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EDITORIAL.

Forest Policy.

THE following extract from a recent Government White Paper on Land Policy is an indication of the increased stability of British Forest Policy.

"Large areas of Land in many parts of Great Britain are more suited to the production of timber than food. An adequate supply of growing timber is also highly desirable on grounds of national defence. The development of Forest Policy is largely dependent on State action continuously applied over a period of years. The Forestry Commission was established to carry out such a policy and is actively engaged on a definite programme, including the afforestation of 150,000 acres in the 10-year period 1919-1929, the encouragement of private forestry by a system of grants, and the systematic establishment of forest workers' holdings at the rate of five holdings per 1,000 acres of afforestable land. It is anticipated that these holdings, the occupiers of which are guaranteed 150 days' work per annum in the State forests, will make a useful permanent addition to the rural population, especially in poor grazing districts. The Crown Woods and Forests, including about 60,000 acres of woodland, have also been transferred to the Commissioners.

"The Government has agreed that this policy shall be carried on without interruption."

Research.

Attention is drawn to the note on Research which is printed, not as a report on the work done, but in order to point out a few outstanding facts and to indicate the various subjects which are under investigation. It is hoped that field officers who are interested in any of these subjects will not hesitate to communicate with the Research officers.

Dr. A. W. Borthwick.

We have to congratulate Dr. A. W. Borthwick on his appointment as the first Professor of Forestry in the University of Aberdeen. All members of the Commission's staff regret that his acceptance of the new post necessitates the severance of his official connection with our work, but it is hoped we shall continue to have his assistance and advice.

Forest Units.

The number of forest units under the Commission now exceeds one hundred and planting is proceeding this season in 96.

Snow-falls.

Preliminary reports indicate that the unusual snow-falls of the present winter have done a good deal of damage to young Douglas plantations, especially on wet sites. The amount appears to have varied with the intensity of thinning to which the plantations have been subjected and possibly also with the planting distance. Observations on these and similar heads will be welcomed and will be correlated for publication in the next issue of this Journal.

A distinctive Tie.

We have received a suggestion that the Commission's staff should adopt a distinctive tie. The Scottish Section has one already, in broad green and red stripes, but some members consider it too bright for general purposes, at least South of the Tweed. Broad stripes of dark green (for the forest) and dark brown (for the earth) would provide a less flamboyant combination. The Editing Committee are prepared to proceed with the latter suggestion if it meets with general approval.

REFLECTIONS.

By A. P. Long.

Tucked away somewhere at the back of our minds is the conception of a "Normal Year," yet if we were asked to define exactly what is meant by the term some of us might find considerable difficulty in doing so, for the reason that we never appear to have one. On the other hand, if were honest with ourselves we would probably confess that our Normal Year would be an Ideal Year, *i.e.*, one in which the seasons permit an early start of planting and nursery operations, with even progress of the work—unhampered, except possibly by a little hard weather in the early weeks of the calendar year, to break down and mellow the nursery soil lying rough, to kill pests and so forth—then to allow the smooth completion of our planting and nursery programme. This would be followed by soft "droppy" weather—free from those devastating east and north-east blasts—and nice, equable conditions would persist until the next planting season; by which time we shall have finished our cleaning and other operations whilst there have been no losses but instead a magnificent growth in plantation and nursery alike. In actual life, however, things are far less accommodating and our horizon lowers to the conviction that the Normal Year is by no means ideal but, instead, one which provides unpleasant surprises at some place or other throughout the whole annual cycle. If there is not too much wet then there is drought, or should it not be too cold it will certainly be too hot, or again lest we be satisfied with a favourable season at one operation we suffer bad or even disastrous failures at others. Thus, it behoves us, as far as is humanly possible, to prepare for the worst on each and every occasion and always to be on our guard. To that end some personal impressions relating to the drought of last summer and the hard weather of the present season may not be inappropriate.

Firstly, the drought. In many places last year's drought was made up of two distinct parts, a spell of very dry and cold easterly winds in late spring and a period of excessive heat during the summer, separated by only a few weeks of mild weather with very little rain. With the exception that the first period was of longer duration than usual it was not abnormal for the time of year in the eastern parts of the country. Perhaps we are inclined to belittle the effects of these cold dry winds, but they are really a very serious factor in our losses.

In the nurseries the newly lined-out plants, where unprotected, could almost be seen to wither away under the influence of these winds. Certainly there was a wonderful difference in the number of losses, quite apart from the rate of growth, between the sheltered portions of nurseries and those outside the range of shelter, indicating that plenty of good windbreaks amply repay their cost.

In the newly made plantations two types of plant suffered most, viz. those with weakly developed root systems and those plants with soft, sappy growth. In the first of these are classed seedlings planted out direct and poor plants, whereas the second includes plants transferred from a soft to a hard climate, such as from west to east, and such species as Douglas, which is a notable offender in that it appears to grow practically the whole year round and suffers more than any species from these winds, especially if the last year's growth in the nursery has been a big one. In this connection, it may be noted that during the last four years, Sitka spruce planted in the autumn has suffered much more severely from these winds than plants put out at the latter end of the season.

The second part of the drought, whilst in some places increasing the effect of the first part, acted very differently on the whole.

In sandy soil nurseries the heat literally burnt up unshaded seedlings and even transplants. In shading seedbeds, many of us had to resort to leafy branches, but that is only partially successful and the provision of cheap but more efficient devices needs consideration. Heavy soil nurseries cracked badly and the only remedy available here is to cultivate continuously, which is expensive but indispensable.

In plantations, the most important effect was upon cleaning operations. It is an axiom that all plantations must be cleaned of harmful vegetation until they are completely established. In normal years most operations experience a rush period at the beginning of spring when large areas need to be cleaned within a very few weeks. This in itself is bad enough, but when, as last year, immediately after the breaking of the drought, cleaning is called for over practically the whole area more or less simultaneously it becomes a perfect nightmare. Admittedly some of our failures in the past have been due to delayed cleaning, and it is really important to consider the whole position with a view to finding a way out of even the normal rush, and much more to escape an abnormal one such as we have just experienced. It is all the more important at this stage owing to a totally new factor, I refer to the recent introduction of sugar beet growing in the agricultural industry. This crop requires large quantities of labour at two seasons of the year, and one of these coincides with the early cleaning period. We have already experienced the drainage of labour for this purpose in some places but, as the crop becomes more generally grown, we are bound to see an increased drifting of labour to places where higher wages can be earned. Methods of relieving the rush period may be direct or indirect.

Direct methods may consist of (a) the reduction of the area of cleanable land planted each year or (b) by arranging for delayed cleaning.

The most obvious way of securing (a) is to reduce the individual planting programme of each forest. This implies either the acquisition of a number of smaller operations, as opposed to large operations, retaining the same percentage programme as at present or by reducing the present percentage and acquiring still more operations. Both alternatives will be considered later from another aspect.

A second way of securing (a) is to arrange the annual programme so as to include less cleanable land, *e.g.*, a higher proportion of moorland to bracken land than hitherto.

Delayed cleaning (b) may be obtained, firstly, by the choice of species which can be cleaned at different stages, *e.g.*, Douglas stands more shade than the larches and can often be substituted for them, or secondly, by including in the area land covered with vegetation of different types, *e.g.*, grass is not so urgent as bracken.

Indirect methods are numerous but they are all designed to enable the plantations to grow out of the cleaning stage as early as possible. Perhaps the most important of these is the use of larger plants for (a) planting and (b) beating up.

(a) It is obvious that the limit of cleaning is governed by the heights of the trees and, other things being equal, larger plants will reach that limit earlier than small ones. There are, however, other factors to be considered such as costs, losses, nursery area, etc., and it becomes a complex question. On the whole, perhaps, one feels that whereas private owners are inclined to use too large plants, we may err on the side of using too small plants. Cleaning is a very expensive operation, as well as being inconvenient, and if it can be reduced by even one year without adding much to the ultimate cost, it is well worth doing. The average extra cost of growing on plants for another year, as given in figures recently circulated, is 13*s.* 6*d.* per 1,000, which at an average of 2,000 plants per acre means an increase in the cost of plants by 27*s.* per acre. The cost of planting has not so far varied between large and small plants. Against this there will be a saving of at least one year's cleaning, which is given in 1924 costing statement for England and Wales, as averaging 30*s.* 9*d.* per acre, and in many cases the saving of more than one year's cleaning may be effected. A further saving in total cost could be made by growing on from the seedling stage in the home nursery, thus avoiding a good deal of the present transport costs.

It could probably be so worked that the present costs would not be increased by adopting a larger plant.

The argument is intended to apply only to land which carries more or less dense vegetation, and can it be doubted that large plants do save enormously in the expense of cleaning under these circumstances. Take Ash, for instance, which is often planted in ground covered with brambles and briars ; unless the plants are large there is almost endless cleaning and a very serious risk of having the plant cut back accidentally owing to the difficulty of distinguishing it. Or again, Corsican pine even in short grass requires a great deal of cleaning as it generally sits tight for at least two years, during which time the unchecked growth of grass would quickly smother it.

To a certain extent the difficulty of present conditions can be overcome by the grading of plants, for the largest plants could be allocated to areas with rank vegetation and small ones to clean areas. To be successful, grading ought to take place both as seedlings and as transplants. There are obvious advantages attaching to grading ; seedlings can be lined out by grades and lifted accordingly, thereby saving the expense of lifting and relining the smallest plants—which are almost invariably derived from the smallest seedlings—as often has to be done when they are mixed anyhow in the lines. The grading of transplants, which can be done at negligible cost and most conveniently at the time of lifting, pays for itself in the comparative evenness of the resulting plantations and its effect upon cleaning operations.

(*b*) Cleaning operations can only be said to be complete when all the trees are out of danger, hence every time failures are beaten up with plants smaller than the majority, the necessity for cleaning is correspondingly prolonged. From this point of view beating up should be done with plants closely comparing in size with those standing. In some cases it is possible to secure large plants from outside, but it is never really certain, besides being expensive in transport, and the only sure means of getting suitably-sized plants is to reserve some and grow them on in the local nursery. For this purpose it would be necessary sometimes to incur temporary extra expense in relining or wrenching, for it is not advisable to allow some species to develop either too big a taproot or make too much top growth as they have the habit of doing if undisturbed, but would not this apparent increase be justified in many ways.

Working conditions up to the present have largely prevented carrying over any plants from one year to another, but the merits of the case seriously suggest that the supply of plants—and consequent nursery area—should be so increased as to permit it in the future.

Coupled with the question of larger plants for beating-up is the factor of time. From the point of view of cleaning alone, beating-up needs to be completed as early as possible after planting, and prima facie the sooner it is done thereby so much is the need for large plants reduced.

Secondly, the hard winter. The most serious effect of the hard winter has been to delay all outdoor work. In an extreme case the ground in East Yorkshire was under frost or snow from November until the end of January, rendering planting and nursery work impossible. Everywhere work has been retarded and operations with large planting and nursery programmes will be hard put to it to complete the whole programmes, especially if we should get an early spring or more hard weather. This is the first severe winter experience during the history of the Department and it may serve its purpose as a warning of what might happen if we should ever return to the much severer winters of twenty years or so ago. Here, indeed, it is likely that we shall feel the severest competition from the sugar beet growing industry, for the second period of the large labour requirements of this industry coincides with the first half of our planting season, from October to Xmas. Already where large scale operations were in progress we had begun in some places to feel a steadily decreasing supply of labour, due to the gradual decrease of unemployment in rural areas, but this winter in beet-growing districts there was not a spare man to be had and some even of our own men left us. As beet growing increases, this difficulty cannot fail to become accentuated, and, be it noted, the best of the unattached men would be the most difficult to secure. This year we are fortunate in probably having seen the severest of the weather in the first half of the season, the probable future period of scarcity of labour, but if we should get in any future year a severe spell in the second half of our season then, indeed, would our programme of work be disorganised. We must not lose sight of the Forest Workers' Holdings as an ameliorative factor as time goes on, but at best that can only be a partial solution of the problem. The lesson of this winter, therefore, would appear to be the desirability of spreading the work over as many districts as possible and thus stand a better chance of carrying out our undertakings under any conditions, and this quite apart from the beet-grwoing influence for, as already mentioned, the lack of labour supplies owing to a steady decrease in rural employment has already been felt. Thus a decrease of individual forest programmes is indicated and, to put it into practice, implies the distribution of the work over a larger number of smaller operations with the present percentage programme or a still larger number of smaller operations with a reduced percentage programme. It will be noted too that such measures would provide a larger nursery area, for transplants at least, since each operation would normally have its own nursery which in turn would help considerably towards that ideal state of self-support in respect of plant requirements. From this point of view the latter of the two alternatives holds the advantage.

Other features of the severe weather are worthy of comment. Seed beds have experienced the need for protection against frost-lift. A satisfactory method is to form an arch over the beds with twiggy branches having leaves still hanging. The leaves falling later are of great service and the branches serve both to protect from hard weather and to break the direct fall of the heavy rains. The leaves are readily removed in the spring by taking away the arch before the normal winds arrive.

Newly lined-out plants need careful watching and firming; it is surprising how large a plant can be lifted by the frost.

This season has fully demonstrated the value of turning up all rough spaces in the nursery as soon as they become vacant, especially in the heavier soils. Without this the soil will, in such a season, take an endless time before it is fit for working. The mechanical effect of dung is also fully emphasised in a wet season.

