Afforestation with special reference to work carried out in Cloosh Valley, Connemara.

By T. Ó Gruínéil

THE extent of blanket bog in Ireland makes the successful utilization of some of it for forestry purposes work of considerable national importance. Indeed the establishment of an economic tree crop on these areas is a challenge to the skill of the modern forester. The difficulties with which he is faced are great but it is only the defeatist who will say that they are insuperable. After all there is proof in these bogs that high forest of pine, oak, birch, etc. once grew on peats similar in composition to those with which we are dealing to-day. Even allowing that those primeval forests were different in some respects from those of our own time it can be concluded from a study of the tree stumps that can be found deep down in the peat that the climatic conditions under which they grew were much akin to those obtaining at present. Coming to more recent times we can find, in seclusion here and there, a flourishing tree crop won from the most acid peat. These crops are the achievements of private owners who did not jib at expensive site preparation so long as it made possible the production of a tree crop. Of course it may not be economically sound to adopt on a large scale the methods of establishment which were employed in respect of these comparatively small areas, but nevertheless the proof is there that these peats will yield trees.

At present we have our own State forests on those forbidding peats some of them now six years old and making great progress. Promising though these plantations may be, however, the writer is of the opinion that in the matter of *site preparation* the surface has merely been scratched. For the *Molinia* clad flush or the *Scabius* clad mineral peat

the heavy mounding plough we know suffices; but for the dwarf, diffuse *Molinia-Eriophorum, Calluna-Scirpus, Narthecium-Erica tetralix* types much more is required than ribbon-ploughing and manuring. A great deal more disturbance of the peat in order to aerate and oxidize it and to release its locked up nutrients is required, and drainage to much greater depths than we have been accustomed to, would follow.

Unless peat is disturbed and aerated it is highly repugnant to tree growth; all the writer's observations to date show that these young plantations are virtually living on the inverted ribbon having made no effort to explore the underlying peat. Inevitably if the food supply in the ribbon cannot be supplemented as the tree requires it, "check" will set in.

The writer's prescription for those difficult types would be firstly a thorough processing or maceration followed by mounding/draining to a depth of from 36 inches to 48 inches at 10 foot spacings plus manuring as now practised with, maybe a slight emphasis on the application to sitka spruce. This preparation should be economically feasible even if it doubled the present low costs of establishment on such types where machinery can be freely used. Rotovation should not cost more than double the present mounding figure and mounding/draining at 36 inches to 48 inches is well within the capacity of available equipment at slightly increased cost. The preparatory work suggested should not cost more than £15 per acre. This preparation would have the added advantage that a high proportion of spruce could be used with confidence, enhancing the value of the crop to a degree more than commensurate with the initial extra cost involved. Also, it would mean more speedy closing of canopy and suppression of the vegetation, a higher yield, and a much more stable peat to give safe anchorage to the crop.

A word or two about our work here in the Cloosh Valley in Connemara might not be amiss.

Planting is done by a wedge-shaped dibble $3\frac{1}{2}$ inches wide and 15 inches long. This has given great results: it is very tidy to carry about, opens a slit that always has a tendency to close thus eliminating airpockets and reducing damage by desiccating March winds and scorching summer sun. Planting costs have been very low here mainly on account of this dibble.

In recent years the selection has been 50% *Pinus contorta*, $37\frac{1}{2}$% sitka spruce in mixture with $12\frac{1}{2}$% birch, the last mentioned in belts 4 to 5 lines wide at 100 yard intervals and at right angles to the prevailing wind or occasionally in groups of 10 plants 45 feet apart. In very distinct *Molina-Juncus* flushes sitka spruce is planted pure. That there will be some criticism of this selection cannot be gainsaid but it is hoped to have a good proportion of sitka spruce in the final crop with *Pinus contorta* thrown in for physical effect and birch for building up soil

fertility. In respect of the last mentioned species group planting is desirable in order to ensure an even distribution of the leaf fall but against that planting in lines, while satisfying reasonably well the distribution problem, might also form a firebreak and later on a windbreak for the pines and spruce. Many contend that the pine will outpace the spruce but the performance to date shows the latter well up with the leaders. The spruces should also have a physical effect on the pines, keeping them straight and wind firm. Better preparation as already outlined, increased drainage and more judicious use of manures would help matters a great deal. The writer is of the opinion that spruce is the tree to be fostered in peat afforestation for the following reasons. It has the anchorage best suited to peat inasmuch as that it has characteristically a lateral root system, it is the most valuable and versatile final crop and, growing on peat, it has been observed to be remarkably free from butt rot. At Ballinahinch forest some giant sitka spruce which grew on peat showed not a trace of butt rot when felled even though some of the early annual rings were as much as one inch wide and as such presumably more susceptible to decay.

One of the big problems outside of drainage in growing it here is its susceptibility to check on *Calluna* ground. This heather ground is potential spruce ground being on par with *Molinia* ground. If such ground lent itself to rotavation with a resultant killing or severe checking of the heather there is no doubt that with generous manuring it would grow spruce well. There are various reasons advanced for spruce going into check on heather ground—the toxic effect of heather roots, competition for nitrogen. An angle worth investigation is the high lime content of heather—a phenomenon that runs counter to expectation. Peat of this composition would be intractable to our calcifuge spruce. Whatever the reason may be we should not tire of trying to find ways and means to grow a great tree better.

Pine, which must be our number one reclamation species on peat, even though essentially a tap rooter and a tree of rocky terrain can adapt itself to peat soils as is clearly evident from the high percentage of pine stumps in our bogs where one can find examples of a great development of the lateral roots with little development of the tap root. There is evidence of the same tendency in young *Pinus contorta* on peat to-day. That straight, clean stems of this species can be expected from any percentage left for the final crop is reasonable in view of its performance in some well treated stands in this country. It is expected that it will have a "drawing" effect on the spruce should the latter need such.

The age of plants used here seems to suggest that 1 + 1 *Pinus contorta* and 2 + 1 sitka spruce are best. A high percentage of seedling *Pinus contorta* was used in the 1952 planting here with a resultant very high percentage failure. Those that survived never got going vigorously but always remained spindly and sickly green while 1 + 1 plants

from the same lot of seedlings planted out one year later are at least twice as big and show great vigour.

Drainage experiments carried out here recently suggest that it is a very important factor as the following figures show:

Average 1956 leader growth in P/52 *Pinus contorta* in compartment 10 Cloosh Valley.

Mound-planted and manured	6.3 "
Ditto with mound drains deepened 18 inches in winter of '55	9.25"
Ditto with every second mound drain deepened 18 inches in winter of '55	7.7 "
Ditto with mound drains deepened 36 inches in winter of '55	11.5 "
Ditto with every second mound drain deepened 36 inches in winter of '55	8.9 "

Similar experiments carried out in sitka spruce show the same trend. From these trials we see that the more intensive and the deeper the drains the greater the increase in leader growth. There is also a marked increase in needle growth but the striking feature of the crop is its great vigour and the dark green colour of the foliage, the green becoming deeper as drainage is intensified. Normally such a response is not expected in so short a time—a clear indication that it is very necessary. It will be interesting to see how those plots behave in later years.

Manurial experiments carried out here seem to follow the path of similar ones carried out by the British Forestry Commission. Untreated control plots in earlier plantings have either stagnated or succumbed. The normal dressing at present is: 3 ozs. ground mineral phosphate per plant for sitka spruce and birch, and 1 oz. per plant for *Pinus contorta.* At first basic slag was used. To this the plants responded somewhat quicker but they did not seem to retain their vigour as well as those dressed with G.M.P. While it seems that phosphates will be the mainstay of our manurial treatment for the future one would like to see more exhaustive trials of the trace elements, notably copper which is proving of great significance in agriculture elsewhere on acid types. The time of application of the phosphate is very important: the earlier it is applied, the better the plant while in the case of sitka spruce if it is delayed the tree, although it may grow, *never* catches up on its comrades manured earlier. Any delay in manuring is time lost and must reflect unfavourably on the yield in the final crop.

To finish, if the writer may, in the light of his present knowledge, offer a brief prescription for the establishment of a tree crop on Connemara peat it is as follows:

(1) Drain intensively and have ground prepared at least 6 months and preferably one year in advance to allow washing out of harmful

acids and decomposition of the peat leaving it less liable to open in summer heat.

(2) Plant ages: 1 + 1 pines, 2 + 1 spruces, 1 + 1 broad leaved species.

(3) Apply manure immediately after planting.

Planting Spacings.

By J. J. THORNHILL

FORESTRY, an applied science, is not an exact one, insofar as seemingly identical conditions or actions do not always produce the same results, and all silvicultural treatments are best discussed with this in mind.

Planting spacings usually vary with species, types of soil, rotations and markets, that is to say, the governing considerations are either silvicultural or financial. While these aspects are not necessarily in conflict what is advantageous to one may be disastrous for the other, and the task of the forester when laying down a plantation is to determine which consideration will predominate or to what extent both may be reconciled. Actual practice, therefore, may pay homage to both, and be, in the words of the well-known British forester, Mr. H. L. Edlin, "a working compromise."

Close spacing has in its favour:

(1) Less replacement of failures will be necessary.
(2) There will be more thinnings for sale.
(3) Earlier closing of canopy, better suppression of weeds and, possibly, greater height growth.
(4) Better soil protection, and improvement of soil conditions through greater humus accumulation.
(5) Lighter side branches, earlier suppression of these, and, possibly, more natural pruning.
(6) Greater number of stems from which to select final crop.

Arguments against close planting:

(1) The greater cost of plants and planting.
(2) The greater cost of maintenance in early stages of the rotation.
(3) More intense root and crown competition, with greater danger of windthrow and snow damage, insect or fungoid attack.
(4) The greater cost of thinning, particularly earlier thinnings.
(5) Less diameter growth, longer rotation and lower rate of interest.

The arguments in favour of open spacing—distances of six feet upwards to a limit compatible with good management are :

(1) Plants and planting cost less.
(2) Silvicultural and maintenance operations will cost less.
(3) Higher increment per stem, shorter rotation and higher financial return.
(4) Better root development, more stable crop, less danger of windthrow and snow damage.
(5) Less suppression and, consequently, less danger of insect or fungoid attack.
(6) More rapid decay of leaf-fall, with increased food supplies and less danger of over accumulation of raw humus.

Open spacing has the disadvantages that :

(1) More replacement of failures may be required.
(2) Live pruning may be necessary.
(3) Later closing of canopy resulting in, possibly, a lower rate of height growth, heavier branches and later suppression of weeds.
(4) Poorer quality timber—possibly.
(5) Less thinnings for sale.

The silvicultural effects of the planting spacing will be most apparent in the earlier stages of the rotation—in the formative and competitive stages. The cash expenditure at these stages could have a decisive effect on the ultimate financial yield and hold the balance between the success and failure of the investment.

Close planting is more suitable for poorer soils, with their greater risk of failures and greater need for soil improvement. Soil improvement through humus accumulation is, however, negligible unless the plantation is opened up soon enough to permit the entry of sufficient air and light to accelerate the decay of the accumulation. It may be necessary for the suppression of heavy vegetation on good ground.

Close spacings are desirable where there is likely to be a profitable market for earlier, small sized thinnings, and are, therefore, suitable for short rotations which as a rule imply a convenient market for such material. With such rotations the financial return will not be so adversely affected by the expenses incurred early in the rotation. With slow growing species such as scots pine close spacing is essential for the production of clean timber.

Where there is undue root or crown competition the dangers of windthrow and snow damage are always present, and silvicultural treatments to reduce and remove them are not always successful and are invariably tedious and costly. This competition will also encourage insect attack and will create conditions ideal for the spread of fungi.

In passing one wonders if there may not be a connection here with "group-dying" in vigorously growing species such as sitka spruce and *Pinus contorta.*

Where it is silviculturally feasible, open spacing with its early savings in costs is suitable for long rotations. It is also suitable for the faster growing, high volume producing species. Most of these seem to produce coarse branches irrespective of spacing.

Open spacing is financially desirable where there is no prospect of a market for small size thinnings. When thinning is carried out the amount of poles available for sale will be much less than that which would be available from the same area of closely-spaced trees. This does not, however, imply that the volume will be less. It will be handled at a much lower unit cost, and be of more saleable size.

Open spacing may be resorted to in order to achieve a saving in the cost of preparing for planting areas with heavy weed growth which later will provide the competition desirable or necessary for securing clean stems.

It can be argued that live pruning is not altogether disadvantageous. True, it may cause a temporary but rarely serious loss in increment, but this danger is remote when the pruning is carried out in moderation. On the other hand the live knots are incorporated in the growing wood, thereby eliminating the risk of "fall-out" after sawing.

The fact that open spacings will allow the establishment and handling of plantations with smaller labour staffs is a matter well worthy of consideration in any area where there is, or may be in the future, an insufficiency of suitable man-power.

Sitka Spruce at Bachelors Lodge

(Note supplied by A. L. LOWRY, ESQ., Bachelors Lodge, Navan, Co. Meath.)

The accompanying photo illustrates the results at sixteen years of 9 ft. × 9 ft. spacing and the following brief description may be of general interest.

Planting was carried out on a freshly cleared open woodland site consisting of heavy clay loam having a high lime status. Pit planting with 2 year/2 year/1 year transplants, took place in March 1940. Development during the initial stages covering a period of five years or more was drastically retarded by aphis infestation but high soil fertility probably assisted in righting what appeared to be a hopeless situation and ultimately the worst effects were overcome.

Suppression of vegetation which consisted mainly of cocksfoot tufts

coincided with formation of the canopy thirteen years after planting. During the past three years the average length of leading shoot has been approximately 2 feet. 6 inches while individual leaders exceeding four feet have been noted. Recent measurements show average

B.H.Q.G. to be 6 inches, and average height 28 ft. Assuming that the timber height (to 3 inches diameter) is 18 feet and Q.G. at mid timber height is $4\frac{1}{4}$ inches the contents over bark is 1,213 hoppus feet per acre. The branch diameter of the average tree at 6 feet is one inch.

Note on the Raising of Eucalypts in the Nursery.

By P. RYAN

THE seeds may be sown in green-houses, cold frames or in ordinary nursery beds. It is advisable to wait until May for the carrying out of this operation as if sown earlier the plants will have grown too large when the time comes to plant them out.

The seed bed soil, which should be loamy and free from damping-off fungi, should be brought to as fine a tilth as possible. The seeds

should be covered very lightly with ordinary soil, leaf mould or sawdust. Water should be applied freely in the form of a fine spray.

When the seedlings reach 2 to 3 inches in height they are pricked out into pots or shallow boxes in order to help development of fine feeding roots and to check height growth. If the roots are more than 4 inches long at this stage they may be trimmed. When boxes are used the seedlings are placed 3 inches apart each way. The depth of the soil in the box is usually about 4 inches.

When pricking out is completed the plants are well watered and shaded for a few days to help them recover.

The plants can remain in the boxes or pots until the following April or May when they can be taken to the planting ground undisturbed. During the winter they must be protected from frost as they are very tender at this stage and watering must not be neglected if necessary.

Before removing them from the boxes a sharp knife should be run across and along beween the rows in order to cut all long roots after which the plants should be watered immediately. It is often an advantage to carry out this last mentioned operation about a month before planting so that the roots may get a chance to heal. Each plant is lifted out of its box by means of a trowel and planted with its ball of soil attached in a prepared pit.