In plantations the advantage of switching bracken as compared with cutting has been shown. In the latter case the loose bracken has in some places been caught by the high winds accompanying the snow, to be piled often actually on the top of young plants and then pressed down by the snow. The result may then be a severe bending or even complete breaking of the plant which often cannot be remedied except by removing the bracken.

On heavy soils the early preparation by loosening and leaving rough in mound form cannot fail to be advantageous for planting in such a season as this.

RESEARCH WORK.

By A. W. Borthwick.

During the past year nursery and plantation experimental work embracing 21 experiments was carried out by Dr. Steven (England) and Dr. Anderson (Scotland). Fundamental research including field experiments and laboratory work was carried out by Dr. Munro (Entomology), Dr. Wilson and Mr. Waldie (Mycology), Mr. E. V. Laing (Anatomy and Physiology), Mr. G. K. Fraser (Soil Physics and Chemistry) and Mr. J. L. Smith (Dunkeld larch and other hybrid conifers).

The work in the hands of the various investigators was as follows :—

Dr. Stevens :—Experiments on season of sowing, shelter weed problems, method and density of sowing, tilth studies of nursery soils. Race and type of tree species, spacing of transplants and grading of seedlings. Season of transplanting Corsican pine.

Dr. Anderson :—Experiments on treatment of seed before sowing. Humus manuring. Weed control. Spacing and grading of Transplants. Mixing species in transplant lines. Sloping of seed beds. Shelter of transplant lines. Continuous cropping of seed beds with the same species. Size of seed. germination capacity and size of seedlings. Field experiments with wrenched and undercut Corsican pine. Field experiments with two grades of Scots pine.

Dr. Wilson and Mr. Waldie :—Fundamental studies on the relationship of fungi and host plants as influenced by race and type of each under varying conditions peculiar to our soils and climate. Control of *Meria laricis*. Special studies of *Fomes annosus*, *Rhozosphaera Kalkhoffii*, *Ceratostomella pini* and *Brunchorstia destruens*.

Mr. E. V. Laing :—Investigations on water content of seedlings and transplants of Norway spruce, Sitka spruce and European larch ; food stores of Norway and Sitka spruces and European larch. Age and size of plants used in planting peat ground. Seeding experiments, Protection experiments. Behaviour of different species of tree on peat. Use of Manganese Dioxide in place of red lead. Anatomical investigations of the origin and fate of tree roots in peat soils.

Mr. G. K. Fraser :—Research on the chemical and physical conditions existing in peat forest soils. Processes at work in the formation, drainage and decomposition of various types of peat. Physical and chemical analysis of nursery soils. Field experiments on manuring and change of peat flora. Manuring and improvement of tree growth—this included the use of chemicals not usually considered as manures, also drainage. Destruction of peat vegetation (sphagnum) by chemicals. Destruction of weeds by chemicals in nurseries and rides. Studies of conditions of surface and soil in " bad " areas. Effect of grazing and burning on surface conditions, especially vegetation.

Dr. Munro :—Investigations covering the whole field of forest entomology and further special attention to investigations concerning the life history and control of the following pests :—pine weevil, cockchafer, *chermes cooleyi*, spruce aphis, oak *tortrix* and bark beetles.

The above brief outline is given to show the nature of the work which was in progress during the year. Some of the work is new and some of it is in continuation of work already begun in previous years. It is not possible to give a full and detailed report of the results so far arrived at in the case of each investigation, but it may be of interest to refer to certain facts which have emerged during the progress of the work. For example :—

1. The experiment on the effect of different kinds of soil for covering seed on subsequent weed-growth has shewn that copper sulphate together with humus as a cover led to an appreciable reduction in the time required for the first and second weeding, as compared with the usual cover of "bed soil." Further investigation is in progress to test the action of the copper sulphate on checking damping-off and other seedling diseases, but whether this gives positive or negative results the use of copper sulphate on a larger scale seems to be justified.

2. The experiment on the influence of depth of sowing has shewn quite clearly that, for Douglas fir the plant per cent. is best with a $\frac{1}{4}$-inch depth. Up to a depth of $\frac{3}{4}$-inch good plant percentages were obtained, hence if the soil is sandy loam, too deep sowing is not likely to be an important cause of low outturn for this species.

In the case of Sitka spruce the optimum depth is from $\frac{1}{8}$-inch to $\frac{1}{4}$-inch, within those limits the results were good—but *a depth of $\frac{1}{2}$-inch is the critical depth for this species,* beyond which the plant percentage falls sharply. For European larch, the same good results as for Sitka spruce were obtained between depths of $\frac{1}{8}$-inch and $\frac{1}{4}$-inch, but for European larch $\frac{1}{8}$-inch is the critical depth, hence special care should be taken against sowing this species too deeply.

3. The experiment on seedling production has shewn both in England and Scotland that nursery seed bed germination can be brought up to the standard of laboratory germination.

4. Control of nursery pests., At the Windsor nurseries, where pests including eight different species of insects, two fungi, and mice had to be guarded against, in order that their depredations might not vitiate results in the experimental nursery plots, it was found that by the adoption of systematic preventive measures damage to the experimental plots was successfully eliminated.

5. Shelter during summer and its effect on production and growth gave some very interesting results. The species used in this experiment were Sitka spruce, Douglas fir and European larch. The influence of shelter on germination and growth in these three species showed interesting variations. For Douglas fir, it was conclusively shown that shelter, even for limited periods, when the screen temperature exceeds 60° Fahr. during germination, has a definitely retarding influence. Hence for this species, shelter should not be applied during germination unless the screen temperature much exceeds 60° Fahr.

In the case of Sitka spruce, shelter during germination when the screen temperature exceeded 60° Fahr. for two days did not retard germination. The subsequent losses in the unsheltered were much higher than in the sheltered plots. On the other hand shelter decreased growth markedly. The shelter was markedly beneficial as regards plant production but not growth.

In the case of European larch shelter was beneficial principally during germination.

In this experiment the shelter consisted of laths 1-inch wide and ½-inch apart. It was applied when the maximum temperature in the screen exceeded 60° Fahr. for two or more days during germination and 70° Fahr. after germination was advanced.

Thus study of shelter has been proceeding during five seasons. The records show that the effect and necessity for shelter varies with the season. The season of 1925 was the first one since 1921 in which shelter gave definitely beneficial results in the southern English zone.

6. The manuring experiments on soil amelioration showed some positive results. They were carried out at the Inverleith Nursery, Edinburgh. The materials applied were ashwood ashes, spruce-wood ashes, peat, and sand mixed with humus from a burnt-over forest area. Application of the manures was made in March The wood ashes were thoroughly raked into the top 2-inches of soil. The peat was mixed with the top layer of soil, passed through a ¼-inch riddle and evenly applied. The humus was in a very fine state of division and was applied as follows :—The top 1-inch or so of soil was cuffed back, the humus being applied in its place to a depth of 2-inches and the soil was then replaced above the humus layer. Subsequent examination showed that the application of wood ashes to seed beds was distinctly harmful, expecially in the case of Scots pine. It greatly increases th intensity of attack by soil fungi. There is reason to believe that a correlation exists between the intensity of attach by soil fungi and the acidity of the soil. The application of humus was likewise harmful. Excellent results followed the application of finely riddled peat to the surface of the seed beds on soil such as exists in the Inverleith Nursery. There was a marked reduction in the surface caking of the seed bed and soil encrustation around the seedlings. The application of peat in this way to Scots pine seed beds appreciably increase the rate of germination, but in the Sitka spruce beds there was an appreciable reduction in germination.

7. Experiments on spacing, grading and rate of marking with seedlings established certain facts. In the case of Corsican pine, careful grading pays and also speed in handling, *i.e.* getting the plants into the soil again with as little exposure of the roots during the process as possible. With European larch, grading is less important and this species stands root exposure better than Corsican pine. Various spacing distances from 1 to 3 inches were tried, but no appreciable difference in growth was observed.

It is interesting and of some importance to note that in the comparative tests in handlaying versus the planting board, the former method gave better results, which indicates that there is room for improvement in the use of the mechanical method.

8. Progress in entomological work has been good. In the important matter of control of weevil population in pine woods it has been found that systematic trapping both before and during felling

gives every promise of success. If the weevil population can be thus kept in check the practical value of such measures is obvious.

9. In the case of *Chermes cooleyi* signs are not lacking that certain types of the green Douglas fir are less liable to attack than others, further work in this important line of investigation is urgently required. It is a case for the botanist and the entomologist.

10. Peat problems. This is one of most important and at the same time one of the most difficult questions which the Research branch are up against. Nevertheless, progress is being made and some interesting facts of fundamental importance are coming to light concerning the food reserves (starches and fats) in Norway spruce, Sitka spruce and European larch. It is a new and significant fact that in no cases so far examined have Norway spruce or Sitka spruce from peat been found to be deficient in starch or fats. In fact "checked" plants at Inverlever showed large fat content even in the bast. In normal plants only a few cells of the bast show starch content, but in peat spruces, on the other hand, every tissue with parenchymatous cells contains starch invariably in large quantities. In fact, plants from peaty ground are pre-eminently starch plants as compared with, say, nursery plants. Fats were found in the endoderm of cortex and roots devoid of mcoryhizal fungi, but absent or much reduced in amount in plants with Mycorhiza.

In order to find out, if possible, what was the disturbing factor or factors which produced these abnormalities, experimental tests were made with similar plants in various culture media and the following facts were established. Absence of potash led to a deficiency in fats, but had no effect on starch content. Absence of magnesia led to an increase in fat content, and in the case of Norway spruce there was a slight increase of starch but no difference occurred in the starch content of Sitka spruce. Absence of iron resulted in a superabundance of starch in both Norway and Sitka spruces and also to an increase in fat content, especially in the endoderms of the root. Absence of lime led to an increased fat content in all tissues of Norway spruce and to absence of starch. Absence of other food materials such as phosphates made no difference.

The conclusion is that the high fat content of the endoderms of the root may interfere with the passage of nutriment solutions from the soil, and thus the building up of new lining tissue by the elaboration of food materials from soil and atmosphere is checked and growth ceases. It will be recalled that absence of iron in artificial cultures led to the same result as regards the presence of fat in the endoderms and the superabundance of starch in other tissues. In a former piece of work Mr. Laing found that many peats give no reaction for iron, or if present it may not be in a form available for absorption by the plant. The next stage is, therefore, to try to find some means of making iron available for plants on peat.

A new line of experimental work on peat nurseries and high elevation peat planting suggested by Sir John Stirling-Maxwell is being started this year.

THE FORESTS OF RUMANIA.

By Fraser Story.

In the following notes I do not claim to do more than record impressions of Rumanian forestry gained during a brief visit to that country last autumn. The government officials did all that they could to assist. They not only gave me much information, but kindly allowed one of their forest officers to accompnay me through the forests of the Eastern Carpathians.

Rumania has been so much altered and enlarged as a consequence of the Treaties of 1919 that I regret a map of the country cannot be reproduced here. Readers will remember that before the war Rumania was of an elongated oval shape, but now it is nearly as round as a ball. Through the centre of this circular area the Carpathian mountains extend in a crescent-shaped curve. Bucharest, the capital, is situated in the south-east, not far from the Bulgarian frontier.

If one starts, as I did, from Bucharest and travels northward making for Transylvania, one passes first of all through a wide alluvial plain where maize is the principal agricultural crop. At irregular intervals there are patches of pedunculate oak but shortly after leaving the plain for higher ground, sessile oak puts in an appearance along with a natural growth of ash, elm, hornbeam, Turkey oak and *Acer tataricum*. On reaching more hilly country one enters the beech belt which occupies a very large area. In the lower part of this belt other broadleaved trees, particularly oak, occur, and in the upper margin a few conifers are found, but most of the forest consists almost entirely of beech. I was informed that the stands were not always in this condition. It is a result of the extraction of all the saleable species, leaving the beech, the supply of which far exceeds the demand.

There is a strong tendency for the beech to monopolise the ground under such circumstances. All the conditions favour its increase. Gaps which have been made in the canopy by the removal of individual trees are quickly filled by the expansion of the crowns of the beech, and the dense overshading of the ground does not give other species a chance of springing up. The many thousands of acres of forest of this type in Rumania suggest the remark that beech is a good servant but a most indifferent master.

Passing through the beech zone to higher altitudes, it is noticed that silver fir gains an increasingly important place in the composition of the forest until it becomes predominant. Some of the finest forests of Transylvania are largely composed of this species. Norway spruce appears in mixed stands at 2,500 feet, at first in small numbers along with silver fir but rapidly increasing in importance as one ascends, until, at about 3,500 feet, very few silver firs remain and pure spruce extends to between 5,000 and 5,500 feet elevation. Beyond this there is a fringe of beech, until with *Alnus viridis* running up the hollows and mountain pine in patches here and there the local limit of tree growth is found at a little over 6,000 feet. European larch occurs in a few places, mostly at an elevation of about 4,000 to 5,000 feet, but, judging from what I saw of it, the species does not grow particularly well in the Carpathians and aphis and canker are by no means absent. Scots pine also is poorly represented. In a few districts it is found indigenously, but evidently the climatic conditions are not favourable to its best development. Among the mountains it suffers severely from snow-break and at lower elevations the quality of timber is poor owing to coarse growth.

According to the forest laws of the country which, I fancy, are not always strictly enforced, private owners cannot do just what they like with their forest property. They must notify the Forestry Department before any considerable area is felled and a cash deposit of an amount sufficient to ensure the restocking of cleared areas must be lodged with the Government authorities before felling operations commence.

I was enabled to inspect a privately-owned estate at Agas where the forest is no less than 50,000 acres in extent. It was interesting to observe that although regeneration could easily have been obtained by natural means, there being an abundant young growth of silver fir and spruce, clear felling was being resorted to, followed by planting with spruce transplants, 5 feet by 5 feet. The explanation offered was that only by concentration of felling operations could a sufficient quantity of timber be obtained to pay for extraction. Felling and timber hauling followed by exposure of the seedlings to frost and sun destroy the natural regeneration and necessitate recommencement by planting. In the best parts of this estate, among the mountains, there are dense stands of silver fir 150 feet in height with a girth of from 10 to 12 feet at breast height. Spruce does not attain this size but falls little short of it and its timber commands a better price. "Resonant" timber for musical instruments obtainable from this district is particularly valuable, but only selected trees over 150 years of age, clean, cylindrical and with fine annual rings meet requirements.

Changes which are taking place in the ownership of forests in Rumania are worth noting. One "reform," which is not called confiscation but which landowners regard as closely akin thereto, consists in taking from private owners any forests in the neighbourhood of hamlets and villages, payment being made by Rumanian Government bonds. Theoretically, the interest on the bonds is equivalent to the net sum which may be obtained from annual fellings after the drawing up of working plans. The communes like the scheme, because they secure any surplus profits there may be, and the State benefits because it is able to regulate the yield and maintain the forest capital; the only sufferers appear to the legitimate owners.

The total land area of Rumania, now nearly seventy three million acres, has been more than doubled since the war and a great deal of the newly acquired territory is densely wooded. Over twelve million acres of valuable forest have been taken from Austria-Hungary—ten million acres from Transylvania and over a million each from Marmaros and Bukovina. With the addition of these great areas, Rumania has fully sixteen million acres under forest (22 per cent. of the whole) and therefore occupies a place of considerable importance among European countries from a timber supply point of view, especially as most of the recent acquisitions are coniferous forests.

It is much too early, of course, to judge what effect the transference will have on the forest. The Hungarians were good foresters, well trained men who took a pride in their work. In their capable hands, forest conservancy was assured. I certainly noticed a marked difference in the condition of the forests since my last visit to the Carpathians in 1912, but no doubt the deterioration is largely due to actual warfare. Forest roads so excellently laid out by Hungarian forest engineers are now in a bad state, streams previously carefully adapted for timber-floating are reverting to their natural state through neglect, and insect damage is being allowed to proceed unchecked. Owing to want of ready money and lack of trained personnel, forest development strikes one as being more or less at a standstill. This may be a temporary phase, but personally I have my doubts about it.

The following statistical information was kindly supplied by Professor V. N. Stinghe, of Bucharest. The figures are interesting, as they apply to the new Rumania and have not previously been published. It will be seen that the net consumption of softwoods is 1½ times greater than the net increment.

Total area of hardwoods ..	12, 349,000 acres.
Total area of softwoods ..	3,963,000 acres.
Economic or workable forest area	15,496,000 acres.
Uneconomic forest area ..	816,000 acres.
Volume of merchantable softwoods ..	5,315,000,000 cub. ft.
Volume of non-merchantable softwoods	282,000,000 cub. ft.
Net annual increment of merchantable softwoods	28 cub. ft. per acre.
Total net increment of merchantable softwoods	106,300,000 cub. ft.
Approximate home utilisation of softwoods	63,500,000 cub. ft.
Exports of softwoods	113,300,000 cub. ft.
Imports of softwoods	466,000 cub. ft.
Balance (net consumption minus net increment of Softwoods) *deficit* ..	71,000,000 cub. ft.

WORKING PLANS: THE OFFICIAL CODE.

By G. B. Rylr.

While engaged in the preparation of working plans for a number of forest units in various types of country, the writer has frequently thought that a revision of the present code would be of considerable assistance both to the compilers of the working plans and to those who may have to refer to them at some future date, when perhaps all those who may have to refer t knew th forest in its early stages will have departed far beyond reach of the belessings consure of Forestry Commissioners yetfnborn.

Where a large number of working plans for separte forests have to be kept in the charge of one body it is no doubt essential to have soje sdefinite system to work upon and every working plan must ,as far as possible, be compiled on the same lines so as to facilitate reference and control. At the same time, however, the system must be one of considerable elasticity to allow for the many difference which occur in the forest types and perhaps also in the individualities of the working plan compilers.

The great majority of Working Plans which are prepared for the forestry Commissioner's properties are of course, practically nothing but planting plans, and in these the most important features are, or should be, reasoned statements for the choice of species, a full description of the anticipated risks to which the forest will be liable (these too are largely mutually inter-dependent) and suggestions of the means by which the risks may be minimised or combated. There are the points which the next generation will want to know; the actual programme for the Working Plans period, will merely be a detailed development of the previous arguments and will be of purely temporary value.

As to skeleton Working Plan in the Code stands at present, either a good deal of rather unnecessary repetition is entailed, or the arguments cannot at once be grasped by a stranger to the forest, reading through the plan. For example, the correct choice of species to be planted is obviously closely dependent on the factors of the locality such as physiography, climatic conditions, geology, and, perhaps, more important than any, the soil conditions as indicated by the main vegetation types existing on the ground. If one adheres closely to the Code all these factors will be described in paragraphs 5 to 8 in Part I, but the section devoted to the "choice of species" will be postponed to paragraph 15 in Part II, and in order to give a clear argument for the selection of the various species it is necessary to repeat to a large extent the date already given in the earlier sections. Again, the risks to which the forest might be liable, including such problems as fire, fungi, insects, rabbits, climatic risks, &c., should be described, according to the Code in the last section of Part I, but "Forest Protection" or the means to be adopted for combating these risks comes in the last section of Part II so that the whole of the risks must be stated *de novo*.

A certain amount of repetition in the Working Plan is probably unavoidable, and for ready reference it is essential, but while any hard and fast key plan is bound to lead to difficulties in special cases—and what forest is not in some way a special case ?—a considerable amount of time and space could be saved by a few slight adjustments of the present "skeleton."

The "Argument" of the plan, which is at present in Part II, might with advantage be brought into Part I, and could be merged in with the general description of the forest.

Part II would thus be limited to a more or less narrative account of the methods and procedure by which the prescribed operations will be carried out. The present paragraph 13 (Prescriptions) might well be transferred to Part III and would thus serve as a tabular summary to the detailed programme which is set out on the Form No. T 9.

In Part V (Organisation and Finance) a considerable enlargement of paragraph 25 will now be required in order to deal adequately with Forest Workers' Holdings.

The following shows some modifications of the "skeleton" which in the writer's opinion might prove more generally convenient—

PART I.

GENERAL DESCRIPTION AND ARGUMENT.

Para. 5. General Argument and Objects of Management, including local requirements and markets and means of satisfying same.

Para. 6. Meteorological data.

Para. 7. Geology and physiography. Main topographical features of the geological types.

Para. 8. Summary description of forest and choice of species.

(*a*) Afforestable land.—

Vegetation and soil types with argued statement for the choice of species for each type.

(*b*) Timbered Areas—

(i) Species and methods of management ; argument for or against change of species on re-afforestation areas ; argument for or against change of methods of management.

(ii) Distribution of age classes : tabular statement.

Para. 9. Probable production : summary only. (Tabular and graphic statements in appendix).

Para. 10. Risks and protective measures.

PART II

PROCEDURE.

Para. 11. Allocation of Area. Division into Working Sections, Circles, Series, &c.

Para. 12. Roads and rides (refer also to Fire Protection in para. 10).

Para. 13. Regeneration—

(*a*) Planting.

(*b*) Replanting.

(*c*) Sowing direct.

(*d*) Underplanting.

(*e*) Natural Regeneration (Refer also to para. 15 (*b*) (ii)).

Para. 14. Thinnings.—

Para. 15. Fellings.—

(*a*) Clear fellings.

(*b*) Special fellings

(i) Coppice and standards.

(ii) Regeneration fellings, &c.

Para. 16. Nursery.

Part III.

Programme.

Para. 17. Prescriptions. Tabular statement by area for the Working Plan period.

Para. 18. Regeneration programme (on Form No. T. 9).

Para. 19. Thinning programme. (on Form No. T. 9).

Para. 20. Felling programme (on Form No. T. 9).

Programmes for weeding and cleaning and for beating up are of somewhat doubtful value and especially in the case of a newly acquired area it is quite impossible to give even approximate estimates. In fact, for the purposes of a Working Plan, it appears hardly necessary to make any mention of the "Incidental Operations Programme."

One of the most valuable parts of the Working Plan is the map, and no forester should be without a detailed map of his forest. If such can be obtained mounted in sections in a portable form so much the better, but in any case a good plan with all the areas clearly marked on it is of great assistance both in making out the weekly progress reports and in completing the compartment records.

The question of revision of the Working Plan needs careful consideration. It very frequently occurs that shortly after the plan has been completed the area of the forest unit undergoes a complete change, either by the acquisition of further land or by an alteration in the reservations for forest workers' holdings or by other means. In some cases an addendum to the plan may suffice to make the necessary alterations, but in other cases a complete revision will be rendered absolutely necessary.

The above remarks and criticisms may leave many points untouched and it will be interesting to learn the views of others on the subject.

LOSSES IN LINED-OUT PLANTS IN ENGLAND AND WALES, 1925.

By W. H. GUILLEBAUD.

The following notes on lining-out losses during the past season have been written at the request of the Assistant Commissioner for England and Wales.

The returns from all the nurseries have been summarised and reports received from the officers in charge of the nursery groups stating what appear to be the main factors influencing the results.

The most general adverse factor was, of course, the weather. Following upon an abnormally mild winter, the spring of 1925 was cool and very wet; these conditions prevailed until the end of May, when there was a sudden change to extremely hot dry weather, which lasted in many places for nearly two months. The conditions were equally as trying, though in different ways, on the heavy, as on the light land nurseries. In the heavy nurseries, the absence of winter frost left the soils badly pulverised and sticky, while the wet spring made lining-out extremely difficult. In many cases proper contact between the roots and the soil could not be established. The soil became puddled by the frequent treading when saturated with water, and baked and cracked in the succeeding drought. In the case of light nurseries, the wet spring was a godsend. It gave the earlier lined-out plants a good chance of root formation and in fact the great majority of the vigorous plants of all species took hold and survived the drought. The effect of the drought was, however, fatal to a great proportion of the weaker plants. The experience in the eastern counties was that, as a whole, the plants stood the first half of the drought remarkably well, but a few very hot days in July had a disastrous effect on the weaker plants, which died off wholesale.

Apart altogether from the adverse weather conditions, the reports indicate that there was a variety of other general as well as local factors which played a more or less important part in the final result.

In the first place the reports are unanimous that the bulk of the losses occurred among the small weakly plants of all species. Age of seedling and species have also to be taken into account. Large numbers of 1-year seedling larch and Douglas fir were lined out and the losses were heavy among the small seedlings, but the 2-year seedlings of these species appear to have suffered much less severely. In Scots pine, on the other hand, in most nurseries, it was the weak semi-suppressed 2-year seedling which fell a victim to the drought. Scots pine seed normally germinates well and the seedlings grow fast, especially in the second year, thus a seed bed which looks nicely stocked at the end of the first year will usually be disastrously overcrowded by the end of the second growing season. To throw out the weakly plants may easily mean a loss of 50 per cent. on the total stock, yet a bad season such as we have just experienced shows convincingly how small the survival chance of these seedlings really is. This sowing of Scots pine, or the lining-out at the end of the first year of all beds carrying more than say 75 seedlings per square foot, would seem the only alternatives.

Losses were generally higher in imported than in home raised seedlings. Apart from the question of acclimatisation, which is probably very important, several other factors are involved such as the method of heeling-in in the despatching nursery, the time the plants remain heeled in, the method of packing and the length of journey, weather conditions, facilities for dealing with the seedlings at the receiving nursery, &c.

In many cases, one or more of these factors is likely to be adverse and so to militate against the chances of success of the imported plants.

More than one report refers to the fact that exceptionally heavy losses have occurred where new land was taken in for a nursery and lined-out for the first time. The physical state of the soil is probably the principal factor, but there may be a lack in such soils of the specific fungi which may be necessary to promote normal root absorption.

Pests, of which cockchafer, surface caterpillars, and wire worm were the chief offenders, caused losses in some nurseries. Pine needles cast was also severe in one group, but, on the whole, losses due to pathological organisms do not seem to have been in any way abnormal.

It appears that in several if not all the groups, part of the casualties were mere paper losses due to the method of counting. The drought caused the presence of a larger proportion of small weakly plants than usual and these, in many cases, were not counted as not being fit for lining-out.

It is suggested that nursery foremen should be instructed to count the whole of the plants fit for either planting or relining-out (in other words practically all the living plants) and to place against the total for each series of beds or lots a reducing factor (*e.g.*, ·8 or ·9) to represent the proportion of the plants fit for planting. The losses would then be worked out from the total of the living plants, while the reduced number would represent the stock available for planting.

The standing instructions with regard to nursery counting really cover this point, but some of the foresters appear to have difficulty in grasping them.

It is probable that the paper losses under this head ran into several millions of plants this season.