Espacements for planting are an open question but 10 feet each way seems suitable for Irish conditions.

As an alternative to leaving the plants in boxes or pots during the winter and early spring the practice of moss-balling may be adopted. This is particularly suitable where large numbers of plants have to be transported long distances and it also makes it possible to delay planting until the danger of late frosts has passed. The job is usually done in September. The operation of running the knife across and between the rows as described above is carried out in advance. The plants are lifted out of the boxes and the roots, with some soil attached, are wrapped in sphagnum moss which is tied in position with raffia or binder twine to make an oval ball. The plants are then lined out as close as the moss balls will allow in lines 10 inches apart. A shelter against frost is erected. This is placed about 4 feet above the lines of plants and usually consists of lath screens laid on horizontal wires supported by posts driven into the ground at intervals of 3 or 4 yards. If lath screens are not available branches of laurels, birch or conifers may be used. If there is a danger of wind-frost side shelter may be provided also. The maximum protection should be provided consistent with the normal requirements of evergreen plants in regard to light, air and moisture.

Willow Growing and Utilization in the Suir Valley.

By J. C. KEARNEY

FRAGMENTS of willow rods found embedded in the plaster of an archway of Waterford's 1,000 year old Reginald's Tower, while on a visit there recently, prompted me to investigate the growing of willows along the Suir.

There is no record as to when or how willow cultivation started in the area but it is said that the Ormondes were responsible for its development during the sixteenth century when their efforts to establish a ship-yard below Carrick-on-Suir were thwarted by the continuous silting up of the river.

At the turn of the last century willow growing and basket-making was a booming industry which provided a good living for a large number of workers, male and female. The greatest outlet from then to World War I was for railway hampers, large crates for agricultural produce, baskets and to a lesser degree hurdles for horticultural uses.

In the 1920's the industry suffered a setback from which it has never recovered. Then, the development of machinery which made box-making and cardboard container manufacturing a more economic proposition really sounded its death knell.

At the present time James Shanaghan of Carrick-on-Suir carries on the family business of willow growing and weaving which has been operating for generations. I paid a worth-while visit to his yard and accompanied him on a tour of some of his willow beds.

There are approximately 200 acres under willows along the Suir and Clodugh rivers in the Carrick-on-Suir-Portlaw-Waterford area. These lands are held by some 70 landowners in lots of from ¼ acre to 35 acres. The river is tidal to Carrick-on-Suir and the willow beds are partly covered at high tides and are completely submerged at spring tides and during periods after heavy rains. The high fertility of this deep alluvial soil can be seen from the following soil analysis of the three principal beds in use to-day.

Location	Depth	pH	Ca	K	P
Carrick-on-Suir Bed	0"—4"	7.0	7,000	56	4½
	4"—8"	6.6	6,000—	30	2
	8"—12"	6.5	6,000—	26	1½
Tinhalla Bed	0"—4"	7.8	20,000+	69	8
	4"—8"	7.9	20,000+	52	4½
	8"—12"	7.8	16,000—	20	3
Fiddown Island Bed	0"—4"	7.6	8,000+	30	5½
	4"—8"	7.3	10,000+	20	1½
	8"—12"	7.2	7,000+	25	1½

Generally speaking these areas are overgrown and are in dire need of draining and restocking. The age of a number of stocks has been estimated to be at least 70 years. Despite these adverse conditions, growths of over 7′ have been noted in a six month period, and between three and four tons of green rods per acre are cut annually.

Species.

The common willow (*Salix viminalis*) is the species which has been mainly used. There are occasional groups of almond willow (*Salix triandra*) and black sally (*Salix purpurea*).

S. viminalis produces a rather strong rod, suitable mainly for large hamper making while the other two tend to develop a more slender rod which is more lissom to handle. The latter type of rod is naturally more in demand to-day because it is cheaper to work and is more suitable for the manufacture of the smaller type basket.

Preparation of Ground and Planting.

Preparation of the ground for willow growing must be thorough. Stumps of old willow scrub must be removed and the ground ploughed and harrowed. Where stagnation of water is evident drainage is essential.

The method used here has been to raise ridges 3½ ft.—4 ft. wide by cutting drains 18 ins.—24 ins. wide and using the spoil from the drain to build up the ridge. This work is usually done in late summer and autumn when the river is at its lowest level.

Three lines of 20 ins. cuttings from 3 year old rods are inserted 14 ins. apart each way. Plantings are made from November to March as flood conditions permit. The actual planting is done by pushing the cutting into the bed, leaving about one quarter of its entire length over ground level.

Hoeing and weeding are necessary during the ensuing summer in order to keep down weeds. A certain amount of care is necessary to ensure that the tender shoots are not broken off the stocks during the operation.

In the second year the rods are well above any weed growth and in any case are sufficiently developed to kill out any weeds. No further maintenance is required except for drainage repairs and replanting where cuttings have not struck.

Harvesting.

Normally, the rods are cut annually, after leaf-fall. Two to three year old rods are required only rarely, being used for the framework of heavy hampers, hurdling, chairmaking and of course for replanting stocks. Cutting is done by gathering a number of the rods under the arm and drawing a *carrick* type bill hook across their butt ends in an

upward cut. They are then tied in bundles of about one cwt. with a willow lash and transported to the yard by boat or cart.

Grading and Storage.

The next operation is grading. This is done by placing the green rods in low barrels or tubs and selecting them according to length and quality into the following classes.

Grade	I	Overbarrel	9 ft.–10 ft. long.
Grade	II	Light barrel	8 ft.—9 ft. long.
Grade	III	Half barrel	5 ft.—6 ft. long.
Grade	IV	Firkin	4 ft.—5 ft. long.
Grade	V	Cags	3 ft.—4 ft. long.

It is interesting to note the origin of these grade names. An example is where a rod was found to be strong enough to produce a split hoop to suit a half barrel it was classed as "half barrel" etc. "Cag" is probably a derogation of "Keg".

In order to keep the rods in their fresh green state until they can be further processed they are placed horizontally in low damp pits and covered with old peelings, soil or any available refuse. When space does not permit they are placed upright in the pits to a depth of 2 ft.—4 ft. according to size and left until required.

Peeling and Boiling.

The rods are peeled and dried in the sun and wind to bring out their natural shining white colour. On completion of this stage they will take any dye or may be painted as required.

Great care has to be taken in peeling to ensure that the rods are not shattered or scratched deeply. This operation is carried out by pushing and then drawing the rods between two hinged steel bars which are pressed together as tightly as required with the worker's hand.

To obtain a buff colour the rods are boiled for at least four hours after which time the bark comes off quite easily. This process gives a natural reddish brown colour to the rods due, no doubt, to the actions of the tannins and other properties in the bark. Boiling is also said to have a preserving effect.

In the large boiling tank at Carrick seven ton lots can be boiled each time. The tank is an oblong open top metal container in which the bundles of rods are placed closely together. The water is then poured in. The bundles are weighted down and allowed to boil for the required length of time.

Uses.

A considerable quantity of the rods is purchased by handicraft guilds in various parts but most of them are used locally in basket-, chair- and hurdle-making. The standard of workmanship is high and

one can seldom pass through the locality without seeing some evidence of this ancient industry which is holding its own against modern packeting methods.

Future Use.

What does the future hold for the industry? In this area it would appear that 30 acres of properly managed willow beds would supply the present-day requirements for weaving and sales.

To what use should the remainder of these lands be put? One is tempted to suggest poplar growing and indeed the soil is most suitable for this species but the high water table will make it a risky undertaking. The same holds for the conifers.

The willow seems to be the best tree to use on this ground and the problem really is to find an outlet for the produce.

Enquiries into the sportsgoods and artificial limb manufacturing trades have elicited the startling information that the few hundred cubic feet of bat willow (*Salix alba* var *coerulea*) which they use each year is imported due to the fact that suitable home grown material is not available.

The growing of bat willow could be tried on a modified scale or at least in pilot plots which would seem to be the best means of trying out the many varieties of willow.

Willow is said to be eminently suitable for the manufacture of wallboard but is not used for this purpose in this country. The supply of other soft timbers is sufficient to meet the demand.

It is inevitable that the wood pulp industry will develop on a large scale in this country and willow will find its place in the raw material. It would be well to recognise that fact now and plan accordingly.

Local growers estimate that they could produce $2\frac{1}{2}$ tons of pulpwood per acre per annum on a 10 year rotation. With good management there seems to be no reason why this increment could not be exceeded by finding the optimum rotation which is likely to be shorter than 10 years.

Conclusion.

To sum up, the willow is still worthy of our attention and interest. It has proved itself to be one of our most useful and versatile timbers from the first day when its twigs were used to fashion the salmon traps on the estuaries of our larger rivers and to reinforce the mud walls of ancient dwellings to its present-day suitability as a pulp producing tree.

Experimentation on the pilot plot system backed by a co-operative association of growers on a nation-wide scale seems to be the answer.

I wish to thank Mr. Mooney and Mr. Deasy for their help in preparing this article also Mr. Shanaghan, Messrs. Wallboard and Messrs. Gray, Russell & Co.

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An Irishman looks at some Australian Forests.

By J. HEVERIN

Introductory.

DURING the postwar years the Forestry Commission of New South Wales established what were known as Survey Units for the purpose of carrying out Survey assessment and road location in unclassified and unsurveyed areas of virgin forest land. The writer has been a member of such a unit and proposes giving in this article some impressions of forest conditions and practices in that State.

General.

New South Wales is fortunate in having a varied and useful tree flora. Forest reserves however are not very great, the present dedicated forest area being 2.2% of the total land area. The native trees particularly the eucalypts, supply some of the finest hardwoods in the world but there are only a few native species such as hoop pine (*Araucaria cunninghamii*) and the Cypress Pines (*Callitris* species) which yield softwoods. In their form, habit and other characteristics the native trees exhibit considerable diversity which is related to the wide range of soil and climatic conditions obtaining throughout New South Wales. On the one hand there are the rain forests of the North Coast where the rainfall sometimes exceeds 60" and where conditions generally are of a tropical or subtropical nature. On the other hand there is the heat blasted plains of the Far West with summer temperatures reaching 110 degrees with arid areas which are not utilized for any purpose. Between these extremes are the semi-alpine conditions of parts of the Tablelands and elsewhere we find temperate regions of varying rainfall and areas with climatic conditions most closely approximating to those of Ireland.

Tree Species.

Many hundreds of different species go to form the pattern of the tree life but the eucalypts are dominant in most areas. They are found almost throughout N.S.W. in moist coastal valleys, on the wind-swept plateaux of the Tablelands and on the dry plains of the interior. They include about 235 different species, apart from varieties and are known mainly as gums, stringybarks, ironbarks, boxes, peppermints, ashes and bloodwoods, such names being based mainly on bark and timber characters. Timber of very high value is provided by most species, 80% yielding excellent marketable timbers. Their usefulness in this respect has been recognised by other countries, extensive plantings having been made in North America, South America, in Mediterranean regions and in New Zealand.

The eucalypts range in size from small whipstick-like mallies to giants over 200 feet in height. They include some of the fastest growing commercial trees in the world, some stringybarks being recorded as growing to a height of 20 feet in one year from seed and blackbutt (*E. pilularis*) has been recorded as reaching 40 feet in 3 years. Quite a number of eucalypts are very ornamental and most varied in their appeal and many yield valuable oils which are finding ever-widening uses. The merchantable volume increment of the irregular eucalypt forest is low because of waste, unsaleable thinnings and defective logs. An inherent character of the species is the development of faulty wood in the centre of the bole which proceeds from brittleness in young trees to doziness and ultimately to a cavity or pipe in mature timber. A yield of 50 cubic feet of merchantable logs per acre per year is a good yield for eucalypts in Australia and 100 cubic feet a very good yield. Forests of *Euc. regnans, Euc. diversicolor, Euc. gigantea* and patches of pure *Euc. pilularis* and *Euc. grandis* may give 200 cubic feet per year or sometimes more under favourable conditions of utilization and in the absence of fires.

The genus *Acacia* resembles the *Eucalyptus* in that its species are found all over New South Wales from the coast line to the Far West. Many of them are only small shrubs but quite a number attain tree size. They are of considerable horticultural value, being fast growing and providing a wealth of blossom in the winter and early spring when other flowers are scarce. Much of the rather austere bushland is brightened by the soft blaze of the golden wattle and it is now generally recognised as Australia's floral emblem. Apart from their ornamental character the wattles have many economic uses. The bark contains one of the most useful tanning materials in the world, the tannin content of some species being over 50%. It is a true soil-improving species and important in maintaining soil fertility. Wattle seeds are interesting in that they have a very hard coat which enables them to retain their vitality for long periods—in some cases up to 50 years.

Apart from species of *Eucalyptus* and *Acacia* there are in New South Wales approximately 380 species of trees and these are contained in a wide range of botanical families, the most important being the *Casuarinas* or "she oaks," figs, laurels and myrtles. The Pine family is not strongly represented in New South Wales. The hoop pine (*Araucaria cunninghami*) is probably the most important species as it provides a valuable softwood. Eight species of cypress pine (*Callitris* species) are found widely distributed from the coast line to western areas.

Man's Influence.

Over one hundred and fifty years of settlement have produced far-reaching effects on the tree flora of New South Wales. The clearing of agricultural and pastoral lands has resulted in almost complete destruction of tree life in many districts. It is, of course, true that many areas show little or no effect of settlement and it is probably equally true that some of these areas will retain more or less indefinitely their distinctive tree flora quite uninfluenced by the activities of the white man. For, apart from natural reserves, there are some parts of New South Wales which are quite unsuitable for settlement of any kind and sufficiently remote to be left undisturbed even in the midst of an expanding population. But in many districts the sound of the axe has been loud in the land and the noise of crashing trees has been the note of progress. On many properties the destruction of tree life has been entirely unjustified and often the landowner has not left sufficient shade and shelter trees for the needs of stock. Forest lands have been exploited and a forest policy has only begun to emerge from the disturbances created by pioneering settlement. A great deal of planting will be necessary in many parts although much could be done by encouraging natural regeneration though the exclusion of stock from selected portions.

Fires have become far more frequent and widely distributed since settlement and have had a considerable effect on tree life. There is, however, always some survival and regeneration, in many cases quite extensive so that the tree flora does not lose its identity. In many cases the trees forming the community, although considerably damaged by fire, re-esablish themselves by suckers or by shoots from root stocks. The great majority of eucalypts produce suckers from trunks and branches very freely after fire. Their ability to survive fire seems to depend to some extent on the nature of the bark. The thick rough bark produced by some species seems to insulate the cambium layer and it is not so much affected as in the thinner smooth-barked species. The fire-resistant qualities of the seed of many Australian plants is very well known, the most common example being provided by the wattles which have a very hard coat protecting the embryo from damage and it is a common experience for seed germination to be greatly stimulated by fire passing over the area.

From the early days of settlement the white man found that certain timber-producing species were suitable for his requirements and were therefore much in demand. The first phase was undisguised exploitation of such trees without any consideration being given to the need for replacement. As supplies became limited attention was given to the conservation of remaining supplies and the establishment of plantations. The general effect of settlement therefore was the gradual disappearance of certain species but, when the consequences of this were realized, conservation and planting resulted.