Finally it may be of interest to summarise the losses according to species and thus to get a general idea of the species which appear to be most difficult to handle. The inclusion of New Forest, Dean Forest and Rapley Nursery with the five Divisions makes a total of eight nursery groups. If the losses in all the nurseries in each group are averaged for the different species and those losses over 35 per cent. picked out, some indication is given of the relative losses as between the species. The following table summarises the position :—

Species.	*No. of nursery groups with average losses exceeding 35 per cent.*
Corsican pine	4
Scots, pine	5
European larch	2
Douglas fir	2
Norway spruce	2
Sitka spruce	1 (out of 7 groups)
Beech	2 (out of 5 groups)

The table brings out clearly the much heavier losses which occurred among the pines than in the other principal species. It is rather surprising to find the Corsican pine making a slightly better showing than Scots pine, but it is suggested that the explanation lies in the heavy mortality during the drought among the poorer grades of 2-year Scots seedlings. With thinner sowing or more intensive culling, many of these losses could be avoided.

Sitka spruce stands at the other end of the list as apparently the easiest plant to handle in the lines. The average loss among the lined-Sitka plants over the whole country did not exceed 25 per cent.

DIRECT SOWINGS.

A PLEA FOR PERSEVERANCE.

By W. L. Taylor.

In a most interesting paper entitled " Reforestation by Seed Sowing in the Northern Rocky Mountains " (W. G. Wahlenberg) reprinted from the *Journal of Agricultural Research*, Washington, D.C., April 1st, 1925, are published the results of experiments, extensive and intensive, during the past fifteen years. These experiments cannot fail to be of great interest to foresters in their search for methods of establishing forest crops cheaper than the accepted practice of planting.

In 1910 wide and destructive fires are stated to have occurred throughout the Rocky Mountain Region and during the following years some 15,379 acres were broadcast, sown by means of corn planters or sown in spots. Of this area, 53 per cent. was seeded with *Pinus monticola* ; 36 per cent. with *P. ponderosa* ; 5 per cent. with Douglas fir and 6 per cent. with various species including *P. contorta*, Norway and Englemann spruces and hardwoods.

Out of the 343 trials only 20 succeeded. The writer, however, rightly emphasises the desirability of examining closely the few instances of success as " unfortunately, recorded information is lacking concerning details of sowing, site and seed conditions, some of which may have been vitally important."

Broadcasting and the use of the corn planter were definitely abandoned in 1916, since which date the experiment of the Forest Service in Northern Idaho have been confined to sowing in prepared spots. It is definitely and significantly stated that the broadcasting was generally done without preparation of soil or use of poison against rodents. For the sowing in spots, patches 6 to 8 inches square were denuded of surface vegetation by means of a planting mattock. 20 to 25 seeds were scattered over the resulting fresh soil surface and tamped into the soil be pressing with the flat of the mattock blade. Loose soil was then scattered over the seeds usually without further firming in. The results are illustrated in the paper by means of graphs, and in the course of six years' painstaking effort the following percentages of success are recorded :—

	Per cent.
Douglas fir	20
Other species	15

The principal sources of danger have been from drought, frost-lift, fungi, cut-worms and rodents, and more losses were due to drought than to any two other causes. Cut-worms were next in destructiveness and fungi were not a large factor. It appears that spring sowing has proved markedly superior to autumn sowing.

In conclusion German experience is referred to ; Germany having found direct sowing successful only when a continuous moisture supply is available.

The sowing in prepared patches is precisely the method which has been employed in the experimental sowings in England and Wales during the past five years. The experience gained can be taken as pointing exclusively to the following features, which need to be most carefully examined in relation to the success or failure in any given case :—

(1) Choice of site.
(2) Complete removal of the surface vegetation and accumulations of peat or raw humus by burning.
(3) Preparation of soil.
(4) Time of sowing.
(5) Climatic conditions during and subsequent to germination.

The best results with conifers have been obtained on the light soils such as the Bagshot formations in Hampshire and Dorset, the East Anglian sands and the Permian and oolitic soils of Devon and the North Riding of Yorkshire respectively.

It has been shown that in the south and east of England *Pinus pinaster* can be established very cheaply indeed by direct sowing and areas have been successfully and fully stocked in Suffolk, Berkshire, Hampshire and Dorset. 50 per cent. successes have been obtained also with Scots and Corsican pine and Sitka spruce while a small area of Douglas fir germinated freely and well at Bramshill Forest though subsequent growth has been irregular owing to frost and fungus troubles. Failures have been largely traceable to insufficient or unsuitable soil preparation, incomplete surface burning, late sowing, excessively deep seed covering, adverse climatic conditions and pests, *e.g.*, birds, moles, mice and fungi.

As a result of the five years' work on a comparatively small scale undoubted successes can be shown and, with the writer of the paper referred to, it is desired strongly to advocate the most careful enquiry into, and complete recording of, the full circumstances of each successful effort for closer comparison with conditions under which the failures have occurred. It is surely from our success that the secret of success in direct sowing are to be drawn.

THE CONVERSION OF COPPICE WITH STANDARDS TO HIGH FOREST IN NORMANDY.

By J. H. Mackay.

Before commencing a study of the methods of converting coppice to high forest as seen in Normandy, it is of importance to note the reasons for so doing. The silvicultural systems of coppice and coppice with standards are favoured by owners of small forest areas because of the little investments that such systems demand, and the relative high net return on the investment, as the following table taken from statistics collected in Baden shows :—

	Annual cut per acre.	On a growing stock of.	Volume growth per cent.
	Cubic feet.	Cubic feet.	Cubic feet.
1. High forest	62·86	3,461	1·82
2. Coppice with standards...	65·68	1,642	4·00
3. Simple coppice	58·62	600	9·76

Other factors were the small expense for regeneration and the quick returns.

At the time when simple coppice and coppice with standards were so largely adopted there was an unlimited demand for fire-wood and charcoal, but owing to the improvements made in modern heating arrangements fire-wood is less in demand and charcoal has more limited uses. The result has been a slump in the markets. The development of new industries demands an increased use of large-sized timber.

At Rouvray there was an excellent example to show that the introduction of high forest would result in the production of trees much superior in quality, height-growth and diameter growth to the present standards over coppice. The present standards over coppice are small and branchy and on the same area previous to conversion to coppice with standards there existed a most excellent oak high forest. There is very little deterioration of the soil under coppice, so that the same results may be expected upon reconversion. For these reasons the State has considered the conversion of coppice to high forest a policy for the common weal of the Republic. The forests visited which demonstrated the methods of conversion were the following :—

1. Forest of Rouvray.
2. Forest of Roumare.
3. Forest of Ecouves.

The underlying principles of conversion are two in number and depend upon (1) the sprouting ability of the chief trees, and (2) the age when sprouting falls off. These principles have been arrived at only through experience, and on these are based two methods, the first of which may be called the " ordinary method," and is exemplified by the forests of Rouvray and Roumare. The second is "Aubert's method," and is applied to the forest of Ecouves.

One important point in the conversion of coppice to high forest applies to the management. Divide the area to be converted into periodic blocks, the number varying with the coppice rotation and the proposed high forest rotation, *e.g.*, if 30 years is the coppice rotation and 120 years is the high forest rotation then four periodic blocks would be formed. The conversion is applied to one block at a time, the other blocks being managed under coppice. This assures an even distribution of the age classes when conversion is completed and avoids many pitfalls that would otherwise arise.

The third working section of the forest of Rouvray may be taken as an actual example of the ordinary method of conversion. The existing wood consists of oak, beech, hornbeam, hazel, and some minor species. It is desired to convert this coppice with standards to high forest on a rotation of 150 years.

The present coppice rotation is 30 years, so that in the future forest there will be formed five periodic blocks. Approximately one-fifth of the area is selected and placed under the fifth periodic block, the areas chosen being the oldest.

The numbering of the periodic blocks is somewhat misleading, the last block to be regenerated is the first periodic block, and the first the fifth periodic block. The other blocks are not selected till their turn for regeneration comes round. In Rouvray the conversion was commenced in 1867, so that the position of the various periodic blocks in 1925 is as follows :—

Fifth	Regenerated.
Fourth	Under regeneration fellings.
Third	In period of rest.
Second and first ..	Coppice with standards, with retention of smaller standards as much as possible.

When a block is being brought under conversion its age varies a great deal because of the different aged standards. This block is allowed to continue growing throughout another complete rotation. This period being known as "the preparatory period of rest." This brings the stand to an age when the coppicing ability of oak is much reduced and of beech is nil, and there is a production of fertile seed.

At this stage the crop is brought under regeneration fellings, the better classes of standards and coppice being allowed to remain. The number of regeneration fellings necessary will vary with the conditions met with, but as a rule three will suffice, these being a seedling felling, a secondary felling and a final felling. The natural seedlings will have little if any competition with the coppice shoots, as these are weak and do not develop to any extent.

Regeneration in this block has to be accomplished by the end of the period of 30 years. During this period the fourth periodic block is selected and allowed to remain untouched during the preparatory period of rest. At the end of the second period the fifth block has been regenerated, the fourth is brought under regeneration fellings, and the third is selected and allowed the preparatory period of rest.

This process is carried on till the first periodic block has been regenerated by which time the fifth block will have a mean age of 120 years. At the end of another few years, possibly 15 years, this block will again be brought under regeneration, the latter extending over a period of 30 years, giving an average age of 150 years. The essential difference between this system and Aubert's system lies in the fact that there is no preparatory period of rest in the latter. Upon a coupe reaching the end of the coppice rotation, instead of being allowed to grow on untouched through another coppice rotation it is thinned and the best coppice shoots and seedlings standards allowed to remain to form the future high forest. About 120 to 200 stems are left per acre, though more might be left to advantage. In normal high forest two to three times this number is to be found per acre at this age. In the forest of Ecouves this thinning yields about 60 stères per hectare (about 847 stacked cubic feet per acre).

The general names applied by the French to the different ages of standards is as follows :—

Standards of 1 coppice rotation ..	" Baliveaux."
Standards of 2 coppice rotations ..	" Modernes."
Standards of 3 coppice rotation ..	" Anciens " (2e classe).
Standards of 4 coppice rotation ..	" Anciens " (1e classe) ; " Bisancien."

In terms of this table the standards removed are as far as possible the " anciens " (1e and 2e classe), and many of the " modernes." It is advisable to retain as many " baliveaux " as possible, since these take up less space and will produce a better class of timber when felled. From this stage till the crop is 60 years older there are carried out thinnings, as in ordinary high forest till the crop at that age is brought under regeneration. The great advantage of this system is that there is no complete cessation of returns from the area under conversion, and there is no difficulty in bringing about regeneration, the trees derived from coppice shoots being able to produce viable seed. Trees derived from coppice can always be distinguished by the undue swelling at the base. It is essential when choosing the coppice shoots that are to remain on the area under conversion to see that these arise from healthy stools otherwise they may die from disease before the regeneration period comes round. On poor soil such as exists on the summits of the hills in the forest of Ecouves neither of the above systems is to be recommended, the most profitable policy being conversion to conifers by clear cutting and artificial regeneration.

A SUGGESTED METHOD OF PLANTING ON A POOR SEASIDE MUIRLAND.

By R. SHAW.

No hard and fast rules can be laid down as to the best method of planting by the seaside. In fact, different methods have to be adopted in different parts according to the nature of the soil round the coast, whether sandy, alluvial or rocky. In the following notes the writer wishes to confine his remarks chiefly to the method of dealing with a sandy muirland soil and to offer a suggestion as to the planting of such a soil. The soil in question is covered with a thin layer of turf and lies at some distance inland from the sand dunes. Part of this soil was at one time arable land and cultivated, but is now derelict and is fit for the growing of trees only.

It was thought that growth might be assisted and success assured by the use of a " C conical " spade, and the following method was carefully practised. The spade was of medium size, having a length of 11 inches and a diameter of 5 inches. The size of the hole and the plug of soil extracted was 10 inches by approximately 5 inches. The operation was a simple one. The spade was inserted to its full depth and the plug extracted carefully, allowing it to remain entire. On examination it was seen that the plug, although only 10 inches in depth, consisted of three layers of soil, more or less sandy, yet of three different colours: (1) Extreme end of plug about 3½ inches in depth, pure sand of a very light colour; (2) middle portion of plug about 4½ inches in depth, soil of a darker and fibrous nature; (3) top of plug, grassy turf about 2 inches in depth.

Instead of the usual method of hole-and-plug-planting, *i.e.*, inserting the plug whole, it was in this case cut transversely into three portions by means of a strong trowel or other instrument (*e.g.*, entrenching tool). The plant was then inserted in the hole at the proper level and the roots covered by the soil from the middle portion of the plug which, being of a darker colour and of a more fibrous nature, had consequently more feeding properties in it, and by being thus placed in contact with the roots the plant had thus a source of readily available food material. In this way the plant may be encouraged to make an earlier start into growth in spring, and as it grows stronger it is better able to suit itself to the conditions under which it has to grow in the future.

After the roots had been well covered by the soil the remainder of the hole was filled up to within an inch of the top with material made by carefully chopping up the turfy top portion of the plug and mixing it with the sandy soil from the bottom of the plug. By leaving the hole unfilled for about 1 inch at the top provision is made for the collection and retention of any rain which falls, and which can thus be readily absorbed by the soil mixture above the roots, and in this way the necessary moisture is retained for the plant, instead of being evaporated on the surface during drying winds and heat. No mistake, however, must be made in using the " chopped up turf and sand mixture." To place this at the bottom of the hole would be injurious to the plant, because when once the turf rotted a cavity would be left at the base of the roots, into which all moisture would drain, or, on the other hand, leave a vacant space around the roots.

While placing the soil of the middle portion of the plug around the roots it need not be interfered with to a great extent or exposed to the air too long, for although it may be of a more fibrous nature there is still a greater percentage of sand in it which renders it porous. This soil, however, if placed firm and close against the roots will give the young plant a better chance of developing new roots and root fibres.

This method of planting was tried by the writer in the spring of 1923 over an area of about 20 acres—40,000 plants approximately, and of these very few died, the result on the whole, being very satisfactory and more successful than the ordinary method of hole-and-plug-planting of the same season. The plants used were good sturdy 2 year × 1 year transplants; but whether the success was due to the method of planting or to the quality of the plants has yet to be ascertained by further experience of the same method with average quality plants.

As this subject of planting by the seaside on land which at one time was agricultural is not altogether without interest, perhaps others with experience would give their views.

THE INFLUENCE OF VARIOUS TYPES OF MOORLAND SOILS ON THE GROWTH OF YOUNG PLANTATIONS.

By D. N. Williams.

In the daily life of forestry, one has a great and also a very interesting opportunity of studying all forms of plant life in their natural environment, and one can specially apply this study to trees now that they are being grown on such an extensive scale. I think the first impression one gains with regard to young trees is how vastly their growth differs on various types of soils and situations. I have had a good opportunity of noticing this here, for the moorlands comprising Exmoor generally vary considerably in soil, aspect, height and natural vegetation.

Of course, the three types of heather preponderate, but still in the lower lands, the bogs and the vast amount of ground which has gone out of cultivation and is utterly waste, the sub-dominant species occur in considerable quantity and are either a nuisance or otherwise to the forester when he has to start to plant.

I propose to separate the land into three classes, viz. :—

The heather lands.
The Gorse lands.
The bracken, whortleberry and grass lands.

The Heather Lands.

Heather certainly covers the greater portion of the area which we are afforesting here, but nevertheless it is varied with considerable patches of bracken and gorse. On this type of land we have mainly planted four different species, viz., the Scots and Corsican pines, Douglas fir and European larch.

We have experienced almost a complete failure with the Douglas fir on heather whether screefed or not and the result of planting larch and a small quantity of common spruce has been but little better. The most promising plants of Douglas fir when planted immediately turn yellow, and lose their vitality, and not producing more than 1 inch of growth per annum. The acidity of the heather-humus doubtless is the cause of a great deal of this, but the sub-soil, being hard sandstone and very rocky, and not porous, may also have a bad effect.

Now the pines have found their *natural* ground, in the same way as the heather has. By this I do not imply that the pines would not do better on a Quality I soil, but that they can and will grow on heather ground satisfactorily, and be able to withstand drought well. It will be noticed that on these dry soils the needles of the pine develop a much thicker epidermis, this conserving to a great extent the available water supply from loss by transpiration. The needles not only become thicker, but become broader, in the same way as they do when continually eaten by rabbits or black game. Yet again, the Corsican pine will be noticed to be far ahead of the Scots, and as the altitude increases, it will be more noticeable still. There is little doubt that the Corsican pine is *the* tree for the poorest and most exposed lands, and provided the greatest practicable care is taken in handling the plant in the various operations through which it has to go, the results in establishing it, will quite justify the care bestowed upon it.

I do not propose to go into the various operations connected with preparing the ground, and planting on the heather, but simply to study the relative growths of the trees when they have been planted. Still, there is one aspect connected with afforesting heather land worth considering, and that is whether to burn preparatory to planting or not. There is little doubt that the ash deposited from the burnt vegetation must have a beneficial effect on the plants, and fire-danger is considerably reduced. From my experience here I am absolutely of the opinion that the advantages of burning are entirely counterbalanced by the advantages of the growing heather in protecting the young transplants (and more so now in the case of 22 year seedlings being planted in the forest) from cold and exposure, in reducing evaporation of water from the ground and causing a struggle for existence, resulting in a much better growth from the plant.

Gorse Lands.

This is far more profitable land to afforest, much better growth resulting. On the other hand, much greater expense is incurred in weeding, and fire-danger is very great. Either type of gorse, the large or dwarf, is a considerable nuisance to the forester, though it will keep rabbits from biting many plants, but the dwarf is probably the greater trouble, because it covers the ground like a mat, and even when burnt will send out the next year a great many small creeping shoots, which cannot be cut with a hook, and which creep round and smother the plant.

The growth of all plants (but even here the pines do better) I should estimate to be quite 6-inches more per year than on heather, at any altitude. Being a leguminous plant, the gorse has nitrogen-collecting nodules on its roots, and thus benefits the soil considerably.

The Bracken, Whortleberry and Grass Land.

The remaining portion of moorlands is chiefly covered with a varied mixture of these plants, chiefly occurring on the slopes and lower parts.

Frequently, it is the result of neglected farm land, which has been out of cultivation for years. The growth of trees on the type of soil which produces bracken as its natural flora is probably as good as one can desire, for invariably it is good land which produces it. The old saying " that bracken land is good corn land " may be slightly exaggerated, but where the fern is found to a height of anything from 4 to 10 feet, trees will revel in it, the Douglas and larch producing often quite 3 to 4 feet growth per annum. Japanese larch planted 4 years on such land on Exmoor have put on shoots of this length. The soil will be found to be a good porous sandy loam, and the bracken in summer can be weeded at will, depending whether there is a drought or otherwise.

The soils under whortleberry are nearly all very stony, but good growth results, and I have heard that Sitka spruce will do excellently on such land.

The grass land often produces splendid growth in young trees, but frequently the effect of the rank grass smothering the plants counterbalances this. Spruce often pushes its way through grass, and excellent spruce planted on such ground can be seen right in the heart of Exmoor.

Lastly, to study accurately the best places for various species would entail a very complicated Group System, and such would not be practicable at the rate of planting at which *the Forestry Commission* is progressing.

A METHOD OF DEALING WITH UNMARKETABLE BIRCH.

By G. Home.

On many of the estates acquired for national afforestation there is a considerable area of land covered with mature naturally regenerated birch, which at present is unmarketable, and it may be of interest to those who have to deal with similar areas to know what is being done on Portclair Forest, which is typical in this respect. On this forest there are 1,000 acres of mature birch which is at present unsaleable, and as plantations have got to be formed year by year, it is impossible to wait on the uncertainty of the birch becoming saleable, consequently some other method of dealing with it is necessary. To clear it would cost not less than £6 an acre and probably more, a heavy expense which is not justified under present conditions, as it appears possible to establish plantations under it without felling a single tree, if the trees are girdled, as is now being done at Portclair. This consists of cutting with an axe a strip of bark about 6 inches wide right round the tree at any convenient height, usually between 2 and 3 feet above the ground, care being taken to disconnect the bark completely, otherwise the cut need not be more than an inch deep. The natural inclination of the men when first employed at the work is to make sure of the killing of the tree, and if not watched they are apt to "nick" the trees too deeply. This renders them liable to be troken off during strong winds. The girdling has usually been done during winter when frost or snow stopped planting, but if it is done in the early summer, when the sap is flowing freely,t he bark comes off much more easily. At this time, however, weeding in the nursery and the cutting of bracken in advance in the plantations, usually keeps the workmen fully occupied. During the past three years, 300 acres of birch have been girdled at a cost varying from 15*s.* to £1 per acre. Where trees have roughly grown stems, or on steep broken ground where it is difficult to secure a proper foothold, the work costs more than under opposite conditions. The laying out of rides is more difficult through girdled areas than on cleared ground, and in localities exposed to wind these should not be cleared in view of the risk of having windfalls amongst the girdled trees. Under such circumstances no clearing beyond the removal of the few trees in the way of the surveying is advisable, or at most a single line of treesup the centre of each ride, the rest being girdled

The effect of girdling, though certain in the end, is not apparent at first. At Portclair, where it was performed in winter, the birch came out in full foliage in the following summer. During the second season a slight check consisting of a loss of about 25 per cent. of the foliage was observed, and in the third year death resulted. Girdling has usually been carried out a year in advance of planting, and 150 acres of Douglas fir and Norway spruce have been planted on ground so treated, with quite satisfactory results. In the second year after planting the Douglas have made a growth averaging 15 inches. The Norway spruce have also grown well, and both species have a remarkably healthy colour. The late spring and summer of 1925 were exceptionally dry, and there is no doubt that on the southern slopes the shelter afforded by the girdled trees has materially helped to conserve soil moisture, thereby benefiting the young plants. Also in this forest fairly severe late spring frosts often occur, against which the shelter of the girdled trees act as a protection.

At present the twigs are still on the first girdled trees, but they are showing signs of decay, and in due course will gradually fall to the ground and form the beginning of the forest floor. Likewise the branches and stems will also gradually fall down, but as by that time they will in all probability be well advanced in decay and light in weight, it is unlikely that they will materially damage the plantations growing under them.

The mycologist and entomologist may regard girdling, which leaves so much dying and dead timber on the ground, as a risky practice. Perhaps the chief danger is Honey Fungus, which is generally found in old birch woods. It has been observed in clearing such woods that a considerable number of old stools die and provide material for the propagation of this fungus. What will happen in the girdled birch remains to be seen, but in the meantime, having effected a saving of at least £5 per acre by girdling instead of clearing, it is considered that a policy of " wait and see " can now be afforded.

THE CUT-WORM—A NURSERY PEST.

By G. B. Ryle.

The cut-worm, grey worm or surface grub is a nursery pest perhaps surpassed in importance and destructiveness only by the better-known cockchafer grub and its allies. Like them, also, it will probably yield to the same methods of treatment; but the question as to what methods of treatment should be adopted still remains more or less unanswered.

English text books on forestry and forest entomology give little or no information on this pest, and it is probable that damage often ascribed to the cockchafer family is in reality caused by the cut-worm. Even without finding the grubs it is often possible to distinguish between the damage caused by the two species. In the case of the cockchafer grub the roots are commonly cut right through, but they are generally also nibbled all around the cut end. The cut-worm, however, makes a perfectly clean bite through the root as though it had been sliced with a sharp knife.

The life history is somewhat obscure, but there are two generations a year, more or less as follows: The turnip moth (*Agrotis segetum*) deposits clusters of eggs on the soil in May or June. The eggs laid by a single female may amount to several hundreds. These eggs hatch very soon and the young cut-worms descend into the soil and remain as root feeders throughout their existence. It is at this period, from May to July, when the first damage occurs. In the nursery lines the grubs will travel along the lines from one plant to another and the rows of dead transplants soon become obvious. If the wilted plants are picked out it will be seen that the root has been cut off just below the ground level. In July or early in August the grub is full grown and it then descends rather deeper into the soil and pupates. The moths may be expected to emerge in August. The larva of the second generation feeds throughout the autumn and early winter, and probably pupates in the late winter or early spring.

During the last season at Ampthill nursery the first generation of larvæ were most prevalent in a bed of European larch lined out the previous winter, and the losses were very heavy. The second brood of grubs were most abundant in the 1-year Scots pine seed beds. Between the time of stock-taking at the end of August and the time when the seedlings were lifted in December considerably over 50 per cent. of the trees had been killed.

The grub is apparently more or less omnivorous, but the Norway spruce appears to be avoided. Like nearly all the soil-inhabiting insects, the cut-worm is most prevalent on light soils, but it has occurred in one heavy clay at Apethorpe, and it will probably be found that no nursery is entirely free from the pest.

As regards means of prevention, it is unfortunate that nothing very definite can be prescribed. In one plot at Ampthill a heavy dressing of naphthalene was dug in during the winter; but it was in this plot where the heaviest losses of larch transplants occurred the following summer. It appears that by the time the larvæ hatched all the naphthalene had volatilised.

A fresh emulsified culture of *Bacillus melolonthæ-non-liquefaciens* causes rapid death from septicæmia, but an old culture not only fails to kill but renders the grub immune from further infection. This method may be of theoretical interest only.

On a badly infested nursery the ground should be thoroughly and deeply hand-dug as soon as the plants have been lifted. This will bring up many of the grubs, and others may be killed by night frost or eaten by birds. At Ampthill partridges have come in large numbers on to the freshly dug ground.

The summer generations obviously cannot be caught by digging, but "traps" consisting of sods of turf, cabbage leaves, bunches of grass, &c., should be scattered over the area and examined daily.

Theobald (*Agric. Zoology*) recommends the use of poison baits consisting of small bunches of clover or lucern soaked in arsenate of lead. This method deserved thorough trial, but obviously great care must be taken in the use of such a poison in the nursery.

It has been suggested that the moths might be caught in lamp-traps, but this was found to be of little value, as the actual number of moths caught was comparatively small, and of these only 19 per cent. were females. Also success was limited to warm, damp, cloudy and windless nights, with no moon shining.

OTIORHYNCHUS PICIPES.

Damage Done at Margam, Glamorgan.

By G. W. Hollis.

This weevil, which resembles the *Hylobius* in general outline, is not commonly destructive in pine plantations, but considerable damage is liable to be done if it appears in large numbers. The weevil is 3/16ths to ¼ inch in length, clay-coloured and wingless, the antennæ springing from near the end of its snout, as in the case of *Hylobius abietis*.