Exotic Species.

Very few trees introduced from other countries have become naturalised in N.S.W. The most common ones which have become established by natural means are insignis pine (*Pinus radiata*), tree of heaven (*Ailanthus glandulosa*) and the olive (*Olea europea*).

Early settlers introduced many species, partly for sentimental reasons in a desire to recreate the atmosphere of their homeland and partly for utilitarian purposes. Looking back, however, over the past century and a half, it is difficult to trace any very definite system or planning in the work of tree introduction. There is a great necessity for obtaining further tree species especially as there are many districts in which it is difficult to recommend with certainty of success, any but a very few species.

When the most commonly grown introduced trees in N.S.W. are classified it is found that the great majority of them come from countries of similar latitude such as the Mediterranean regions generally. Some cultivated trees have been introduced from Western Europe. The oak (*Quercus robur*) has been planted in many districts for reason of sentiment and has sometimes made quite good development. The common elm (*Ulmus procera*) has succeeded in cooler, moister areas. The larch (*Larix decidua*) has not proved very well adapted to the conditions but most of the pines and cypresses from the Mediterranean and Southern Europe have proved successful.

The cold-country species of Europe and America reach their best development in the region which is known as the Tablelands and here too we find districts whose climate most closely resembles that of Ireland. The Tablelands have an altitude varying from 1,500 to 3,000 feet with some districts fairly cold in winter months with heavy frosts fairly common and rainfall varying from 35 to 45 inches. Soils are mainly of sandstone origin but there are some areas of shale and basalt.

The most valuable eucalypts of the area and those which should have the best chance of succeeding in the colder climates of Europe are Mountain Ash (*E. gigantea*), snow gum (*E. pauciflora*) smooth-barked ash (*E. oreades*), ribbon gum (*E. viminalis*) and mountain gum (*E. goniocalyx*) all of which are good timber producing species and reproduce themselves freely.

Silvicultural System.

The establishment of fixed minimum exploitable girths in the mixed eucalypt forest by the Australian forest authorities imposed a form of selection of trees or groups of trees for utilization as a result of which scattered groups of regeneration came up in gaps of the forest. This form of exploitation led to a variable silvicultural system which was classified as the "Group Selection System." The objective in fixing minimum exploitable girths is the principle of sustained yield in which the cut is limited to the growth capacity. The moisture demanding eucalypts are considered as the parallel of the light demander in Europe and can be treated in the same way—by opening the forest in groups. The system has many advantages and possibly the most important is that the whole forest is worked-over every period of say, 10 years. In Australia the idea of locking up part of the forest for a rotation is abhorrent.

Similarly with the objective of sustained yield, control is exercised over the number of sawmills allowed to operate by a system of licensing and restricting the number of licences to meet the capacity of the forests concerned. Areas are allocated under licence to sawmillers and a sale contract is drawn up specifying the silvicultural system to be adopted, the amount and method of cutting and other restrictions placed on the sawmiller.

Sales of Timber.

All sales are based on the price of the standing timber on the "stumpage appraisal system" which is the sum remaining after the cost of transportation and production with a margin of profit have been subtracted from the selling price of product. The Forester is responsible for the determination of the stumpage value in the area under his control and is one of his most important and involved duties as it is necessary for him to have an intimate knowledge of the quantity, quality and kind of timber to be sold, the topography of the area, the access thereto, the cost of operating a sawmill, haulage costs, freights, etc.

Stumpage or standing value is calculated by the quarter girth system giving the volume in super feet Hoppus and this is equated to the true volume of the sawn product. In N.S.W. the Forestry Commission has adopted the policy of giving sawmillers access to the appraisal of stumpage value on their particular areas and of discussing with them matters of allowances for the extraction and haulage of the logs etc. In many instances the purchaser is made an allowance for road construction which he undertakes in areas where access is difficult and is reimbursed to the extent of the cost of construction by means of reduced stumpage rate.

All such roads are built on sites determined by the Commission and to the required specification. The Commission employs a staff of

technicians who survey proposed roads and determine the best location, alignment and grades. Roads are then designed to the required specification having regard to width, surface, drainage and any improvements needed in alignment and grades before construction proceeds.

Forest Survey Units.

All sales and roading contracts must conform to the plan or management of the forest or area which plan is formulated from the report submitted by special survey units such as mentioned in the introduction of this article. Consequently the utmost importance is attached to the organisation and operation of the survey units, particularly in the case of uncharted and unassessed areas. After a reconnaissance and a quick preliminary inspection an area, sometimes 100,000 acres or more, is considered desirable for dedication as a state forest and here the survey unit is used to make a further intensive non-precision survey for the purpose of formulating a management plan.

The normal survey party consists of an officer-in-charge, an estimator and a labour staff. Whenever possible it is customary to assign an assistant to the officer-in-charge for training as a replacement or nucleus of a further party. All employees engaged must be carefully selected as the whole party must live together over long periods in camp removed from the comforts and amenities of ordinary living. It is essentially a young man's job involving a great deal of hard walking every day.

The whole of the assessment depends on the reliability, skill and judgment of the estimator. He should have a sound knowledge of logging, milling and timber conversion operations, be able to identify the species and keep field notes.

Transport is one of the main difficulties associated with survey camps and the most useful type of vehicle is the four-wheel-drive type such as a landrover or jeep with trailer. This allows of supplies of food at regular intervals as well as shortening walking time where trafficable roads are available while shifting camp is greatly expedited. In certain cases consideration is given to the use of pack horses for bringing up supplies where access is difficult.

The checking of all equipment, instruments, tools, drawing materials, camping gear, cooking utensils, first aid outfit and personal equipment such as blankets, is of the utmost importance owing to the difficulties of getting replacements later.

The survey camp is organised from the head office of the Forestry Commission and instructions concerning the survey are given direct to the officer-in-charge but the responsibility for the conduct and efficiency of the camp and operations devolves on him. The campaign of operations is in most cases greatly facilitated by consultation with the district and local foresters who generally have a knowledge of the area to be

surveyed. They are able to advise on the existing routes of access, the location of permanent water, camp sites, etc.

The first consideration is the selection of a main camp site and this choice is restricted to places in proximity to permanent water and in most cases by the limits of truck access.

Other aspects to be considered are the transport of food supplies, protection from wind, flooding and fire. All the details of where and where not to camp are learnt by actual experience of the discomfiture of an ill-chosen site. The advisability of shifting camp to facilitate the work must always be kept in mind or the original camp may be left partially erected while the party proceeds to a "flying camp" for two or three days duration.

While the Forestry Commission provides a cook for the camp the question of food is one of mutual agreement. It is usual to establish a mess with equal contribution by all hands towards the cost of supplies. The field work involved generally follows the same procedure, i.e., the establishment of boundaries, volume assessment, identification of species, division into logging areas, volume table data collection, etc.

Aerial Surveys.

Much of the conditions and practices of survey are being gradually superseded by improved techniques in survey and assessment from aerial photographs. Contour and topographical maps from photo interpretation and maps showing broad forest types are being prepared. To obtain maximum use of an aerial survey for planning of roading and logging it is essential that it should be possible from the study of photographs to give accurate volume estimates of timber stands of approximately 40-50 acres. Much work has been done on timber volume estimates and considerable progress has been made in this field. At the same time there is no doubt that some of the reports on the use of photography appear to be over-enthusiastic, particularly where 20-40 chains to 1" photography has been used.

Generally speaking it is true that this work is still very much in the experimental stage in Australia and outstanding success with volume estimates from the air appears to be either in connection with reconnaissance work covering very large areas or in homogeneous well stocked stands of coniferous species, in each case supported by random sampling by ground parties and the establishment of a scale of comparison between ground plots and photo plots for direct visual estimates from the photographs.

It appears however that margins of error usually are large and these methods are unsuitable for intensive planning of logging and roading in Australian eucalypt forests where stand volume changes rapidly from place to place.

Correspondence.

To the Editor, Irish Forestry.

Sir,

I read with interest Mr. Finnerty's valuable note concerning the raising of birch from seed in last summer's issue of "Irish Forestry." In this connection we had an experience here in Ballinglen state forest nursery which may be of interest to readers.

A few years ago we used some birch branches for covering 1 year seedbeds of *Abies alba* against frost lift and frost shoot damage. The branches, which bore a good many fruits, were cut in October and laid on supporting wires about one foot above the beds. On removal of the branches in the following June we were pleasantly surprised to find a fine crop of birch seedlings mixed through those of the *Abies alba.* As the latter were a thin crop both species co-existed very satisfactorily until they were lifted in the following spring.

Yours faithfully,

J. Rouine.

Ballinglen,

Co. Wicklow.

Study Tour in the Black Forest, 1956

General.

ON the evening of May 26th, 1956 the main body of members of the Society who had enrolled for the 1956 study tour left Ireland on the first lap of their journey to Germany.

They crossed the Irish Sea, passed down through England and on Sunday 27th, paused in London for some three hours during which many of the party attended Mass at Westminster Cathedral.

At Victoria railway terminus a few more members joined the party which shortly after 10 a.m. moved south to Dover and crossed the English Channel to Ostend. Having duly set foot on Belgian soil the party could fairly claim to have made history for not only was it the first time a party of the Society of Irish Foresters had crossed on to the mainland of Europe but it could also be claimed that it was the first

occasion on which any representative group of Irish foresters had crossed the English Channel. From Ostend the train brought us through Brussels and Liege on to Aachen and Köln, thence soutwards along the Rhine and to our destination at Frankfurt at about 2.30 a.m. on Monday 28th. At Frankfurt railway station we were met by Oberregierungsrat Karl Oedekoven of the Forest Administration at Bonn who walked with us through the then quiet city and across the River Main to our quarters at a youth hostel. This act of kindness and great courtesy on the part of Herr Oedekoven struck the highest possible note of hospitality and goodwill which never waned throughout the six days of our stay in Germany.

At the youth hostel a few more members joined to make the main party complete which then, numbering 58 was, we were told, the largest forestry group ever to be received by the German Forest Service. And so, we were ready to look out at Germany, to meet her people and to see her forests.

Looking back now with the perspective of the mind's eye on the tour as a whole the happy recollections come crowding in and the pictures of people and places are still vivid.

Our first journey on the road from Frankfurt southwards to Baden-Baden was an enthralling experience for most who were seeing Germany for the first time. This was a long journey starting as we did about 7.30 a.m. and getting into Baden-Baden at about 1 p.m. but speeding along the autobahn in two smoothly moving buses—the "Red" and the "Blue" bus—and being absorbed by so much that was new and of intense interest the journey passed quickly and without fatigue. Early we passed through the far stretching areas of the Rhine plain, all intensively cultivated agricultural land. Perhaps we wondered why we could see so far and so clearly and then remembered our own road-side hedges and trees and raised farm fences. Here was the first striking contrast: the absence of raised fences and in fact the very vague evidence of any land divisions was a fundamental difference. The frequent passing of great towns and cities from which much of this land seemed to be worked was also strange to us. With the Rhine on our right, but seldom seen, our attention was diverted first to the Bergstrasse and then to the outer hills of the Odenwald gradually rising on our left. Crossing the river Neckar, of whose beauties we were to know later, we passed close by the famed city of Mannheim on our right and Ludwigshaven on the west bank of the Rhine which was never far away. After crossing the Neckar, though still on the plain, we passed nearer to the mountains on the east and moved away from the Rhine and it was here that we entered scots pine forests on either side of the road and saw the first evidence of forest management in Germany. Many of these stands impressed us by their heavy stocking for their height; artificially regenerated scots pine seemed too to be very closely spaced—possibly at 3 ft. × 4 ft. or 3 ft. × 3 ft. These

forests were mainly communal or privately owned. We saw too the evidence of some recent severe frosts where the foliage of all exposed young beech had been completely burned black. Very remarkable too was the fact that most of the foliage on the locust trees (*Robinia pseudoacacia*) appeared to have been stripped after the first flush. This may have been due to frost, but it was also suggested that it was possibly caused by the may bug, a cockchafer beetle which apparently causes considerable damage by eating tree foliage in Germany. But these were only passing impressions. We were introduced also on this journey to a German road-house where we enjoyed a pleasant snack and were able to stretch our legs. This was an attractive building which stood in a short by-pass of the autobahn and blended into the scots pine forest at its back; here all travellers' needs—food, drink, post cards and petrol—were to be found.

Moving on then past Karlsruhe we started to look eagerly forward and to the south-east for now we were seeing for the first time the outlying hills of the Schwarzwald. Then we were on smaller roads, then Rastatt, and finally Baden-Baden.

The ceremonial lunch at Baden-Baden was one of the big occasions of the tour and got everything off to a flying start; there for the first time we met President Kurz, Chief of the Baden-Württenberg Forest Service, Oberforstmeister Mahler, Chief of the forests in the Baden-Baden area, Forstmeister Weirich from Stuttgart, and Dr. Graf von Wallwitz. During a most convivial dinner we tasted the fresh, lively German wines and a delectable dish of venison from young roebuck. After the meal we were all presented with a most valuable memento, *Der Stadtwald von Baden-Baden,* written and compiled by one of our hosts, Oberforstmeister Otto Mahler. The photographs in this book, which are of the very highest quality, are in themselves a silvicultural treat and an education for any forester. They illustrate vividly the perfection which has been reached in utilisation, road making, game preservation and protection, and in the silvicultural application of natural and artificial methods of regeneration. Oberforstmeister Mahler pointed out all this to us in the afternoon in the forest with the aid of Dr. Graf von Wallwitz's vigorous interpretation.

At Baden-Baden a particularly impressive point of silviculture was the fact that the management was prepared to introduce douglas artificially into an already heavily stocked crop of natural regeneration of spruce and to protect each douglas individually against deer. The douglas was put in at something like a final crop spacing so that to protect each of these trees with mesh wire and four strong posts battened at the top was a costly undertaking. One could not but be impressed by the fact that here we had the most famous silviculturists in the world prepared to incur great expense in order to attain a possible state of perfection silviculturally and productively; here we had a true valuation of the worth of the forest.

We will never forget the warmth and conviviality of our reception at Baden-Baden, the high quality of the forest management and the outstanding beauty of the countryside and town, but how truly these same words could be said of so many delightful places we were to see during our tour.

Who could forget Zwingenberg and that breathtaking view of the beauty of the Neckar from the lofty battlements of the Castle of the Duke of Baden to whom we owe our best thanks for permitting us to visit his estate. Who, indeed, will forget Forstmeister Peter Hautermans and the silvicultural treat he gave us at Zwingenberg Forest. It was at Zwingenberg too that the Irish party and the Society of Irish Foresters were greatly honoured by being invited to plant an oak tree in memory of the occasion. This tree which was named St. Patrick's Oak by Forstmeister Hautermans, will strengthen the desire to return—a desire developed in this and many other places during our tour.

We will not forget either the generosity of Dr. Fischer-Zach and his co-directors and the prodigious skill and vigour of Forstassessor Clarsen's bugling. On the next day the Forstassessor showed even greater skill and vigour in his handling of the demonstration of *unimog* mechanical extraction devices at Schifferschaftswald.