About four acres of P 25 Scots pine, 2-year, 1-year, which took remarkably well, and were, until the attack began, showing good growth, were completely ruined by these weevils. The first signs of the attack were noticed early in June, and the damage was attributed to *Hylobius abietis*; but as none could be found feeding during the day, and as the ordinary weevil traps failed to attract any, close investigations were made, and numerous clay-coloured weevils were found lying motionless at the foot of the plant. None of these little weevils could be found on the plants during the day, so the writer determined to discover the cause of the damage and visited the infested area, both early morning and late at night. It was then found that about sunset the weevils crawled from their concealment, up the stem of the plant and there fed, presumably throughout the night and until about 7 a.m., after which hour they quickly dropped to the ground and crept beneath the soil covering of grass. During the hours of 9 to 10 p.m. and 5 to 6 a.m. as many as 15 to 20 weevils could be found feeding on one plant, but before 9 p.m. and after 7 a.m. only a few remained feeding.

Unhealthy plants were first destroyed, but as the weevils increased in number healthy and unhealthy were treated alike. Usually the young shoot and tender needles were eaten first, and afterwards the bark from the main stem and branches. By the middle of June the attack had spread rapidly, despite hand picking. Specimens were then sent to Dr. Munro, who advised isolating the attacked area by means of a trench 8 inches deep, continuance of hand picking and trapping by means of the common sorrell, *Rumex acetella*. Hand picking proved the most effective, but the sorrell traps as a secondary measure were quite useful, and the weevils could be collected from these at any time of the day. Difficulty was experienced at first with regard to hand picking: the weevils, being very sensitive to danger, would drop to the ground almost before the plant was touched. However, by means of a small sheet of cardboard placed beneath the plant and then bending the plant over on to the sheet the majority of weevils feeding were captured.

After the rain and cooler days of early July the weevils were not so alert and were more easily caught. Many stayed on the plant throughout the day when cool and wet. Hand collecting and trapping were continued until August, after which the numbers had decreased to such an extent that it was considered unnecessary to keep up the work. Although a considerable number of weevils were captured outside the isolating trench, it is quite likely that but for this precaution the attack would have spread over a much larger area.

A fair estimate of the weevils captured would be 12,000 to 15,000, 11,000 of which were exhibited at the Royal Welsh Show at Carmarthen.

During the early days of October, which were quite warm and summer-like, numerous weevils emerged and fed : this seems to indicate that large numbers are hibernating in the turf layer, and that we may expect a further attack next spring and summer.

FIRE CONTROL.

By A. P. Long.

The forests under the control of the writer fall into two classes, hardwood and coniferous.

In the former case, risk of fire is only likely to occur at times when the forests are frequented by trippers. Owing to their comparatively small area, the annual cutting of grass on the rides and patrol by the local man in charge—perhaps augmented during public holiday times—would appear to be all that is necessary for proper protection.

Coniferous forests present a totally different problem on account of increased inflammability and the size of the areas. In these cases protection resolves itself into steps taken for prevention and methods adopted for fighting fire.

It is suggested that, as far as possible, procedure should be standardised on uniform lines, and the proposals now put forward are general ones for adoption throughout coniferous areas, with modification or supplementation to meet exceptional cases.

Prevention.

The first consideration would appear to be that of rides, to act both as stops and points of attack.

(1) The width of the rides adopted now is a minimum of 30 feet. This may be sufficient for woods in the thickest stage; but when the plantations reach the pole and later stages the lateral branches of the trees spread over much of this width, and it is very questionable whether such rides would offer much of a barrier in the case of a crown fire.

It is suggested that, whereas 30 feet may be wide enough for rides running in the direction of the prevailing wind, those running perpendicularly to that direction should be even wider.

(2) The value of a narrow strip of standard hardwoods on the ride sides is questionable, for some cases of rapid fires through hardwood plantations have come under notice. A fire in a coppice area, however, is unknown to me, and it is suggested that coppice might be given a trial. For this purpose chestnut or sycamore might be suitable species on most coniferous soils, but whilst beech does not coppice readily it responds well to pollarding at high or low levels.

(3) The keeping of rides clean of combustible vegetation is highly important, and treatment falls into two main classes according to the contour of the ground. On flat ground, where there are no stumps, the most effective means would be to keep the narrower rides lightly ploughed so as to prevent all growth of vegetation. Ploughing outside strips and burning the middle is of questionable value owing to the danger of flying sparks, for fires in themselves create currents even on the stillest of days.

The wider rides, if wide enough and free of stumps, could be treated differently. It is my convinced opinion that such rides, or all except the sides, could be cultivated and cropped, and some return produced thereby which will go far, even if not all the way, to meet the cost of keeping the rides clear. It is well known that cereal crops are not to any great degree inflammable and root crops are even less so. Crops suggested are rye and lupins—there being a ready sale for the seed of the latter—buck wheat and possibly sugar beet or white turnips, which crops wouldprovide a useful rotation and a crop could be secured without very great expense. There are various ways of getting the ground cultivated, which will differ according to circumstances, and three means suggest themselves, viz., cultivation to be done by small holders, by sporting tenants, or by ourselves. The indispensable condition is to have the rides wide enough.

Where stumps occur, *i.e.*, in old woodland areas, cultivation will be possible, and experiments with chemical weed-killers for use in the spring will be necessary. I would suggest a trial of commercial common salt, the effect of which on vegetation is both severe and long lasting. It is thought that the chemicals should be applied to sandy land in a powdered form for a solution will quickly soak through and consequently have a diminished effect.

Where the ground is hilly cultivation is generally out of the question owing to the slopes and often the presence of rock. In such places the vegetation should first be burned. Subsequent treatment would appear to depend largely upon some successful chemical weed-killer. Otherwise bracken and grass will need to be cut and cleared sufficiently often to prevent the accumulation of dry vegetation. Ling offers considerable difficulty owing to the impossibility of cutting it low down, and even when short it is very inflammable.

The same principles apply to strips on the side of railways and highways.

(4) Fire patrols are essential. Every forest should be divided into fire sections. The area of such sections will necessarily vary, but it is thought that approximately 1,000 acres would form a convenient working unit. Normally one patrol per section in spring and summer would probably be sufficient during the earliest stages of the plantations, that is, a continuous patrol during these seasons made up of, say ,two men taking eight hours' duty each. (These men could also be made responsible for the proper condition of the fences and various other odd jobs, but fire-patrol would be their main function). On special occasions—such as public holidays or loca learly closing days—this patrol might need reinforcing according to the necessity which may be disclosed.

In order to ensure that the patrol duty is properly carried out, there should be a rigid system of point meetings between patrols of neighbouring sections with counter-signature of diaries giving time and place of meetings. Such diaries would be inspected from time to time by a responisble officer and cases of default without complete and sufficient reason dealt with severely.

The patrols would be directly responsible for the erection and maintenance of sufficient fire-notices and the efficient control of trespassers. In flat country, where there are hard roads, bicyles should be provided to facilitate patrol duty.

(5) A case came to my notice a few years ago, where a landowner had arranged with a railway company for the latter to keep clear of all vegetation a strip of ground on both sides of a line that ran through the former's plantations. The company readily assented on the grounds that it was a cheap method of insurance against fire. Perhapss omething similar could be arranged in those cases where railways run through property belonging to the Department.

Fire Fighting.

The essence of successful fire-fighting is the ready availability of, firstly, fire-fighters, and secondly, fire-fighting appliances.

The former implies an efficient system of alarms, and the latter a supply of appliances at convenient spots which can be got at easily. To fulfil these conditions each fire section should have a small fire station in the form of a hut, say 4 to 5 feet square constructed of corrugated iron on a wooden frame, (or a tower where required as a look-out) situated on clear ground at a strategic point to which a number of rides or paths converge.

Such fire stations would form the centres from which alarms are sent. The alarm might be in the form of maroons, which would attract considerable, attention and each fire section would be given a distinctivec olour, so that a maroon producing, on bursting, stars of a particular colour would indicate that the alarm was sent from and the fire occurs in a given section. It is thought that maroons would be preferable to rockets on account of the greater noise provided by the former, and since the latter require a stick for proper projection which sometimes descends in a smouldering form, thus providing an additional risk of fire. Maroons would be kept at the fire-station in an air-tight case, such as can be purchased at small cost at many stores.

It is thought that this form of alarm would be more efficient and much cheaper than a system of telephones. The latter have many disadvantages, such as disorder of the instrument due to damp or running down of batteries, or again the severance of wires by accidental or malicious action, or particularly in hilly districts—the effect of wind upon anything but stout poles.

The accessibility of appliances would be secured by keeping a supply of fire extinguishers, spades, axes and fire-beaters in each fire station, and such appliances should not be used for any purpose other than fire. The station would be kept locked and a key kept in a glass panelled box on the door in the usual way, a duplicate being kept by the section patrol. As already suggested, a cyclist patrol should carry fire extinguishers on his bicycle.

Instruction would be given to all the men working in the forest concerning the distinctive colour of each section, the whereabouts of each fire-station and the necessity of proceeding immediately to the scene. It should also be made well known in the district that helpers will be adequately rewarded for services rendered in connection with fires, for the population of this country has yet to learn the seriousness of a forest fire and in most cases we shall be largely dependent upon the good-will and ready assistance of the local inhabitants.

FIRE CONTROL.

By T. E. Anderson.

Owing to the extremely dry conditions during the summer of 1925, excellent opportunity was afforded to test the efficiency of fire control methods and, in view of the importance of this work, especially on areas which are bounded by or have railways running through them, it is proposed to give briefly some idea of the methods adopted at Clipstone Forest, which, judging by results, were entirely satisfactory. No fewer than three railways run through the area, and fires from this source have caused great devastation in recent years over practically the whole of the ground.

In the first place a strip of land one chain wide was ploughed adjacent to the railway, and, where ploughing could not be done, two trenches were dug, one at each edge of the strip ploughed ; these were about a yard wide and one foot deep, the soil being thrown towards the source of danger, The trenches joined up the ploughed strips, thus making sure that no fires could obtain free access to the main area. The ploughing was done in March, and in August the ground was harrowed ; all weeds brought to the surface were collected into heaps and burnt at the first favourable opportunity.

At first it was doubted if this width would be sufficient to arrest any sparks which might be thrown out by locomotives, but it was found. however, that under the most favourable conditions for carrying sparks, etc., none reached the main area. Numerous fires were observed on the railway embankment, all of which died out when coming in contact with the ploughed land. Passenger trains were observed to be much worse than goods trains in causing fires, and on one of the many favourable days last summer the writer counted no fewer than five fires started by one passenger train within the distance of half a mile.

Constant vigilance was necessary during the whole summer, and one man was on duty the whole time. including Saturday afternoons and Sundays. It was his duty to patrol the railway line and to dig over any piece of land that had grown weeds likely to carry fire. Also he was informed each day of the whereabouts of the main gang in case help was required, and in addition every man was told that, in the event of an outbreak of fire, he was to leave the work in hand immediately without waiting for further orders and proceed to the outbreak, taking some fire-fighting applicance which was always kept handy and accessible.

Other measures are being taken as the areas come to be planted by using some fire-resisting species planted in belts parallel with the railway ; this will, however, furnish the basis of a further article later.

TIMBER JOTTINGS.

By A. P. Long.

The English timber market has been very dull of late, but there are signs that it is waking up a little. Some of us have timber to sell and it would be helpful to know the trend of the markets in all parts of the country from time to time. In order to start the ball rolling some short notes are given below, their application being mainly to the Midlands.

Oak is selling a little better, and it is hoped to improve upon last year's price of 2*s.* 6*d.* per cubic foot for moderate timber, sold standing but measured down with usual allowance for bark. It is learned that some wagon builders are now relying upon Austrian timber for sole-bars. This should help the home market considerably,for many parcels have been rejected owing to the absence of large enough proportion of big trees to provide the necessary number of solebars for wagon sets. It appears that the demand for other sizes of wagon scantling is a little better. Bark, too, improved last year and made up to 150*s.* per ton delivered unhatched.

Sycamore is in good demand, and quite ordinary parcels are making up to 1*s.* 3*d.* per cubic foot.

Birch has been selling a little better at 6*d.* per cube for brush backs, but it is said that home turneries are again beginning to feel the effect of large imports from Germany.

Ash is in ready demand, especially the better qualities. As much as 4*s.* 6*d.* per cubic foot has been paid for good quality timber suitable for bending, for which there seems to be unlimited demand and short supplies.

Sweet chestnut is in very good demand in the Midlands, where it is used for coffin sets. It is said that 90 per cent. of the coffins in those parts are made of chestnut.

The other hardwoods do not seem to find a very ready market, except walnut, for which there is a brisk foreign demand.

Scots pine is selling better, and fair average samples of medium to large size are fetching as much as 9*d.* per foot standing.

Corsican pine is not ar eady seller, but it is interesting to learn that the Midland pits are now accepting this species for props. All sizes are being taken from 12 feet down to 3 feet in length and 8 inches to $4\frac{1}{2}$ inches top diameter, but the props must be peeled and dry. This is a welcome innovation, as the pits are knowingly accepting them as "pine" (as distinct from "fir"), but perhaps the peeling and drying are largely responsible, for undoubtedly that policy must be adopted in future if home props are to attempt to compete with imported. There is really no reason why this species should not be accepted by the pits—so far as one can gather it has been included in imported consignments for some time. One private estate forester asserts that some parcels include as much as 75 per cent. Corsican; others doubt it, but I have myself seen it at a Midland pit, although it must be admitted that almost everything was represented, even birch, in quantity. Larger sizes of Corsican pine are also being converted into corve boards 8 inches by 1 inch and accepted by the pits.

Larch maintains the usual price of something in the neighbourhood of 1*s*. 3*d*. per cubic foot standing, at which price there is good demand.

Spruce is not much sought after, and has been sold for less than 6*d*. per foot.

In general we still appear to be suffering from the effects of the splitting up of large estates. Large quantities of timber have come on the market regardless of price, and the merchant has been able to pick up many bargains. There are signs that these stocks are becoming exhausted, and a more hopeful prospect for a better demand and, in some cases, better prices may be looked for.

FORESTRY SCHOOL EX-TRAINEES.

By H. Watson.

In previous issues of the *Journal*, articles have dealt with and discussed the shortcomings of the ex-trainees of the Forestry Schools. The one great fault seems to be the inability to handle men. The question arises—Is it fair to ask these youths to be proficient in what, undoubtedly, is only acquired by the majority through years of practical experience ? A few have the natural gift of leading men ; others, through time, alter their previous wrong methods and become more in touch with their workers, while others again will never get work out of men.

Why is this ? and is it possible to collect some really helpful advice which could be taught to the apprentices in the Schools. Perhaps by inducing others to give their observations these short notes may lead to the solution of what is undoubtedly the big question in forestry—the obtaining of a maximum quantity of highly efficient work from a contented forest worker.

My own observations *re* general treatment of workers, which, in my experience, have been successful in forestry work among such different material, as seamen of all nationalities, Canadian lumbermen, disabled ex-service men and all kinds of casual workers are as follows :—

(1) *Study* your man. There is a way to work even the worst of them.

(2) Treat him " white." If there is an inch of a man about him this should appeal to him.

(3) *Don't* shout at him. " Serjeant-Major stunts " ceased in 1918. Give your orders in a friendly way and always try to instil a keenness in forestry.

(4) When the squad are together, say at planting, give them a few remarks on the why and wherefore of the operation and let them feel that the success of the forest will be a feather in their own cap. It will rank then in their minds next to their football team.

If the above fails, get the man to sign A/Cs. Gen. 5 and hand him his insurance card.

As regards the difficult period for the ex-trainee—the day he leaves school and enters the Commission's service—I would suggest that certain areas be selected which are suitable for supervision and variety of work. Each of these could have an ex-trainee as a ganger for the annual cycle of operations. On such areas, where there are a forester and foreman, the ex-trainee could have, say, a small beating-up squad, then boys for cleaning plants, etc., until he gradually acquired the necessary confidence in himself. From there he could be drafted as a foreman in charge of a small area, where no forester is employed, or to a vacancy as a foreman on a larger area.

But even with all this there is, in my humble opinion, one thing lacking in the Forest Service. No one can ever accuse any forest officer of being mercenary, and the one big thing to get the right youths into the service is to remove every obstacle that stands in the way of a young worker rising to the highest rank in the service. Previously it was essential to recruit from outside, but now that we are a large corps with numerous able youths, could outside recruiting not cease ? Would it not be practicable for the Forestry Commissioners to set certain examinations for entry into the different ranks and grades, step by step, when, say, a forester passed his necessary examination, he would wait his turn for promotfon to District Forest Officer, and when a vacancy did occur,. provided his other qualifications were of the right standard, he would be selected. The same would apply to the higher and lower ranks and grades.

Forestry is essentially practical, and with such material available plus the necessary theory, whether acquired by self study or classes, the Forestry Service would be second to none. All I humbly plead for is that everything possible should be done to show these forest youths that future promotion is assured for them if only they work and study hard.

I think this would ensure the entrance of apprentices with a real "Forest Sense"—an absolute necessity, if men are to make these outlying areas a success.

SAVING TIME ON TIME-SHEETS.

By C. R. C. Pink.

Time-books and summary time-sheets are designed to show :— (1) the time worked by each individual workman and (2) the number of man-days given to each individual cultural operation. This information is required in order to ascertain : (1) the earnings of each man and (2) the labour cost of each operation (for insertion in progress reports, etc.).

The present forms, if properly used, do provide the required information, but in a not very expeditious manner.

To illustrate : normally, a time book is kept something like this :—

	J. Jones.	B. Smith.	W. Harris.
Prep. Gd. ..	1 1 1	1 1 1	1 1 1
Fencing (Upk.)		1 1 1	
Planting ..	1 1		1 1
Beating Up ..	½		1

It will be seen that from this, besides the time worked by each man, the total number of man-days spent on each operation (by the eight men whose names occupy a double opening of the book), may be conveniently ascertained by totalling the entries which appear horizontally against each kind of work. In the above example, for instance, it is obvious at a glance that nine days were given to Prep. Ground.

This convenient arrangement is, however, destroyed by transcribing to the summary time-sheet, whereon the example given above appears thus :—

J. Jones	Prep. Gd.	3	
	Planting	2	
	B.U. ..	½	
			—5½
B. Smith	Prep. Gd. ..	3	
	Fencing Upk.. .	3	
			—6
W. Harris	Prep. Gd.	3	
	Planting	2	
	B.U. ..	1	
			—6

Observe that this, besides involving extra pen work in writing the names of cultural operations repeatedly against each man's name, renders the process of ascertaining the labour cost of each job considerably more difficult ; to go through several summary time-sheets picking out odd days here and there for each operation is tiresome, and prolific of errors.

By far the best method of ascertaining wages earned and labour costs is to do the work on the time-book itself.

For individual earnings, cast the eye up each column which is headed by a man's name. At a glance you see the number of days worked. Show the earnings at the foot of the column after this fashion :—

5½ @ 5/4 = £1 9*s.* 4*d.*

For labour costs, count the number of days opposite each cultural operation. If all the eight men on the page are paid at the same daily rate, the calculation of the labour cost (in respect of the group of 8 men) is simple ; and an entry can be made in the "Remarks" column (at the extreme right hand of the book) thus :—

33½ @ 5/4 = £8 18*s.* 8*d.*

If, however, the men are paid at varying rates, the entry is, perhaps, a little more complicated, thus :—

	£	*s.*	*d.*	
6 @ 5/8	1	14	0	
12 @ 5/4	3	4	0	
15½ @ 4/2	3	4	7	
				£8 2 7

The average gang employed upon a major operation is, say, 12 men, so that there may be entries on a second opening of the time-book. If these are dealt with in the same way, the total labour cost for each job is readily obtained by adding together the appropriate figures appearing in the "Remarks" columns of the two pages. The result may be transcribed direct to the weekly progress report, whilst the entries at the foot of each column may be put direct on to the pay-sheets.

The reader who has followed thus far will say : "What, then, is the use of the summary time-sheets ?" The answer is : None, except to convey to Divisional Office the details from which wages and costs are obtained.

Further, the system may be criticised on the grounds that the pages and spaces in the time-book are too small, and that the books themselves, after having been carried in a ganger's pocket in all weathers, for weeks, are too dog-eared and dirty to work on.

To meet all these points, it is suggested that loose sheets be provided in future, instead of time-books ; the sheets to be slightly deeper, and wide enough to contain at least 12 name-columns, with a good wide column at the right-hand side for labour cost entries. Two or three of these sheets would be handed out to gangers (who would be provided with a cardboard case to keep them in) at each pay day, and handed in by them at the end of the pay period. The ganger would record only the names of the men (inserting against each his daily rate, thus :—J. Jones—6*s.* 2*d.*, names of operations and time worked. The forester would "extend" this information at the foot of columns, and on the right-hand side, as explained above. The completed sheets would be sent (instead of summary time-sheets) to Divisional Office : where they would greatly facilitate the work of checking earnings and labour costs.

The writer hopes that this suggestion will be adopted. By a practical test he has found that it reduces actual writing on the forester's part by over 50 per cent. But even if it is not adopted, the present time-books may be used, with a little care, to work the system, and thus save a good deal of time.

Notes.—(*a*) When wages are paid fortnightly, it is merely necessary to insert the record of a man's attendances for the second week immediately beneath the entries for the first week; and proceed as before, using two horizontal lines in respect of each operation.

(*b*) A day on piece-work would be denoted by P. instead of 1. The quantity of work, rate per unit and resultant earnings would be shown at the foot of the name column in the same manner as for day-work.

[ED.—It has been decided to put the above proposals into practice in two or three forests with a view to their general adoption later.]

THE WORK OF AN OFFICER IN CHARGE OF A DISTRICT.

By L. A. Newton.

In an earlier number of the Commission's *Journal* it was the privilege of the present writer to print a short essay on the work of the forester in charge of a forest area. He is only following a logical sequence if he now tries to delineate and comment on the responsibilities of the grade next above the forester, *i.e.*, the District Officer.

Unlike a well-known soldier who, when a Major, wrote an essay on the duties of a Brigadier presumably, though not expressedly, for the guidance of that rank, the present writer does not propose to pursue his series any higher.

The District Officer is in a privileged position, somewhat similar to that of a Company Commander in the Army, in this respect that his is the senior grade that comes into anything like direct contact with the men who are carrying out the actual operations. To use a mixed metaphor, he is the buffer state between the instructions issuing from High Policy on the one hand, and urging for improved conditions on the other. The sympathetic chain which should exist between highest and lowest to sweep on the afforestation movement will be rendered worse than useless if the centre link be weak. It is for him to secure that the two ends of the chain are in connection with one another. This is no light duty in an age when sympathy is sometimes difficult, and misunderstanding always fatally easy.

In addition to his responsibility for the smooth working of the staff the District Officer has very heavy technical responsibilities. In fact, it is not too much to say that he is responsible to a greater or less degree for every plant that is raised, and the method of its raising, every acre that is planted, and the method of its planting, every drain that is dug, and every fence that is erected. The great majority of the records that are kept are his, or under his supervision. It is his duty to delimit areas and prepare the necessary maps, make plans for the future, record the past and keep the present ever active.

Nor with these technical duties is his work more than half done. In 75 per cent. of cases it falls on him to visit and smooth down indignant neighbours and investigate the complaints of tenants. He ought to make it his business—it is also his pleasure—to meet the local landowners and agents and others interested in the afforestation movement. Cases are not unknown where acquaintance with a landlord has led directly to an acquisition.

Where produce has to be sold—and in a few years' time this will be in every district—a most important part of the District Officer's work lies in his relations with the timber merchants, a race of men not entirely without business acumen. In addition to the disposal of regular lines, on the District Officer will fall the finding of a market for his minor produce. He can only do this by getting about the country and seeing people. The current number of the *Quarterly Journal of Forestry* has an article on the disposal of conifer thinnings. A District Officer, with the time to do it, should not find the building up of such an industry an insuperable difficulty.

In a few years' time—if not already—the running of a district will prove to be a highly intensive business. It is an interesting speculation for the future as to how the business will be developed. A policy of de-centralization may perhaps be evolved with a central bureau for guidance, information and control. The department responsible for forestry, whatever be its nature in the future, will be inevitably a large trading department. If it is to escape the losses which are always associated with government trading, it will be due in good part to a modified monopoly, but also to the business training which it will be incumbent on the District Officer of the future to possess.

To come back once more to the present, the average area in which a District Officer may be asked to travel can easily amount to three or four thousand square miles. He will be responsible for the administration of grants within that area, the survey of areas for acquisition, and the giving of advice when called for. Facilities for transport in districts not very accessible are therefore of the greatest importance.

If this short description of a District Officer's duties should seem to some readers somewhat grandiose, it must be remembered that it is an effort by a District Officer to realise his own responsibilities and certainly not to belittle them. If he can persuade other grades, above and below, of the sincerity of his convictions, his aim is achieved.

CURRENT LITERATURE: REVIEWS AND ABSTRACTS.

PLANT LIFE ON EAST ANGLIAN HEATHS.

By E. Pickworth Farrow, M.A., D.Sc.

(Cambridge University Press, 1925.)

This book gives an account of ecological studies and experiments carried out mainly on Cavenham Heath in the south portion of Breckland, and the area to which particular attention was paid may be taken as being typical of nearly the whole of the Breck District.

The region is separated into several more or less distinct vegetation types of which the five important ones are (*a*) associations dominated by *Calluna vulgaris*, (*b*) grass-heath associations, (*c*) associations dominated by *Carex arenaria*, (*d*) *Pteris aquitina* associations, and (*e*) the valley fen-wood associations.

It is demonstrated that the distribution of the first four vegetation units is regulated almost entirely, if not absolutely, by the local variations in the rabbit population, and that general soil conditions or the proportion of lime in the surface soil have very little to do with the local plant associations.

Typical *Calluna* heath, under the influence of intense rabbit attack, rapidly degenerates into the close-cropped grass-heath type. The extermination of *Calluna*, however, enables the less tasty *Carex* to become colonised, and many of the large areas of *Carex arenaria* in Breckland were probably in comparatively recent times typical *Calluna* heaths which have completely degenerated owing to rabbit attack. Though rabbits will attack *Carex* they apparently only do so under conditions of necessity, while *Calluna* is eaten much more readily; thus where *Carex* and *Calluna* are competing against one another, the rabbits confer a relative advantage on the former, even though attacking it very severely.