Many will remember with pleasure also the kindness extended to them and the excellence of fare that they received at the country guest houses outside the town of Forbach where the main hotel in the town was unable to accommodate the entire party.

Freiburg im Breisgau, the worthy capital of the Black Forest, the "Open City," still remains open, fresh, a typical university town dominated by the splendour of the medieval cathedral in red sandstone with its unbelieveable 380 foot spire which has been so aptly described as "lacework in stone." It was here on the feast of Corpus Christi that the party heard Mass in the great cathedral and later saw from the balcony of the Kaufhaus (Guildhall)—a great privilege indeed—the colourful Corpus Christi procession. Happily, the cathedral and the Kaufhaus which overlooked the market square where the procession finally assembled, came through the war with comparatively little damage.

It was here in Freiburg that Dr. Graf von Wallwitz exerted himself to the utmost in telling us everything obout the old city and showing us through its narrow alleys where all the shops and windows were tastefully bedecked with interwoven fir, birch and spruce branches and wreaths in honour of Corpus Christi.

That afternoon because of a persistent drizzle, so familiar to us at home, we missed seeing the famous Feldberg (4,898 ft.) mountain at a distance. But whatever the rain may have done that day it can never efface the memory of that highlight of our tour, the oration by Praesident Kurz in the Forest at Villingen on the basic principles of

silviculture and forestry; that was a great moment indeed. Yes, we will remember Villingen, and the kind words of Forstmeister Frendenbergin too. The weather was not over gracious to us during our tour and robbed us of the full enjoyment of such views as southward from St. Margen to the Feldberg and, later, to the Alps on the road to Villingen. Imagination can almost offer the full picture of the sweeping view down across the Rhine plain to Strasbourg in France on that tremendous drive on the Black Forest highway from the Schifferschaftswald to Freudenstadt. It was at the highest part of this drive some 4,900 ft. above sea level that the spruce became very stunted and petered out and the tree cover changed to sparse mountain pine (*Pinus mugo*)—and the ground vegetation to heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*). At this altitude we were at the limit of economic tree growth. Irish foresters realised here in a very impressive way—for this was one of the few times we saw heather—how very much more favourable the conditions were for tree growth in the Black Forest compared with the conditions and relative altitudes in their own country where dominant *Calluna* is a normal condition. But consideration of such a comparison is made difficult by the complex factor of relativity.

An evening drive to Stuttgart along the north western margin of the Swabian Alp and earlier along the watersheds for the Rhine to the north-west and north and the Danube to the south-west is vivid in our memories with Dr. Graf von Wallwitz ever eager that we should not miss anything, shepherding us up a side road in the fading light in order that we could see an unforgettable and haunting silhouette of the historic Hohenzollern castle in lonely and lofty isolation.

At Stuttgart our stay was short: we arrived late, had a later night, and had to leave early the next morning. Once again, however, Dr. Graf von Wallwitz made sure we did not pass along without a rapid glimpse of the dignified architecture in red sandstone in the central city area. He rushed a party round before the early departure of the bus for Zwingenberg and many were lucky enough to see the Theatre Platz and the Schloss Platz.

The Konigsbau and the really ancient part of the city, the Schiller Square with its very old buildings, go back to the 12th century and were the places where the counts of old foregathered for ceremonial occasions in far-off days. Many of these fine buildings had suffered severe damage from bombing but the work of raising up these historic structures again in their original form was well under way.

We saw too from a distance the unique television tower or Fernsehturm, a slender, hollow, conical structure of concrete reaching high over the city to 690 ft. with an enlargement or "crow's nest" at 478 ft. which can be reached by lift and in which one can sit down to a meal in a glass-surrounded restaurant and look out over the city and

the countryside. We left Stuttgart wondering at the sight of vineyards sloping down to meet suburban houses and terraces.

We are grateful to our hosts for providing the opportunity for a brief visit to the historic old university town of Heidelberg where we were shown through the old castle of Heidelberg by an official guide.

At Weinheim Forest we were all astonished, to say the least of it, in being confronted in what we thought was Germany of the continental climate, with luxuriant groves of western American, Chinese and Japanese tree and shrub species.

It was here at Weinheim, in an unforgettable setting, that we offered our thanks to Forstmeister Fabricius and were presented with an Atlas Cedar (*Cedrus Atlantica* Manettii) by him which will duly find a place of honour in the arboretum at our own Avondale.

It was here at Weinheim too that we offered very inadequate thanks and appreciation to President Kurz who had so greatly honoured us by staying with us and leading us throughout the tour in Baden-Württemberg; to Forstmeister Weirich of Stuttgart who had spared no effort to make us familiar with all aspects of the Schwarzwald country which he knew so well, and who was a friend to us all; and to Dr. Graf von Wallwitz.

Count Willwitz, who must love his adopted country of the Black Forest very deeply, was able to convey to us the very spirit of its hills and valleys, and of the history of its towns. He certainly made the history of this part of Germany a living thing for us and his orations, such as on the history of Hohenzollern, were unforgettable. He worked in every way and at all hours to make our tour the happy, instructive one it certainly was.

Perhaps of all the towns we visited we should say most about Frankfurt for we dallied longer there than elsewhere, and its streets and show places were explored by most. However these explorations left a maze of personal experiences and impressions which cannot be condensed by the individual. It was at Frankfurt we first looked out at Germany and at Frankfurt we bade reluctant farewells. Of Frankfurt we must first remember the manager and manageress at the youth hostel for their patience, helpfulness, and the excellence of their fare. Our stay at the youth hostel was a very important factor in the success of our tour and a well conceived idea in the first place.

Many enjoyed boat trips up the Main, some down as far as Mainz and others were fortunate enough to be driven both through the Taunus mountains and near to the Wester Wald and the Mosel, and then down the western bank of the Rhine under the steeply sloping vineyards and Rhine castles past the Loreley Rock and the historic Rhine crossing at Kaub Die Pfalz, to the wine town of Rudesheim, then to Wiesbaden and back to Frankfurt.

In Frankfurt itself the cheerful courtesy with which we were met in all the shops was remarkable. Some saw also the children's park

which was developed from the town forest to meet the needs and demands of the ever enlarging and encircling suburbs. Here every advantage had been taken of nature to adapt it to the whims and requirements of childhood. Apart from a splashing pool with crystal-clear water there were tunnels made from hollow logs, closely stocked spinneys for "Red Indians," special climbing trees and logs for carving names on, slides and many other ingenious adaptations of nature for the pleasure of the young. The whole park was specklessly tidy. The predominance of Robinia or locust tree (*Robinia pseudoacacia*) and limes was a noteworthy feature in the streets and suburban roads as compared with the usual species in our own country.

At Frankfurt on Friday night we were entertained to dinner by the Federal Government at which we had a very good speech from Oberregierungsrat Oedekoven who, having spoken in fluent English concluded by wishing the party Slán Libh agus go n'éirighe an bhothar libh, which is a wish each and every one of us can most warmly return to him personally.

The President of the Society, Mr. Mooney, the Vice-President, Mr. Cosgrave, and Mr. McEvoy ex-President, replied on behalf of the Society.

On the evening of Saturday, June 2nd at about 11.30 p.m. we paid our farewells to Herr Oedekoven and started on our homeward journey down the Rhine via Mainz to Köln and then to Aachen and back along the same way we had come through Belgium to Ostend finally arriving home early on Monday, 4th of June.

Town Forest of Baden-Baden and The Wood Cellulose and Paper Mills of E. Holtzman & Co., Ltd.

First Day (*May 29th*).

THE first forest on our itinerary was the town forest of Baden-Baden about 130 km. south of Frankfurt. On arrival at Baden-Baden after a pleasant journey down the Rhine valley we were met by President Kurz of the State of Baden-Württemberg and entertained to lunch as the guests of the town. At the lunch our party was welcomed by President Kurz, himself an eminent and internationally known forester, who hoped that our visit would be both pleasant and instructive, and he expressed his intention of accompanying us throughout our tour. Herr Meita representing the Mayor of Baden-Baden extended a welcome on behalf of the town and expressed his pleasure that their forest was to be our first introduction to German forestry. Oberforstmeister Mahler also associated himself with the expressions of welcome. Our President Mr. Mooney replied on behalf of the Society and Mr. Clear also spoke.

After lunch we were conducted by Oberforstmeister Mahler on a tour of the town forest. This forest comprises some 5,700 ha. and

ranges in elevation from 140 to 1,000 mertes.* Rainfall for the district ranges between 1,000—2,000 mm. which would correspond broadly to our own range but the average summer temperatures are higher than ours and range from 16.2° (61° F.) for Baden-Baden on the lower slopes fronting the Rhine valley to 12.9° (55° F.) for Buhlerhohe at an elevation of 900 metres and situated in the hills 8 km. due south of Baden-Baden.

The geology of the district may, in its simplest form, be divided into 3 zones. Up to 500 metres we find upper carboniferous limestone with loess drift in the valleys and on the lower slopes; from 500 to 700 metres the underlying rock is granite while above 700 metres we find the variegated sandstones.

The proportion of species at the 1949 census was silver fir 34%; spruce 30%; pines/larch 7%; beech 24%; oak and other hardwoods 5%. These were distributed in age classes as follows: gaps 8%; 1-20 years 20%; 21-40 years 10%; 41-60 years 11%; 61-80 years 4%; 81-100 years 7%; over 100 years 40%.

Fellings are based on careful assessment of growing stock and increment and the calculated coupe for 1956 is 55,000 m³ or 9.9 harvest m³ per hectare. This is calculated to yield a *nett* profit per hectare of approximately 200 DM. for the municipal forest budget and it is interesting to note that this is only slightly less than the return from the grazing lands of Co. Meath as shown by the recent farm survey.

In 1947 the French started exploitation fellings and clear felled large areas. Since then Oberforstmeister Mahler has endeavoured both by natural and artificial regeneration to reafforest the devastated areas. The three species mainly in use are silver fir, spruce and beech; but also included in their mixtures are douglas , *P. strobus,* oak and sycamore. The silver firs have been found difficult to manage below 500 m. elevation mainly due to the rather dry sites and devastation from bark-beetle, consequently below 500 m. douglas and *P. Strobus* are the main species filled up with sliver fir, spruce, oak, beech, etc. Pure stands have fallen into disfavour and mixtures are now encouraged. Formerly the silviculture based on pure stands of silver fir yielded a mean annual increment of 10m³ but now in the mixed crops the M.A.I. is estimated to be 12 m³.

Above the 500 m. elevation the silver fir comes into prominence. The slopes here were originally clothed with oak and beech and only in the last 300 years have the conifers been introduced. The present aim is to grow beech to 120 years and silver fir to 70 to 80 years all regeneration being natural. M.A.I. here is about 10 m³/ha.

Above the 700 m. mark we find the variegated sandstone, and because of the difficulty of root penetration in this medium spruce

* 1 metre = 39.37 inches.
1 kilometre = 0.62 mile.
1 cubic metre = 35.31 cubic feet.
1 hectare = 2.47 acres.

becomes the dominant species but again mixtures are favoured so that we also find silver fir and beech. The variegated sandstone is very acid with a pH of about 4.5 and it also has hard pan not found in the granite in these regions. The M.A.I. on these sites is 7 to 8 m^3 per hectare.

The control of game is very important to the management of the woods and, in fact, is the first consideration in this municipal forest, with the natural regeneration of silver fir as the second. Deer do comparatively little damage to the beech but despite the strict control of their numbers their damage to the silver fir and douglas make it necessary to have individual protection to the young silver fir and douglas plants. Bark peeling by the red deer also can seriously reduce yields but at the same time the hunt as an attraction to the tourist must not be overlooked or forgotten.

A good road system in the forest is considered essential and as a good road system can command higher prices for the produce it is also sound economy. Consequently the costs of the road system is an important item in the forest budget and the annual allowance on road construction and maintenance is between 5 and 600,000 D.M. Concrete roads are now favoured at an average cost of 43 D.M. per metre run for a width of 4½ metres. During our tour of this forest all driving was on forest roads which gives an indication of the importance placed on a good road system.

Leaving the forest we next went to see one of the important industries based on the forest produce, the wood cellulose and paper mills of E. Holtzman and Co. Ltd. At the mill we were met and welcomed by Dr. Fischer Zach and his co-directors. Dr. Fischer Zach, a fluent English speaker, who had travelled extensively in the study of modern techniques of the industry, gave us an outline of the history and development of their company, and then led the party on a tour of the Wolfsheck paper mill.

This firm was established in 1883 in the Murg river valley between Forbach and Weisenbach and now controls 3 separate mills in close proximity along the river. The site was specially chosen to utilise the steep fall of the river which in the early years provided all the power necessary. As the mills developed and were enlarged and modernised to meet the growing dmands additional power became necessary and this is now supplied by a modern high pressure steam plant capable of delivering almost four times the power supply of the river. Modern equipment recently introduced into the Wolfsheck Paper Mill includes a new paper making machine, a modern debarking plant in place of the old manual methods which were found to be wasteful, and two new continuous high powered grinders for mechanical pulp bringing the total number of grinders at Wolfsheck to six.

Two of the three mills controlled by the company are concerned

with paper making; the first at Wolfsheck, which is also the largest, produces newsprint while the second at Breitwies produces better grade paper for magazines etc. The combined daily consumption of wood in these two mills is about 5,000 stères and it is interesting to note that the production of these two mills if confined to newsprint alone could supply ¾ of our own requirements.

The bulk of the pulp used is mechanical and is produced in the mills themselves. A small proportion of chemical pulp is mixed with the mechanical to provide strength and varies with the quality of the paper to be produced. This has to be imported as there are as yet no facilities for the production of chemical pulp at the mills.

After our tour of the mills our party was entertained to dinner by the company. This was followed by light entertainment which was contributed to both by our hosts and by our members. It was on this occasion we had our first introduction to the hunting horn, when various calls were sounded by Dr. Fischer Zach and Forstassessor Clarsen, the highlight being when the former sounded the calls on two horns simultaneously.

At the conclusion Dr. F. Zach spoke words of welcome to the Irish party and mentioned the warm feelings Germans had towards our people. The President of the Society replied and was seconded by Mr. M. Flannery in offering the heartfelt thanks of the Society of Irish Foresters for having the operation of the paper mills so clearly demonstrated to them and for the magnificent hospitality the company had extended to members of the Society.

Schifferschaftswald and the Town Forest of Freudenstadt

Second Day (*May 30th*).

After a night of storm with a vivid and colourful display of lightning on the rugged mountainous country we rose to a morning of clear air and bright sunshine. Our first stop was to inspect the forest of the Murgfloating Company and to see a demonstration of the very adaptable *unimog* jeep.

We were met by Oberforstmeister Dr. Kanzler and Forstmeister Neukume. Before proceding with the inspection Forstassessor Clarsen and his foresters sounded a traditional welcome on the hunting horn, an honour which we deeply appreciated.

Dr. Kanzler and Forstmeister Neukume gave us an interesting and detailed account of the history of this Company.

The Schifferschaftswald comprising about 5,000 hectares belongs to a company whose origin can be traced to the 13th century. The name "Schiffer" means raftsman and the Murg river raftsmen were men who floated timber out of the Murgvalley to the Rhine and thence to the

Netherlands. These "floating-tenants" operated sawmills in addition to their timber exports. Even at that early date they were organised in groups or companies and developed the Murgvalley for colonisation. In the 16th and 17th centuries the Murgfloating Company was fully established with forest property amounting to 20,000 ha. and operating 30 sawmills in the Murgvalley.

Severe set backs were suffered during the 30 Years War (1618-48). A disastrous fire which burned down many of the mills, family dissension, deaths, etc. brought the company to near ruin. Only 5,000 ha. remained in the hands of the seven families which survived. They set up new sawmills and re-established the company which has survived to this day. The forest was divided into 307 properties of different sizes varying from 1 to 307 ha. One central management controlled operations over the entire area. The revenue from the different properties was paid directly to the owners but only when felling operations were carried out in his particular share did he receive any revenue. This plan proved unsatisfactory as the property owners wished to have a steady income and the management found it increasingly difficult to keep track of the properties which were constantly being subdivided in marriage settlements, inheritances, etc.

In 1892 the resources of the Murgfloating forest were pooled and the ownership of the various properties passed from private hands to the company and the share values were based on the soil expectation value of the lands surrendered.

At the end of the nineteenth century the state of Baden acquired a controlling interest in the company and, by an agreement of 1886, while they took over technical management, administration still remained in the hands of the Murgfloating company.

The area now administered by this company comprises some 5,000 ha. situated in the valleys of the Murg river and its tributaries, Schwartzenbach, Raumung, Schonmunz and Langenbach. The forest is typical of the Black Forest mountains with steep, craggy slopes and generally rugged terrain. The altitude range is from 330 m. to 1,260 m. The continental climate which might be expected in this situation is not so pronounced due to protection from the bitterly cold east winds provided by the continuing massif to the east. However, within the forest district there is a considerable variation in mean annual temperature from place to place due to altitude. Thus we find on the lower slopes a mean annual temperature of 50° F. with an average summer temperature of 68° F. while in the upper regions the corresponding figures are 43° F. and 59° F.

The area enjoys a high rainfall which is fairly evenly distributed with the greatest fall occurring during the growing season. The soils in the main are derived from granite. They are deep, free-draining, sandy soils, rich in potash and magnesium but poor in calcium. Sporadic

intrusions of crag and rock-outcrop occur. Upper and lower variegated sandstone are present on the higher regions, the former predominates giving a shallow, stoney soil with peat cap.

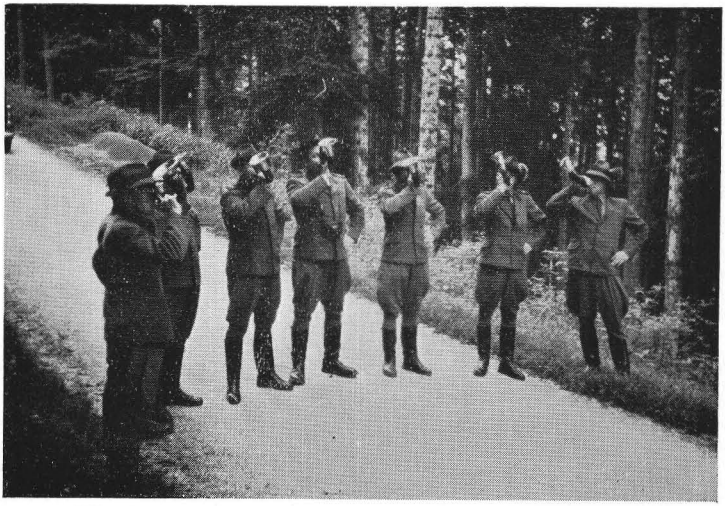
The selection system of silviculture had its origins in the peculiarities of ownership and dividend payment in the early days of the Murgfloating company. As each shareholder derived revenue from his woodlands only when felling actually took place in his share, he devised the system of continuous selection fellings to provide a small but steady income rather than a larger but intermittent income which would accrue from a clear felling system.

The advantages of this particular system were recognised by the company and management continued on these lines after the amalgamation of 1892. This system favoured silver fir but unfortunately the absence of adequate control of deer resulted in a severe set-back to this species, so that to-day we find it occupying a secondary place. The ideal stand is considered to be 70% silver fir, 15% spruce, 10% beech and 5% pine in order to give maximum utilization of site and under these proportions it is estimated that the site could carry 850 m^3 as against present actual stocking of 365 m^3.

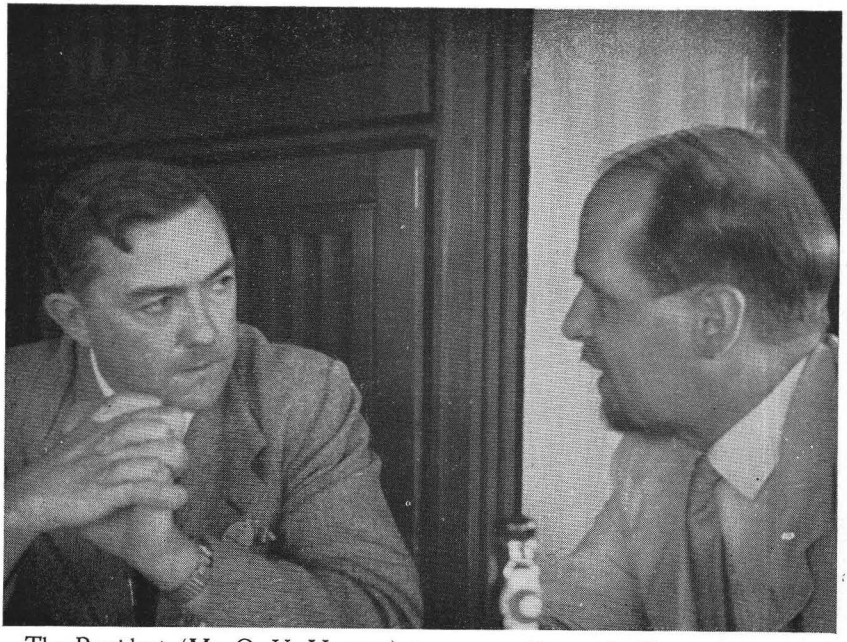
To achieve this, a rigorous system of protection against game is being pursued. The present game stocking is 7 deer (5 roe and 2 red) per 100 ha. as against a tolerable 2.5 (1 roe and 1.5 red) per 100 ha. The protective measures include reduction of the game stock, fencing of individual regeneration and valuable blocks and also by the use of chemical deterrents to browsing. In addition to protection against game the nature of the terrain necessitates special precautions against storm damage and snow break.

The increment for 1956 is estimated to be 8.2 m^3 total volume per ha. but it has been decided to overcut by some 2.0 m^3 per ha. This is estimated to yield some 50,000 m^3 almost 80% of which will be larger saw timber and 20% firewood and lop and top.

The forest property of the Murgfloating company is divided into 9 districts with areas ranging from 500 to 600 ha. Continuous employment is provided for some 200 workmen and seasonal employment for 150 female workers. The universal trend for labour to move from the country to industrial centres is also in evidence here with resultant scarcity of manual labour for forest operations. This has led to increased mechanisation in the forest and the most versatile machine is the *unimog,* a jeep developed by the Mercedes-Benz company. Research and development for the adaptation of this machine for forestry operations are still proceeding and the company's technicians are working in the field in collaboration with the forest officers. The main features of the *unimog* are its very efficient hydraulic system, the large variety of implements which have been adapted for use with it, its manoeuvrability and robust construction which enables it to operate with efficiency in the



The party being welcomed at Murgschifferschaftswald.
(*Photo—Forstmeister Weirich*).



The President (Mr. O. V. Mooney) in conversation with Oberregierungsrat Karl Oedekoven over a cup of coffee in a wayside inn.
(*Photo—Gerald Scully*).

Black Forest, 1956.

The President and Forstmeister Peter Hautermans planting the St. Patrick's Oak at the Duke of Baden's estate at Zwingenberg.

(*Photo—Gerald Scully*).

Forstmeister Neukume addressing the party at Murgschifferschaftswald.

(*Photo—Forstmeister Weirich*).

Black Forest, 1956.

rugged terrain of this region. This was effectively demonstrated in a variety of operations under the direction of Forest Assessor Clarsen.

Having spent a very interesting morning, we were entertained to lunch by the Murgfloating company at which our President, Mr. Mooney expressed the thanks and appreciation of the Society for the great pains taken by the company to ensure the success of the visit.

Town-Forest of Freudenstadt.

Having left the forest of the Murgfloating company we proceeded southwards through country whose natural grandeur was enhanced by the colour and fragrance of early summer to Freudenstadt, where we were accorded a civic welcome. After tea in the Spa we were conducted on a tour of the town. Following the last war this town was razed to the ground, only one house remained standing. This house has now become a public monument and the town has been completely rebuilt in its original style and architecture by the co-operative efforts of the inhabitants.

President Kurz conducted our party through the town forest. Some of the most important attractions of Freudenstadt are its scenic beauty and the hunting and winter sports facilities it can offer visitors, the considerations of which have a big influence on the management and silviculture of this municipal forest. In general, the selection system as formerly practised is adhered to by the present owners.

At the beginning of the century silver fir and spruce were the main species but due to clear-fellings practised up to 1901 and the over-cuttings necessitated by the last war and exploitation fellings during the later French occupation the silver fir population was reduced considerably and spruce has become the dominant species. Present silviculture is aimed at favouring silver fir and the success is now apparent in the one to twenty year class. The soils are generally derived from variegated sandstones and are poor in mineral nutrients with frequent hard-pan. The disappearance of beech due to the heavy demand for firewood has not helped matters and its re-introduction as a soil improver has assumed an important place in the silviculture of the district.

The estimated mean annual increment prior to the exploitation fellings of 1947-49 was approximately 6 m^3 per ha. of saw-timber. Exploitation fellings in the municipal forest were not quite as heavy as in other public forests in consideration of the total destruction of the town. Nevertheless some 75 ha. of the total 2,500 ha. of the forest were clear cut.

Considerable importance is placed on the forest road system and in addition to three public highways which traverse the area there are some 85 kms. of metalled road, 81 kms. of secondary roads and 22 kms. of sledge ways to serve the 2,500 ha. of forest. For the upkeep and

maintenance of this road system three road surveyors and ten workmen are employed. The labour content of the forest is some 130 men of whom 50 are skilled forest labourers working under 4 forest rangers, the entire service being under the direction of President Kurz.

Freiburg—Villingen—Stuttgart

Third Day (May 31st).

Thursday, 31st May, Corpus Christi, proved a long, full and most memorable day. Members had the privilege of attending High Mass in the historic cathedral of Freiburg im Breisgau at 7 a.m., followed by a tour of the old mediæval city lovingly conducted by Graf von Wallwitz, who has made his home there and whose distinguished figure seems to be greeted heartily by most of its citizens. We were most fortunate to be able to see the decoration of the narrow streets with religious plaques and statues, precious family heirlooms, wonderful examples of traditional craftsmanship especially in wood, against a background of the fresh green foliage of birch. A balcony of the Old Diet House overlooking the cathedral square was specially reserved for the Irish party as distinguished visitors, and we had a wonderful view of the assembly of all the townspeople, council, university faculties, schools, and mediæval guilds, for the Benediction which marked the end of the traditional Corpus Christi Procession. The occasion was marked by a colourful ceremony wedded to religious fervour which left an indelible impression on our minds.

Time did not permit a visit to the town forest of Freiburg (3,722 hectares) which clothes the encircling hills and adds so much to the city's setting.

We drove for lunch to St. Margen, a village in the foothills of the Southern Black Forest which we were now entering; then westwards crossing the watershed of the Rhine and the Danube near Furtwangen (home of cuckoo clock manufacture) on our way to Villingen, an ancient garrison town enclosed within its square of walls pierced by four gates.

The visit to the state forest of Villingen was of particular interest. For one thing it was the first state forest we had encountered but more important still was its association with our renowned leader, President Kurz, who was in charge of this area for 20 years. It was a pity that the afternoon turned out rather wet, but it was not unlike Irish weather and our members were not unduly put out.

This high lying region is the source of the Danube which flows east and the Neckar which flows west to the Rhine. It is reputed to be the coldest region in Germany and is in an immense frost hollow brought about by the Swabian Jura Mountains to the east and the Black Forest Highland to the west. The climate is described as raw, and relatively

dry with the frost free period extending only to 120 days. The soil varies with the local rock formations and so also does the site productivity.

The woodlands in this district are mainly private or co-operative forest under state management together with about 30% of state-owned forest. It is purely a coniferous forest area with spruce predominating, about 70% Silver fir (12%) and Scots pine (18%) make up the rest. It is the aim of the management to reduce the proportion of spruce to 50% by area and to have 20% silver fir, 25% Scots pine and larch and 5% hardwoods. The rotation is fixed at 110 years. The production figures for this high-lying region, are quite impressive. The mean annual increment for all sites is well over 110 cubic feet per acre *per annum*.

Silvicultural Management.

This area is renowned for its silvicultural management. The aim of the silvicultural system evolved here is the maintenance of soil productivity, security of the timber crops against storm, snow and wind, elimination of weeds and disease, improved volume, value and size of produce and finally natural regeneration from healthy, perfectly grown, selected mature crops. This is achieved by a system of constant selection and freeing of high quality stems, while maintaining an understorey of soil protecting trees. The emphasis is on quality.

The spruce is the main species and the basis of all management plans is the recognition of the rôle of the spruce as the principal source of the wealth of the forest. The silver fir and pine, however, are recognised as essential ingredients for the sustained production of timber because of their soil and crop protecting qualities. It has been the aim of research to develop a suitable technique calculated to achieve the objects outlined. The wedge system seems to be the ideal one both on economical and technical grounds.

This system was adapted and perfected in the state forest of Villingen under Landforstmeister Kurz as a model form of management for the guidance and control of the forests in this area. It is claimed for this system that it guarantees sustained production of the highest yield of timber in volume and value for the lowest outlay. The wedge system aims at natural regeneration where this is desirable and possible. The process is as follows :

1. Firstly the tolerant species, silver fir and spruce, are regenerated under shade by a systematic removal of the soil-protecting understorey and a thinning in the dominants.
2. Since any attempt at a uniform opening in the stand is fraught with danger from windthrow a wedge is driven in in an east to west direction giving at one and the same time protection against

wind and conditions suitable for regeneration of the intolerant species, larch and pine.

A network of roads enables a large area to be handled at once and provides for thinning and extraction. This system is elastic, natural, simple, practical, beautiful and successful. It is a system, however, that requires a high level of technical skill and singlemindedness on the part of the management. Landforstmeister Kurz possessed the necessary skill and feeling and the purposeful outlook to carry to its present perfection the system established under his distinguished predecessors, Eberhardt and Phillips.

It was indeed a memorable experience to meet this great silviculturist on his own ground and to hear him expound the great universal principles of sound forestry.

President Kurz expounds a principle of silviculture.

One of the features of the forest, excellent larch regeneration, was well demonstrated and at one point we were shown the final stages of this process under the Wedge System—scattered standards of larch of good form over crowded regeneration of silver fir, spruce and larch—an example of the applied skill of President Kurz.

Our final 'stop' in this forest was of particular interest to Irish foresters. It showed the gradual evolution of a three storeyed mixed forest from low land planted about 100 years ago with pine, spruce and silver fir. The silver fir originally dominated the stand but selective felling developed an overstorey of pine which are now putting on quality increment; these are followed by spruce and occasional mother trees of silver provide by natural regeneration a soil protecting understorey. It is claimed that such stands yield about 50% more than single storey forest under Villingen conditions—M.A.I. being up to 200 H. feet per acre. The pine in this district is of the typical mountain type with narrow crown and light side branches, very resistant to snow damage and very manageable in mixed stands.

We were accompanied in Villingen by Forstmeister Freudenberger who is now privileged to manage this famous forest. At the conclusion of the forest inspection we were entertained to a "hunter's meal" of Zwillingen sausage and beer. Our President and Mr. McEvoy conveyed sincerest thanks to our hosts and guides and President Kurz replied.

The remainder of the day was occupied by the journey northwards of some 120 kilometres to Stuttgart. We crossed the upper reaches of the Neckar at Rottweil, an old Swabian town, paused to view the castle of Hohenzollern on its pinnacle near Heckingen etched against the evening sky, recalling memories of the Holy Roman Empire; recrossed the swelling Neckar at Tubingen and joined it again at Stuttgart at 10 p.m.

Stuttgart—Zwingenberg—Weinheim—Frankfurt

Fourth Day (*June 1st*).

Before leaving Stuttgart, Graf Wallwitz, conducted a lightning tour of the city which was heavily damaged by war bombing but now contains many outstanding examples of architecture in the modern idiom.

We then drove north for some 80 kilometres, following the broadening waters of the barge-laden Neckar and admiring the vineyards on the valley slopes, until we reached Zwingenberg.

The castle of Zwingenberg, property of His Royal Highness, the Mark-Graf of Baden, which was the first stop on our itinerary is a very beautiful and impressive building towering as it does above the Neckar river. We were greeted at the castle gate by a fanfare from hunters lined up on the battlements and were welcomed, in excellent English, by Forstmeister Peter Houtermans who then conducted us over the castle. Here we were right back in the Middle Ages. Zwingenberg is the only fortress on the Neckar about which there is a very definite history. It was originally built by a robber baron and was, therefore, destroyed in the 14th century by Prince Rupprech I. It was later rebuilt and changed several times until it finally came into the hands of the Grand Duke of Baden in 1808, in the hands of which family it has since remained.

Property of His Royal Highness, The Mark-Graf of Baden

The castle now houses the forestry office which administers the property of some 5,000 acres of forest. There is no agricultural land on the estate. The forest is widely scattered along the flanks of the Odenwald and occupies the steep and infertile slopes and high-lying glens. The land in between is farmed intensively. The soils are of local *Bunter* sandstone origin and are of excellent quality. They are lacking in lime, however, and are liable to cause shallow rooting in spruces in certain places.

The greatest problem is windthrow and snowbreak. This is best illustrated by the fact that in the period 1951 to 1955 over 37,000 cubic metres of timber was blown, equal to the allowable cut of 3 years.

The menace of widthrow is being combatted by a variety of measures; better selection of species (including the deep-rooting pine and larch), early and heavy thinning, provision of shelter zones and the reduction of the spruce crowns of endangered margins. Red and roe deer cause great damage in the pole woods and new plantations and special and expensive fencing and protective measures are everywhere in evidence. It is specially necessary to protect valuable introduced species like douglas.

Benediction of the Blessed Sacrament in the cathedral square in Freiburg on the feast of Corpus Christi as seen by our party from the balcony of the Guildhall.

(*Photo—Forstmeister Weirich*).

The forest is now mostly mixed coniferous, high forest resulting from the steady replacement of poor hardwood coppice since around 1800. This afforestation programme has resulted in splendid mixed mature stands of spruce, silver fir, pine, larch and beech. More recently douglas has entered the picture. The aim is to maintain mixed stands with larch, douglas and silver fir forming the long-term, valuable timber trees, the spruce the intermediate or early yielder and the beech the soil protector. The very complicated mixtures require expert treatment from the very beginning. The planting itself is rated unskilled work and can be done by casual labour but the cultural treatment is left to skilled workers. The constant cleaning and selecting goes on right through the life of the crop. All timber is felled and extracted by the forestry staff.

A unique feature of this estate is the scheme for training apprentices. At the present time there are 10 trainees under instruction. They are in the hands of two skilled instructors who have been specially trained at a Forest Worker School. There are two classrooms, where the trainees receive vocational instruction including the care of the axe and saw and other tools, the identification of timbers, common woodland plants and animals. Their work in the woods is constantly supervised and after 7 years apprenticeship they become skilled forest workers and secure permanent appointments.

Other outstanding features of this estate are a splendid system of roadways and a high degree of mechanisation. All foresters have motorcycles and most of the workers are similarly equipped. Loans are made for the purchase of these vehicles. There is also a splendidly appointed forestry office with the services of two filing clerks and a forester accountant. Timber sales are controlled by a very excellent system which is well in advance of that generally employed. There are working plans going back to 1830 and at present the working plan is being revised. To aid in this revision, the forest has been mapped by aerial photography and is also being site-mapped by a team of soil scientists and *ecologists.* Finally a team of university trained working plan experts will be called in to prepare the blueprints for the management for the next 20 years.

The party was entertained to tea by Frau Houtermans in Zwingenberg Castle and later to beer and sausages in the forest. Forstmeister Houtermanns also had an oak tree potted and ready for a ceremonial planting. Our President, Mr. O. V. Mooney, planted the "St. Patrick's Oak" which grows to-day in the Odenwald in Germany.

The outstanding feature of this visit was the emphasis on the skill and training of forest labour. We saw fully equipped workers with crash helmets and all (!), skilled extraction by *unimog* and young growth tending by trainees. It is doubtful if so much instructive matter was ever packed into so short a time on any forest excursion anywhere. The members of the Society are indeed grateful to Peter Houtermans for all the trouble he took to make our visit worthwhile.

From Zwingenberg we followed the Neckar westwards to Heidelberg where a tour of the city and Castle was laid on. This site was occupied successively by Romans, Germans and Franks and the University dates from 1386. It is a city of great tradition and great beauty rising steeply from the river to its forest clad heights.

Leaving Heidelberg and travelling westwards we were soon out of the mountains and turning northwards on to the autobahn in the plain of the Rhine with Weinheim as our next call.

Weinheim.

So far the places we were in and the forests we had visited were typically German. Here at Weinheim was something different. Walking up the approach road an Irish forester was immediately reminded

of Killeagh, or was it Galtee Forest or maybe the Battery road at Avondale? We were in the forest of the exotics, mainly Western North American conifers, all species very much a part of our home afforestation work and, to our minds, very Irish.

Weinheim Forest lies north-east of Mannheim in a glen opening westwards in the Bergstrasse range which flanks the Rhine valley to the east. It is a district noted for its mildness, the Spring, we are told, makes its appearance here three weeks earlier than in other parts of Germany and the climate permits of almond growing, allows figs to ripen and even hardy sorts of lemon trees to produce flowers. The luxuriant growth of tender plants encouraged the former owner, Baron Christian von Berckheim, to plant exotic trees in a big way. He went in for good sized plots, 0.3 to 2.5 ha. and to-day, thanks to his endeavours and those of his descendants, there is an area of about 32 ha. in close stands and ranging up to 90 years old. Sample plots have been laid down for silvicultural research purposes and these comprise 10 North Ameican species, 8 east Asiatic species and 3 Mediterranean species.

The forest lies between 135 and 250 metres in altitude and the soil is fertile, of weathered granite from the hills above and increasing in loaminess at lower level. In places there is medium variegated sandstone and an overlay of loess loam.

No timber has yet been put to industrial use as it is considered to be too knotty. Research into possible uses is being carried out at the Forestry Institute in Hanover. The main value of the forest is as an experimental area to test the behaviour of exotic species under silvicultural conditions and as a source of seed for propagation and of material for scientific investigation.

Weinheim Forest remained in the hands of the Berckheim family up till 1955 when it became the property of the State. Since 1929 it has been under the care of State Forest Officer Fabricius who still manages it and who led us during our visit to the forest.

The soft rain fell gently as we ascended the mountain road, reminding us of Ireland and preparing us for journey's end before we began the long trek home. Overhead towered douglas, *Tsuga heterophylla* and *Abies grandis*— to right and left we caught glimpses of Sequoia and Lawson Cypress. We were told of natural regeneration springing up freely under these exiles now perfectly at home in the country of their adoption.

And then we stopped under the tallest douglas trees of them all. It was time to say good-bye. We had valedictory addresses from President Kurz and Count Wallwitz. Our President, Mr. Mooney and Mr. FitzPatrick replied on behalf of the Society. The last farewell of the green coated forester was sounded on his hunting horn, the notes reverberating up the tree-clad slopes until they were lost in the mists above.

Sadly we climbed into our buses and proceeded on our way in the wake of President Kurz's car with Count Wallwitz and Forstmeister Weirich as his passengers. Their final leave-taking was spontaneous and dramatic: as the buses took the high road leading to the Frankfurt autobahn, the car pulled up on the road below and our hosts jumped out to give us a heart warming waving of arms and hats. This was symbolical of the warm friendliness, the kindness and the courtesy we had met with everywhere under the guidance and care of President Kurz, Forstmeister Weirich and Dr. Graf von Wallwitz.

Conclusion.

In conclusion we would like to thank the West German Federal Government at Bonn for accepting the idea of this tour in the first place and then through their central direction opening the gates of the German forests to us. We offer them our best thanks too for having allocated Oberregierungsrat Oedekoven to the work of planning our tour and looking after us while we were in Germany. The Council and members would like to pay a special tribute to Herr Oedekoven for the unassuming way he went among them and advised and helped them in any sphere whenever he was called upon to do so. The Study Tour Committee leaned heavily upon him both during the tour and in the time of planning long before that, and consider that his advice and direction was one of the important factors in making the tour the success that it was.

The tour went far beyond just being a success, it far exceeded all our hopes in every respect and our only regrets were that we could not stay longer in many places.

We came home with warm feelings and happy memories of the German people, memories of their industry, resilience and durability, and of their kindness and generosity to us, and we give them full credit for making the tour a great and unforgettable experience for each one of us.

Cover Photograph

Our cover photograph shows a 22 year old plot of *Eucalyptus dalrympleana* in compartment 6, Ballymanus property, Glenealy state forest, Co. Wicklow. Some trees in this plot are already 90 feet high with a breast height quarter girth of 10 inches.

The plot stands on a dryish, south eastern slope about 6 miles from the sea. The average rainfall for the area is approximately 40 inches and the mean annual temperature is 49° F. The vegetation comprises bramble (*Rubus fruticosus*), bracken (*Pteris aquilina*), bilberry (*Vaccinium myrtillus*) and some ling heather (*Calluna vulgaris*).

On the left of the picture is Mr. P. Ryan, Inspector of Nurseries in the Forestry Division of the Dept. of Lands, who, as a forester, supervised the raising of those trees from seeds and the final planting of them. (See editorial and, also, note on the nursery treatment of eucalypts.).

Excursion to Lough Eske Forest.

A small attendance of Society members was favoured with an exceptionally fine day when by kind permission of The Minister for Lands and of Mr. Scott-Swan they visited Lough Eske state forest and Lough Eske demesne on Sunday, June 17th, 1956. Mr. Moloney, district inspector, was in attendance and some unusual and valuable silvicultural fare was well presented and fully documented by Mr. Ernest Johnston, the convenor.

The first stand shown to the party was a very remarkable one of sitka spruce planted in 1912 at $4\frac{1}{2}$ ft. $\times$ $4\frac{1}{2}$ ft. spacing with an admixture of *Thuja plicata,* common larch and scots pine. The stand which is now almost a pure one of sitka spruce stands on a dry ridge at an altitude of approximately 225 feet. It was estimated to carry some 7,200 cu. feet per acre in 1950. Now there are some 240 stems per acre with trees 105 feet $\times$ 15 inch Q.G.B.H. The height of an average dominant was estimated by the party to be 112 feet with a B.H.Q.G. of $14\frac{3}{4}$ inches. The crop showed no evidence of check during its life and looked healthy though somewhat sparsely crowned. There was no evidence of butt rot in the stand which had been thinned quite recently. The annual rainfall for the district was given as 60 inches.

The party was then guided to another stand of sitka spruce two or three hundred yards to the south which was in contrast with the former. This stand which stood on pure, black peat which had been considerably drained showed a height growth of only 40 feet in the best trees though the crop was 25 years old. Considerable check had been caused by frost in the early stages and parts of the crop had only closed recently. Current leader growth was, however, good and it was intended to thin the crop heavily (3rd thinning) to about 400 stems per acre and to prune prime stems at about 20 feet apart.

A sitka spruce—*Thuja plicata* mixture at $4\frac{1}{2}$ ft. $\times$ $4\frac{1}{2}$ ft. spacing and 43 years old was then inspected. *Thuja* was mostly suffering from butt rot and also *Keithia thujina.* It seemed, however, as in the first crop we saw that its being in mixture with *sitka spruce* was greatly to the benefit of the latter. Dominants of sitka spruce were 18 inches B.H.Q.G. $\times$ 80 feet in height and in seemingly good health. In a discussion on the treatment of the crop some thought that the most practical approach would be to clear-fell it owing to the erratic stocking or at least to remove the *Thuja.* Others considered that the retention of such a remarkable stand for thinning in the ordinary way would be justified.

At Lough Eske Castle in the very beautiful surroundings of Mr. Scott-Swan's estate we saw still finer sitka spruce which was shown to us by the owner himself who accompanied the party.

This stand was 43 years old and contained a mixture of sitka spruce, douglas and *Thuja plicata,* some silver fir and common larch. The *Thuja*

had been suppressed to an understorey of 65 ft.—75 ft. while at about 85 ft. to 95 ft. douglas was dominated by sitka spruce as large as 22" B.H.Q.G. × 130 ft. high. Many sitka spruce were of much smaller girth and very drawn up and the stand had been knocked about considerably by wind and was now very difficult to handle.

A discussion was held and opinions were expressed to the effect that the stand might be marketed soon particularly as the middle size saw-log was more attractive to timber merchants than the heavy type as at 22 ins. B.H.Q.G. Considerable comment was made on the *Thuja plicata*—sitka spruce mixtures at Lough Eske which seemed so successful in raising good quality sitka. Indeed the important lessons learnt at this outing were mainly concerned with this mixture found here in such advanced stages as were hitherto not generally known in practice in Ireland. The fine individual performance of sitka in that part of Donegal was also of significance: conditions there suit this tree very well.

O.V.M.

Excursion to Emo Forest.

A substantial gathering of members met at Emo forest on Sunday, 29th June, 1956 under the convenorship of Mr. O'Leary. They were met by Mr. Cronin head forester who, on behalf of the Minister for Lands, guided the party round the forest. In expressing appreciation on behalf of the Society to the Minister for Lands for the privilege of being allowed to visit the forest the President recalled that the Society had visited Emo in 1946 and that because of this comparisons between the state of the plantations then and now would be of special interest and value.

Mr. O'Leary presented the party with a number of silvicultural problems on the ground. The first offered was a P/35 plantation of sitka spruce at 5 ft. × 5 ft. which had been beaten up shortly afterwards with scots pine between the original plants. Scots pine had so far taken command to the extent that it was present at spacings of 20 ft. to 25 ft., pruned to 8 ft., in healthy condition and growing strongly with sitka spruce spaced at 4 ft. to 10 ft., badly suppressed and, with a few exceptions, very short leader growth. In a short discussion Mr. Hayes suggested that the scots pine crop must now be accepted except in certain cases where poor groups of scots pine had allowed the sitka spruce to get away. This view appeared to meet with general agreement from the party as did the "treat on its individual merits" judgement on a norway spruce-beech-oak mixture where many of

the hardwoods had become badly suppressed and it would hardly be worth sacrificing the norway spruce as a general policy. At this stage it was noted how strongly frost affects the growth of sitka spruce in these grassy midland areas. An area of P/35 sitka spruce had not yet closed and varied from 3 ft. to 10 ft. on to a maximum of 20 ft. high. Mr. Cronin also later showed us a crop of sitka spruce P/30 on fertile grassland over limestone drift where in places the crop had not yet closed with trees at 10 ft. to 20 ft. high. Trees of 20 ft. high had grown from 6 ft. in the last 10 years and the crop having got above frost level was growing vigorously now. The closed areas showed better sitka spruce at 6 ins. B.H.Q.G. by 40 ft. which suggested growth of only about fourth quality class up to the present time. Mr. Hayes pointed out how much better a line of scots pine at $7\frac{1}{4}$ ins. B.H.Q.G. $\times$ 40 ft. had done in the same crop. The improvement in the douglas stands since 1946 when their clearance and replacement was discussed was remarkable. Some P/33 douglas/european larch mixtures had been reduced to some 400 stems per acre and practically all the larch had been removed. Though the height growth of this douglas crop suggested 4" quality class or lower it was now growing with great vigour and all were agreed that when high pruned this would develop into a very good stand. Douglas beside the latter stand planted three years later at 5 ft. $\times$ 5 ft. pure showed much finer form of tree.

Mr. O'Leary showed the members the area where the douglas had been cleared in groups and belts in 1946 and replanted with beech and scots pine. This is fully recorded in the journal and some of the members present remembered the 1946 discussion.

The performance of the P/46 beech and scots pine in the grass from one group to another varied considerably. In some groups beech had grown to 10 ft. high and scots pine to 6 ft. or more but in other areas the beech had not yet come away and was at $1\frac{1}{2}$ ft. —2 ft. high with scots pine at 4 ft. or thereabout. The douglas in the retained belts (P/30) are growing well, look healthy at 35 ft. to 40 ft. high and when high pruned should make a good stand. Some thought that the douglas might in future so far dominate the P/46 scots pine and beech as to press it out except for the middle trees. Neither Mr. O'Leary nor Mr. Cosgrave, however, subscribed to this view but thought the P/46 plants would compete successfully. The area of naturally regenerated beech in compartment 1 was revisited and was now very closely stocked, probably 4,000 stems per acre at 15 ft. high in places. It was generally considered that the time had come for some more of the seed trees to come out but opinions differed considerably whether it was the right time to thin the young beech.

The party also visited the grapery by kind permission of the Jesuit Fathers and spent some time admiring the various exotic conifers and magnificent beeches.

In concluding the proceedings the President thanked Mr. O'Leary

for the skilful way he had brought out the important factors in silviculture in the district and given those who had been there in 1946 a chance of reviewing what they had seen then. He also thanked Mr. Cronin the head forester for making the way easy for us and for the comfortable arrangements he had made for our well being at the end of the day. He also alluded to the heartening change that had come over all crops since 1946 and commented on the lesson in patience that should be well learned by all foresters arising particularly from the great recovery of the douglas which seemed a doomed tree in 1946.

O.V.M.

Excursion to Kinnitty Forest.

THE appallingly wet weather of the summer of 1956 relented at the eleventh hour and lifted during the morning of the 9th of September in time to allow a large and representative gathering of members and friends of the Society to enjoy their visit to Kinnitty Forest. The party of about 50, including a very welcome group from Northern Ireland, met at the main gates of Kinnitty Castle forestry school where they were introduced by Mr. O. V. Mooney, President, to Mr. T. Prior, instructor-in-charge and district inspector, and Mr. D. Horgan, forester-in-charge. Mr. Prior welcomed the Society on behalf of the Minister for Lands, and gave a brief resumé of the history of Kinnitty Forest since the first planting took place in 1935.

The party then moved off to inspect some european larch and beech planted in belts on rich grassland which had been ploughed for planting. This ploughing had not, however, appreciably reduced the cleaning costs. The beech on this site is showing remarkably good growth in spite of severe frost damage in the spring of this year. We were then shown a plot of pure spanish chestnut growing on the other side of the main avenue. These are of the same age as the larch/beech mixture and had also been planted into ploughed ground. These chestnuts had not yet been cut back and a discussion followed as to the best means of producing straight stems. Mr. Chisholm said that, in his experience, they should be cut back twice, the first cutting to be done when the plants are 3-4 years old and the second, three years later. He further suggested that the cutting is best done during October or November and that the cut should be made almost at ground level leaving one good bud. The majority opinion was, however, in favour of one cutting only, followed by a careful selection and pruning of the shoots which were destined to become the timber crop.

Returning to the cars members had an opportunity to admire the instructor's new house which is nicely situated on an eminence overlooking the well wooded grounds.

Next on the programme was a series of visits to sitka spruce plots at various elevations starting with one at 1,100 ft. which was planted in 1938. This compartment had been thinned once, in 1954, yielding poles of about ½ cu. ft. each but due to its slow early growth did not even reach Quality V on Yield table rating. At this point Mr. Mooney raised an interesting point concerning the damage done by flocks of starlings roosting, in large numbers, in the crowns of sitka spruce from the thicket stage upward. Mr. Cremin confirmed that he had considerable experience of this type of damage at Killavullen Forest where fairly large patches of sitka spruce had been killed off. It is found that thinning and other forest operations disturb these colonies but they only move on to another, quieter, part of the forest!

Another plot of sitka spruce visited at the 800 ft. level, which was planted in 1935, showed a distinct improvement and after two thinnings is now rated as 3rd quality, with an average height of 33 feet. Peeling of pulp-wood logs was the main topic at this stage. Mr. Cusack of Clondalkin paper mills was strongly in favour of peeling the logs in the wood before transit. He also produced figures which spoke eloquently in favour of clean knot-free poles, as knotty wood requires the chipping-knives to be sharpened twice a day, as against once every three days with clean timber.

The excursion concluded with a very welcome cup of tea, which was most efficiently provided by Miss Morris, matron, Kinnitty training school, and her staff. Before the members finally departed Mr. Mooney proposed a hearty vote of thanks to Messrs. Prior and Horgan and Miss Morris for a most instructive and enjoyable afternoon. This was warmly seconded by Mr. Galvin and carried enthusiastically by all present.

A.M.S.H.

Excursion to Clondalkin Paper Mills.

DO foresters ever wonder what becomes of the timber they grow? Many apparently do, for about forty members and friends of the Society travelled to Clondalkin on November 17th last on the occasion of the Society's excursion to Clondalkin Paper Mills.

Before setting out on a tour of the mills the excursionists separated into two parties, one of which was led by Dr. Sherry and the other by Mr. Enda Kelly, neither of whom spared any pains to explain what we saw and to point out what we did not see. As the day was rather cold

the party to which your reporter was attached was greatly encouraged by being led first to the boiler room, where we were allowed to bask luxuriously for a while before being taken to the extensive storage yard. Here, in the lee of a large pile of timber, the party heard an outline of the mills' timber requirements and consumption.

The annual consumption is 15,000 tons, sitka spruce mainly is used, but norway spruce has been found to be equally usable. Owing to the amount of resinous material which it contains not more than 10 per cent. of contorta pine can be used, and, because of human fallibility, it is hoped eventually to do this mixing mechanically. Three tons of green timber with bark yield 1 ton of pulp. Bearing in mind that the average thinning yields approximately 10 tons of timber per acre some interesting conclusions can be drawn from the above figures.

From the storage yard the bolts of timber are taken to the barking machine where each is treated separately and without the use of water. To a layman this seemed a simple and more elegant method of barking than that used in the German factory visited during the annual excursion. The question of quality arises at this stage: in barking a rough or crooked stick much of the wood may be lost; as when one tries to peel an oddly shaped potato and loses much of the eatable part.

It is from this point onwards that the timber begins to lose its "quiddity" as timber. The bolts, having been sawn in half, are loaded into the grinders. Grinding is effected by pressing the timber against a revolving carborundum "stone". The quality of the pulp is affected by the pressure in the grinder, which must be nicely regulated: this is done by electricity. It is interesting to note that a 1,000 h.p. motor is required to turn the stone.

The pulp which dribbles out at the bottom of the grinder is carried along by a stream of water to other machines where it is purified and partly dried.

The second stage begins in another building where the paper-making machines are housed. Essentially these are like the proverbial sausage machine—the pulp goes in at one end and the paper emerges, yards later, at the other. In fascinated awe our excursionists traced the course of the material from sloppy pulp right through to an ever-increasing roll of beautiful, shiny brown paper. Some 25% of imported chemical pulp is used in the process of making paper from native mechanical pulp.

In the next-door department we saw some of the finished products—paper bags of all shapes and sizes. The specifications to which some of these are made are very strict. One would never have suspected, for instance, that each roll of paper destined for the manufacture of cement bags must undergo twelve separate tests before being passed as fit for the job.

Writing paper is also produced here. This is made from imported

chemical pulp. The machine which was cutting it into sheets was almost frightening in its neatness and efficiency.

Back at the assembly point Mr. O. V. Mooney, President, extended the Society's gratitude to Mr. Cusack and the management, and in particular to our two guides, Dr. Sherry and Mr. Kelly, for taking such pains to make every detail of this important process clear to members.

N.O.C.

Genetics in Silviculture

By Dr. C. Syrach Larsen,
Director of the National Arboretum at Horsholm, Denmark.
Translated by M. L. Anderson.

Published by Oliver and Boyd, Edinburgh, September 1956. Price 30/-

IN the fields of agriculture and horticulture a great deal of useful work has been done in the production of improved strains of grasses, clovers, corn, vegetables, fruit and flowers. By comparison efforts to improve forest trees have been puny indeed.

There are, of course, some reasons for this backwardness in the silvicultural field. In agriculture and horticulture the number of plants suitable for the areas to be utilised are only planted out while in forestry we plant out at least ten times as many as we need for the final crop. This gives us a wide selection and, if thinning is skilfully done, the majority of the trees that will reach maturity should be those that have good inherent tendencies. In addition there is the point that the forester can "train" his trees.

It is well known that in plant improvement of any kind controlled pollination plays an important part. Here the tree improver runs into trouble right away. Trees often do not flower until late in life and then the female flowers are so inconveniently placed that controlled pollination is rendered extremely difficult. Even if carried out successfully a long period may have to elapse before the succeeding generation flowers and sets seeds.

Then there is the difficulty that trees selected for breeding are often widely scattered and, unlike agricultural plants cannot very well be uprooted and brought together in a breeding station. Also owing to the fact that trees take up so much room both above and below ground it is impossible to say that any two trees have grown under identical conditions. In selecting the best trees, therefore, it is difficult to

distinguish between genotype and phenotype—between the effects of heredity and environment.

In spite of the difficulties with which the tree improver has to contend, however, much useful work has been done in the last quarter of a century and there has been a decided quickening of interest in tree breeding particularly in the last decade.

The writer of this book Dr. C. Syrach Larsen of Copenhagen is one of the most outstanding workers in this field. He has a world-wide reputation as a pioneer in tree breeding and in this volume he gives an account of the results of his twenty-five years of work on the subject.

He scorns any attitude of despair regarding tree improvement. That the difficulties are great and almost insurmountable he readily admits, but only so long as we follow the same lines that have been used in agriculture and horticulture. If, instead, he says, we go our own way while, of course, establishing relationships with other branches of plant breeding and making use of already existing scientific results, the matter can be viewed in a very different light.

In this book Dr. Larsen charts a course along which the tree breeder may travel. In its twelve chapters he deals with every aspect of tree breeding and gives the fullest information on the procedures by which the goal of better trees can be achieved.

Historical.

Included is an historical sketch of the efforts at tree improvement in which he goes back through almost two centuries to the time when Duhamel du Monceau found that seed from a stunted tree produced ugly trees if it is stunted by nature but can produce fine trees when the difference in its form is due to injuries. In the past attention was concentrated mainly on provenance trials which did not go beyond selection on the basis of free uncontrolled pollination.

Provenance Trials.

In discussing provenance trials he shows that experiments prove beyond any shadow of doubt that several tree species display great differences when seed is used from a series of geographically distinct regions. He stresses that it is not enough to get seeds from regions with similar climate; importance should also be placed on the quality of the stand from which the seeds are collected and a sharp watch should be kept for variations in respect of attributes valuable in forestry.

Controlled Pollination.

From a chapter on controlled pollination it would seem that the genus *Populus* presents the least difficulty. As an example the commercial production in Denmark of the hybrid between *Populus tremula* and *P. tremuloides*—the European and American aspens—is described. The process, first employed by Wettstein of Austria, hinges on the

capacity of the poplars to flower and set viable seed on cut-off branches. The branches which are cut in February while still in the bud stage are handled like flowers in a vase. They are placed in water in a warm room and later in moist peat. The seeds are collected in early May.

The technique of controlled pollination of various genera is described in detail together with the aids such as transparent parchment bags, pollen blowers and all the impedimenta of the plant geneticist.

Vegetative Propagation.

The subject of vegetative propogation is dear to the heart of the author as he regards it as being of vital importance as a *technical aid.* By its means it is possible to produce seeds which will bring together and combine the valuable genes. Grafting, budding and propagation by cuttings are dealt with in such a way that even a tiro should be successful if he follows the instructions.

Seed Orchards.

On the subject of the seed orchard the author gives much information. This according to him is our "trump card." By its use we can produce any quantity of seed through controlled pollination. He brings up arguments in favour of seed gardens as a practical means of producing seeds. The system seems particularly suitable for conifers which are characterised by bearing many seeds on a single tree. They are also suitable he says for some leaf trees and mentions ash, alder and birch as examples in respect of which experience is available. He emphasises their special importance in regard to the production of hybrid seed. By means of seed orchards the aim of a more regular annual seed setting, instead of the production of large quantities of seeds in individual years, can be accomplished by the judicious applications of nutrients. The work should proceed hand in hand with controlled pollination which should show clearly whether or not the trees in question are good genotypes. It is pointed out however that we must not wait for the results of the pollination but get going right away on the selection of our finest and most luxuriant trees and give them a place in our orchards. When, later, controlled pollination and observation of their behaviour will reveal the inherent tendencies the poorest can be removed and the orchard in its final form will thus comprise only the most valuable trees.

Tree Shows.

As already mentioned the tree breeder is up against the difficulty of distinguishing between genotype and phenotype. Larsen, however, discusses a method which he claims helps considerably in appraising the genotype of trees; that is by the use of Tree Shows. Tree Shows "are groups of plants produced vegetatively, in which each group represents a single tree—a single clone—and they are laid out in such a manner that mutual comparisons can be carried out." Usually in order to know

sufficient about a tree there must be an opportunity of following the development of it from the seedling stage to maturity. If that were the only way it would be discouraging indeed. Tree Shows according to the author, however, can help us considerably to understand how the selected tree was capable of growing to be one of the finest in the forest. They can help us to judge the form of the tree, its growth, energy and resistance to disease. Judgment can be formed early—a close agreement has been found between the appraisal of the oldest tree show, now fifteen years of age and that which it was possible to make a few years after its establishment.

Genetics.

In a chapter on genetics all relevant aspects of the subject are discussed including the Mendelian segregation laws, cytology, mutation, apomixis, metandry, protandry, inbreeding and other fascinating aspects of the work. Here the author mentions an interesting case of apomixis (apomixis is the phenomenon that plants set viable seed without previous fertilization) in alder, which would seem to have practical value in forestry. The alder referred to is characterised by good growth in youth and heavy foliage which makes it a good nurse tree. It is peculiar, however, in that it is short-lived and dies at the time it should normally be removed thus saving the cost of cutting it out. It is produced in large quantities in a Danish nursery.

Hybrids.

There is a chapter devoted to hybrids in which the use of heterosis (hybrid vigour) on the basis of crosses between two species "unrelated" to one another is discussed. The superior qualities of hybrid larch and hybrid aspen are dealt with at length. In regard to heterosis Larsen echoes the statement of another Danish geneticist, Mogens Westergaard, who said : "It can scarcely be doubted that the heterosis method is the answer to breeding difficulties due to cross fertilization. In fact it eliminates entirely two unsolved problems, determination and fixation of the good genotype."

Breeding of Larch.

The breeding of larch is given a chapter to itself as larch is a tree which has long been subject to experiment, it flowers at a relatively early age and lends itself well to the process of improvement. In one example of the breeding of larch the author attempts to bring together the various links in the breeding of forest trees.

Breeding and Mechanisation.

The final chapter is on Breeding and Mechanisation. In it the author advocates that the botanist and the forester should be given a jeep, extension ladder and assistance to study the flowering in the tall tree crowns. Motor and air transport must be used for the rapid dispatch

of vegetative material. He gives an example of douglas scions having been grafted in Denmark four days after their dispatch from California and of pollen travelling as quickly in the opposite direction.

On reading this book one feels infected with the enthusiasm of the author : the possibilities in the field of tree breeding are good.

In a country such as ours where the forests of the future will be almost entirely the result of planting out nursery stock the book has a special significance.

The volume is well illustrated with many good black and white photographs, line drawings and diagrams.

J.J.D.

Silviculture

By JOSEF KOSTLER.

Translated by M. L. Anderson.

Published September 1956, by Oliver & Boyd Ltd., Tweedale Court, Edinburgh, 1. Price : 45/- nett.

THE members of the Society who participated in the annual general excursion to Baden will have savoured the excellence of central European forestry. The magnificent stands of timber, the very attractive mixed forests and the very handsome yields in money, all command attention and respect. In the short time available during the excursion one could make only a superficial acquaintance with the silviculture practised in Southern Germany. The final product looked so inviting, however, that one is really anxious to know more about the recipe. It is opportune, therefore, that this English translation of a book on modern German silviculture should come up for review.

Professor Kostler, in the preface, explains that his book contains a summary of the subject matter of two courses of lectures on silviculture. He stresses, however, that in silviculture no generalising and systematizing is permissible but it is the educational aim to awaken the learner's own critical faculty to such an extent that he is put in a position to reach a decision himself about the individual sites and stands.

Professor Kostler's book is an excellent introduction to scientific silviculture. He says "Forestry as a science has a structure peculiarly its own; it can be classed neither as a pure nor as an applied science but has a foot in both camps." He also stresses the fact "that scientific knowledge in the field of forestry has become so comprehensive that the participation of universities in its diffusion is now essential. In the managed forest it has been proved, moreover, that 'experience' alone

has, with few exceptions led to the ruin and devastation of the forest; on the other hand, it should not be overlooked that for successful handling of the forest in addition to a scientific grounding a wealth of forest experience is necessary."

Again and again in reading through this stimulating book one is struck by the emphasis on basic principles. "The kernel of the business of forestry is silviculture" writes Kostler and again, "the most important part of silvicultural work is the marking of trees for felling—the scribe is the tool proper to the silviculturist."

The book is in two parts. Part 1 deals with the principles of silviculture and with the individual factors of locality. The second part is a treatise on the practice of silviculture with special reference to conditions in Southern Germany. It is in this part of the book that we get a very useful introduction to the practices which have been evolved in Baden and Bavaria. Here indeed is silviculture in its best and most attractive form. The chapter on 'Tending of Stands' is excellent and full of practical guides for the management of natural regeneration and the complex mixtures which are a feature of the silviculture practised by Central European foresters.

There is a full history of thinning from the 'dark' days of Hartig down to the present era of heavy thinning and including a detailed description of a "numerical" system evolved by a forester named Michaelis. That the author does not favour 'rule of thumb' or calculated thinning, however, is apparent from the following: "All these arithmetical manipulations, however, are only another *pons asinorum* for the novice. Remember what Shadelin has said 'Whoever thins according to number of stems and spacing or uses basal area and yield table data and similar crutches, comes under the grave suspicion of being incapable of marking a satisfactory thinning'."

This book should become a standard text book in forestry schools particularly in temperate regions. While the book might be said to speak with a German accent it is nevertheless very readable. One of its novel features comes in the final pages where there is a discussion on what it takes to make a skilled silviculturist. "One takes up Forestry for the love of the thing" seems to sum up the case.

Looking at the future of the profession the author is rather despondent. "There is an ever-increasing danger that the productive professional activity, which is devoted to direct silvicultural handling, may be overwhelmed by bureaucratic functions and that the foresters themselves may come to lose the inclination for their life's work."

The forestry profession should, indeed, be grateful to Dr. Anderson for making Professor Kostler's book available to English speaking members.

T.C.

Economics of Plantations.

By W. E. HILEY.

Published by Faber and Faber, 24 Russell Square, London.

Price: 25/- net.

ANY work on Forest Economics coming from the pen of W. E. Hiley is worthy of our consideration. For years his "Economics of Forestry" was the main standby of those concerned with the teaching of Forest Valuation. His "Woodland Management" was a monumental work and contained much new matter of great importance to the forest economist as well as the forest manager. In addition, many papers on forest economics and forest policy and including methods and calculations designed to provide valuable tools for those saddled with the job of making decisions about forestry matters have appeared in recent years. These papers are widely scattered and it is of very great importance to have the material assembled in one book.

The object of this book is to show that conclusions which can be derived from financial calculations have a profound bearing on the practical problems of forest management and forest policy. In the introduction the scope of the book is discussed and it is pointed out that "the business of forest economists is to show, how, with the resources at our disposal we can create wealth in the shortest possible time." The author's thesis is "that timber can be grown more cheaply on good land than on bad and, for the prudent implementation of our national forest policy, it is desirable that more good land should be planted."

In his calculations he employs the financial yield as the measure or yardstick of the financial productivity of the resources employed in forestry. "It is the rate at which forestry creates wealth." He also points out that when judged in this way "it cuts across the distinction which has frequently been drawn between the objects of private forestry and those of state forestry. In terms of social accountancy it is just as important that state forests should create wealth rapidly as that private forestry should do so. The nationalization of an industry does not relieve it from the need to operate economically."

The prospective investor in forest land would be well advised to read this book. The owner of a plantation or a timbered estate will also benefit from a study of the methods and conclusions here assembled. Those concerned with the thinning and treatment of growing plantations will find here to hand a practical tool for use in the forest. Those concerned with policy will also see presented a method designed to show how the capital invested in forestry can be used to the best advantage and how foresters can increase the productivity of this vital industry and thereby contribute to a higher national standard of living.

T.C.

Treasury of Trees.

By H. L. EDLIN and M. NIMMO.

Published by Countrygoer Books Limited, Old Colony House, Manchester, 2. Price: 75s. nett.

IN our study of modern forestry in Ireland with its emphasis on large scale cultivation of a comparatively small number of fast-growing exotic species there is a danger that we may neglect the study of all the other more or less common trees which can be found in groves, hedgerows, gardens and parkland up and down the country. Practicality and realism in regard to forestry are important but we must be careful as we go on our way that we do not lose our sense of wonder at the structure, the beauty and the behaviour of the less commercially important of our woodland trees.

The field of tree study is wide and the subject is full of absorbing interest. Each tree has its own peculiarities in regard to its life and growth, its relationship to environment, its reaction to silvicultural or arboricultural treatment, its place in the economy of the countryside.

Before we can embark on a proper study of these aspects of tree life, however, we must first be able to identify our trees accurately by all available characteristics at every season of the year. To help readers to achieve proficiency in this pleasant work is the main object of this book. All the trees to be found wild in the British countryside and all those extensively planted in British forests are dealt with in detail; altogether 140 different trees are described. The 380 photographs, depicting bark, foliage, flowers and seeds make tree recognition easy, even for those with little botanical knowledge. The text, which brings out the important features whereby one tree may be distinguished from another, describes the course of life and growth throughout the years and the seasons and outlines the importance of each tree as a timber producer or as an ornament of the landscape.

The book is divided into two sections—hardwoods and conifers—and the trees in both sections are presented alphabetically under their common English names. In regard to *Acer pseudoplatanus* it can be seen that the name great maple is given pride of place over the better known (in this country) name, sycamore. The authors deplore that the name sycamore should have been generally adopted for this tree on account of the fact that it does not indicate that it is a member of the genus *Acer*. It appears that when it was introduced from central Europe in or before the sixteenth century it was confused with the "sycamore" of the Bible, which is in fact a fig tree with a somewhat similar leaf. Then the Scots confused the sycamore with the plane and still call the tree and timber "plane." The Americans call their occidental plane a "sycamore" and to bamboozle us properly the French apply the name "plane" to norway maple!

In using this book, however, the reader can be sure that he will not be confused : the text, which is written with lucidity and precision, and the pictures, which are fine examples of photographic art, will together enable him to name any common woodland tree at any time of the year.

The volume is sumptuously produced and at the price is good value for anybody who wants to know his trees whether he be forester, gardener, landowner, teacher or student.

J.J.D.

The Empire Forestry Review.

Volume 35, No. 3, September 1956.

Published by the Empire Forestry Association at The Royal Empire Society, Northumberland Avenue, London, W.C.2.

Price to Non-Members 7/6.

THIS Review is published quarterly in March, June, September and December. It is a medium for the exchange of information on forestry in all its aspects among the foresters of the Empire and its contents include technical and descriptive articles, technical notes, and reviews of current forest literature.

In this issue there is an interesting article on the Forest Management Licence scheme in British Columbia with references to a few of the more common objections to it. As a concrete example the article deals with the progress of management on one such licence in the Okanagan Valley.

In another article an officer of the Indian Forest Service tells how the tropical forests, which are made up of many species of trees, shrubs, climbers and herbs regenerate and how their composition changes.

Forestry in South Africa is touched on in an article written from the standpoint of a private afforestation scheme in the midlands of Natal with a discussion of silvicultural and other technical and management problems there in the light of recent developments.

There is an interesting article entitled "Preliminary Nursery Investigations, Nyika Plateau (Nyasaland)."

Some of the work of Kenya's Forest Department is the subject of an article describing an experiment designed to rehabilitate certain parts of large areas of marginal land and to put these to practical use by the planting of economic tree crops, which previously could not have survived.

A silviculturist of the Federation of Malaya describes the "frill girdle." This is used in the application of aboricides to trees and consists of a single line of axe cuts slightly overlapping and continuous

round the tree. The poison, filling the narrow axe cuts, comes in contact with both the upper and lower surface of the cut and is absorbed downwards in the bark and upwards in the sapwood. In regard to the poisons used the writer states that the cheapness and efficiency of sodium arsenite in water outweighs the disadvantages of the strict precautions necessary in its use. The average kill of uneconomic and useless trees using 2 lbs. sodium arsenite per gallon of water is about 90 per cent. at a year after treatment.

Dr. Ida Levisohn of the University of London discusses in a short article the effects of mulching on the development of mycorrhizal fungi. It would appear that stimulation of mycelial growth and promotion of sporophore formation are brought about as a result of the new conditions created by the mulched tree but not by the mulch alone.

Irish foresters wishing to broaden their horizons and stimulate their thinking can read this publication with great advantage.

J.J.D.

Forest Seed Directory.

Published by the Food and Agricultural Organisation of the United Nations, Viale della Terme di Caracalla, Rome. Price 10s.

THIS is a directory of suppliers of seeds of woody species for forest production, erosion control, game and wild life management, shelter belts and windbreaks and for animal fodder purposes.

The publication includes an alphabetical list of species and names of governmental agencies and commercial dealers with their addresses in the individual countries. Commercial dealers who are prepared to supply, on request of the purchaser, certificates of quality and origin are indicated.

In a special appendix there is a letter from the Director-General, Commonwealth Forestry and Timber Bureau at Canberra, Australia with a list of eucalypt species of which small quantities of seeds can be supplied, classified by broad climatic zones

This is the third year in which this directory has been issued. As, however, a number of governments stated they had in 1956 no change from the previously submitted information consideration is being given to issuing the directory at more widely spaced intervals in the future. The publication would be of particular value to nurserymen and seedsmen but it would also be useful to the landowner who would like to have a shot at raising from seed not only the major tree species but also the rarer ornamental trees and shrubs.

J.J.D.

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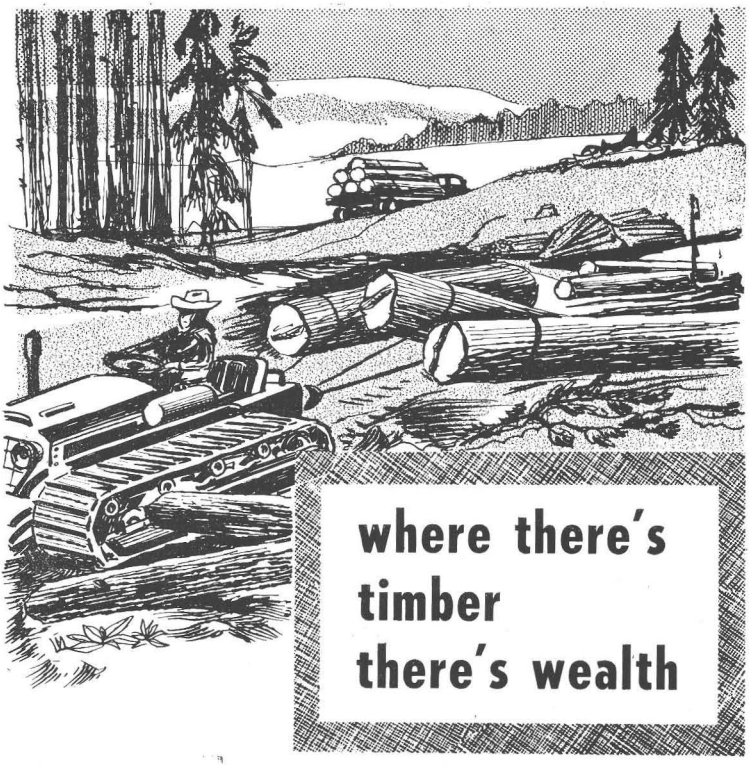

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