Pteris (bracken) is another plant which rabbits will only eat when other food becomes scarce, and degeneration of *Pteris* zones through rabbit attack takes place only exceptionally and when the rabbit-pressure is very intense. Where bracken is competing with *Calluna* the former is seldom eaten by rabbits, but the ling is heavily attacked and as the bracken frontage advances (by rhizone growth) the rabbit burrows become engulfed by the bracken zone and thus perpetually more and more rabbits have to travel through the bracken to reach the *Calluna* frontage for food. The result is that the *Calluna* may be eaten down more rapidly than the *Pteris* can advance, and it commonly occurs that a belt of short grass-heath is formed between the degenerating *Calluna* and the advancing *Pteris*.

In a similar though less marked fashion *Pteris* is able to advance over a *Carex* zone.

The different intensities of rabbit-pressure at varying distances from the burrows or warrens produces a characteristic zonation of the vegetation around the burrows on the otherwise uniform sandy plains of the Breckland. A small intensity of rabbit attack is sufficient to kill off seedling trees which would normally be present in some places but allows *Calluna* to become dominant ; a somewhat greater intensity kills off *Calluna* and allows *Carex arenaria* to colonise the area ; a still greater intensity kills off *Carex* and allows the dwarf grass-heath association to dominate the area.

G. B. Ryle

ZEITSCHRIFT FÜR FORST UND JAGDWESEN, FEBRUARY, 1925.

The Afforestability of Peat Bogs in Germany and Sweden.

By G. Springer.

The writer discusses the causes of peat formation in general and also the results of many of the experiments on peat afforestation in Sweden and the universal failure of such attempts as have been made hitherto in Germany. The description of peat formation follows the generally accepted theories and need not be mentioned in this review, but the contrast between the results of experiments in Sweden and Germany is interesting.

The writer had recently visited the North of Sweden and found some most successful examples of peat reclamation.

The method consists solely in intensive drainage of bogs, the depth of peat in which ranges from 6 to 12 feet. The essence of the operation is that the drains should be deep enough to grain the whole of the peat. Owing to the scarcity of labour, subsequent operations are left to Nature. The first species to colonise the drained peat are aspen and birch ; these are followed slowly but surely by pine and spruce which ultimately stock sparsely the whole area. The drains are maintained until the young trees are 5 to 6 feet high and then allowed to fall in and disappear ; the needles and leaves falling down from the trees decay completely year by year and there is no trace of a fresh accumulation or raw humus or peat due to the needle fall. The presence of birch and aspen is, however, essential to the process. Pure pine and spruce woods lead to the formation of raw humus and the ultimate decay of the woods.

The writer finds the main explanation for this success in the nature of the Swedish peat and of the underlying rock. The Swedish peats are very dense and compact, and rest on granitic and other igneous rocks which, up to within comparatively recent times, were covered by ice and so protected from the leaching action of the weather. The water percolating through these rocks is rich in bases, and it is probable that the peat itself has a higher mineral content than in corresponding peat areas in Germany.

The German peat bogs, on the other hand, for the most part overlie deep layers of glacial deposits which have been subjected to a process of leaching over very long periods and are thus very deficient in flocculating bases. The peat has accumulated more quickly than in Sweden and is much spongier and less consolidated, so even if the early difficulties of establishment are overcome storms quickly thin out the plantation and the result is a failure.

The only successes obtained in Germany have been in areas where the peat is shallow and the tree roots have been able to get down to the mineral soil below.

Springer states that when a Swedish peat bog is drained, the water flowing from it is clear and not deeply coloured with iron as in the German bogs, indicating that there are sufficient bases present in the Swedish water to precipitate the peat colloids.

After thorough drainage the Swedish peat appears quickly to lose its acid character and to become suitable for tree-growth, while the very slowly formed peat itself is so well consolidated that it gives good root hold and there is no trouble from windfall after the trees are established.

The deep drainage which is such a vital factor in the success of the Swedish work has been found to be impracticable in Germany. The cause lies in the difference between the two climates. In the north of Sweden the low rainfall is more than offset by low temperature and high air humidity and there is no danger from drought at any time of the year, while in more southerly latitudes, although the rainfall may be higher, the mean temperature is also much higher and spring or summer droughts are not uncommon. The result of deep drainage under these conditions is the complete drying-out of the upper layers of the peat during a dry spell, resulting in the death of the plantations. The drains, therefore, can only go part way down into the peat, leaving a layer of saturated sterile peat under the drained peat. When the tree roots reach this layer growth is checked and the plantation fails.

The writer stresses three points, namely :—

(1) The drainage must be deep, extending downward to the mineral soil. The effect of such drainage is to establish the capillary rise of water from the subsoil through the peat, and as this water is rich in mineral salts, the colloids are precipitated and the nature of the peat transformed.

(2) After drainage the peat must lie for some years until the upper layers are converted into mild humus before the growth can become established.

(3) There must be a mixture of broad-leaved trees with the conifers if the work is to be ultimately successful.

Springer's final conclusion is that the afforestation of peat bogs is largely a factor of soil and climate. In some of the mountain areas of Germany, such as the Harz, peat reclamation is essential and can be carried out if the development of mountain meadows sparsely stocked with trees is not disdained. The peat bogs of the north-west German plain are too valuable economically for such treatment, and Springer recommends the Dutch method of removing the peat entirely—for use as fuel and cultivating the bog-sole for agricultural crops.

W. H. GUILLEBAUD.

ZITSCHRIFTFÜR FORST UND JAGDWESEN, MARCH, 1925.

THE SILVICULTURAL VALUE OF DUNE SANDS.

By DR. ALBERT.

Dr. Albert has extended his previous investigations into the soils of the Lieberoser Forst (reviewed in the last number of the Commission's *Journal*) by a similar investigation into the physical properties of the dune sands in North Germany. These sands date from the receding of the last Ice Age; they cover extensive areas in North Germany and are largely under forest. Their chief characteristics are their great depth and general uniformity in texture, at least as far as eye can tell, but this uniformity does not prevent the quality of the tree-growth from varying very greatly in different parts of the same forest. These soils can carry first quality mixed stands of Scots pine and beech as well as fifth quality " cripple " woods of Scots pine.

In the past, the variation in rate of growth has often been ascribed to faulty silvicultural treatment, but Dr. Albert shows that this is by no means always the case. Atterberg's soil classification has again proved its great value as a means of assessing the quality of these deep coarse sands. It will be remembered that this divides the soil particles into two classes, namely :—

(1) Particles of 0·2 mm. and over, and
(2) Particles smaller than 0·2 mm.

Class 1 represents the non-water retaining portion of the soil and Class 2 the retentive portion.

Albert has analysed many of the dune sands in the forests of Eberswalde and Biesenthal and has found that the proportion which Class 2 bears to Class 1 very largely determines the quality of the tree-growth. He finds that these soils can be divided into five classes according to the physical composition of the soil and the corresponding vegetation and tree-growth.

(1) Soils with less than 10 per cent. of Class 2 particles.

Up to the present found only on a large scale in the Lieberoser Forst.

Vegetation wholly absent. Soil incapable of carrying a full tree crop.

(2) Soils with about 10 per cent. of Class 2 particles.

Capable only of carrying Scots pine of Classes 4 and 5. *Cladonia rangiferina* is the dominant vegetation with occasional dwarf clumps of ling and cowberry (*V. vitis idæa*). Birch occurs sporadically : coppiced beech and oak will survive for many years, but remain dwarfed and scrubby.

(3) Soils with about 20 per cent. of Class 2 particles.

Carry middle quality Scots pine in which beech is able to survive as an under story.

Vegetation- Light green mosses such as *Hypnum Schreberi* are characteristic : *Aira flexuosa* and poorly developed clumps of bilberry also occur.

(4) Sands with about 30 per cent. of Class 2 particles.

Scots pine and beech, about equal in rate of growth.

Vegetation under pure conifer, strong growth of bilberry or *Aira flexuosa* with patches of *Calamagrostis* and *Pteridium aquifolium*; under mixed woods, Wood Sorrel with patches of *Luzula pilosa, Poa nemoralis* and Melica nutans.

(5) Soils with 40 per cent. and over of Class 2 particles.

First to second quality Scots pine soils. Oak and beech about equal in rate of growth.

These classes are, of course, not absolute, and it should be possible with correct silvicultural treatment to improve to some extent the production on soils belonging to Classes 2 and 3. Equally, by bad treatment, such as clear felling on a large scale, or the growing of pure coniferous stands, the production on soils of Classes 4 and 5 can all too easily be reduced to the lowest level. In general, however, it is useless to expect first or second quality growth from soils containing only 10 to 20 per cent. of the finer soil particles.

It should be observed that the investigation deals only with sands of such depth that the underlying rocks *in situ* can play no appreciable part in the growth of trees or other vegetation on the surface, and where the water table is below the reach of the tree roots.

The writer's final conclusion is that the soil flora affords a useful and quite definite guide to the quality of these deep sands.

W. H. GUILLEBAUD.

ZEITSCHRIFT FÜR FORST UND JAGDWESEN, JULY, 1925.

EFFECT OF DEPTH OF COVERING UPON THE GERMINATION AND EARLY DEVELOPMENT OF SCOTS PINE SEED.

By DR. ALFRED DENGLER.

This is an interesting account of an elaborate series of box experiments on the depth of covering Scots pine. Four depths of covering were employed 0·2 inch, 0·4 inch, 0·8 inch and 1·2 inches and the boxes received different treatment, viz. :—

Series 1. Kept warm and dry.
,, 2. ,, cool and moist.
,, 3. ,, cool and very moist.

Part of the seed was grown in and covered with a mixture of sand and humus, part in pure sand and part in a mixture of sand and loam.

The effect of depth of covering upon germination was very marked in all series. The typicalr esult was as follows :—0·2 inch, 80 per cent. ; 0·4 inch, 76 per cent. ; 0·8 inch, 20 per cent. ; 1·4 inches, 0 per cent.

A further experiment in which very hot and dry conditions were provided showed that the lightest covering under such conditions gave very much poorer results than the 0·4 inch covering. Investigations made into the seed which had not appeared above ground showed that the majority of these had actually germinated and then dried and the number still capable of germination was extremely small. Thus Dengler considers that in the case of a direct sowing which has failed there is very little to hope for in the form of a second germination the following year.

Other experiments showed tha when making direct sowings after the seed is sown and covered the soil should be gently pressed down with the foot to consolidate the soil and establish capillarity, but if this is done it is essential that the seed should not be covered to more than 0·4 inch. Firming the surface leads to quicker and also a higher germination. One of the effects of increasing depth of covering is to delay the germination.

A further investigation dealt with the losses occuring in the various series during the growing season. Losses were remarkably higher in the thick than in the thin coverings, *e.g.*, 0·2 inch, 1 per cent.; 0·4 inch, 7 per cent.; 0·8 inch, 36 per cent. One would have expected that in the more deeply covered series the most vigorous seed only would germinate and that these seedlings could stand better on the average than those in the other series, but this is not the case.

The above figures are for the series covered with pure sand, The losses in all the series covered with sand and humus were much higher, *e.g.*, 0·2 inch, 32 per cent.; 0·4 inch, 52 per cent.; 0·8 inch, 70 per cent. The deaths in these series were associated with a discolouration of the hypocotyl near ground level, the seedling falling over and then shrivelling up. A fungus, *Fusoma parasiticum*, was found to be the cause. *Fusoma* deaths were only occasionally observed in the other series (pure sand and sandy loam). In all depths of covering the total length of the hypocotyl remained about the same, viz., 1 inch; thus the length of the hypocotyl above ground depends upon the depth at which the seed was sown, so by measuring the average length of hypocotyl above ground the depth to which the seed was covered can be determined. It also follows that ¾ inch is about the critical depth for Scots pine, and any greater depth of covering will be fatal for germination (exceptionally vigorous seeds only will break through to the surface).

At the end of the growing season comparative measurements showed the great superiority in growth of the seedlings raised in the sand and humus mixture as compared with those raised in pure sand and sand and loam. The respective lengths of shoot above ground in a typical series were as follows:—Seed and humus, 2·5 inches; sand and loam, 1·7 inches; pure sand, 0·7 inch. It should be observed that the sand was collected from the subsoil and therefore had a very low content of mineral food, micro-organisms, etc.; the humus used was broad-leaved humus.

The writer goes on to criticise the various automatic sowing machines, such as the Planet Junior and various German makes, all of which tend to sow irregularly and cover too deeply. He considers that it would be much better to remove the covering appliances from the machines and use them merely for sowing, the covering being done by a man walking behind the driller.

Reviewer's note.—The above article has been reviewed at considerable length on account of its bearing upon the success of direct sowings. The points of greatest interest appear to be as follows :—

(1) The danger of sowing too deeply, which results not merely in a low initial germination, but also in heavy subsequent losses among the seedlings which do struggle to the surface.

(2) The importance of a fairly firm seed bed. If the soil has been loosened, it should be firmed with the foot before the seed is sown; the seed should then be covered to a depth of not more than ½ inch (not less on account of danger from drought, birds, etc.) and the soil again gently firmed with the foot.

(3) The large percentage of deaths occurring in the sand and humus boxes, and due, in part at least, to attack by *Fusoma parasiticum*, is of especial interest. This may explain why so much better results have been obtained on soil from which the humus has been destroyed by an intense fire (*e.g.*, Rendlesham, Wokingham, etc.), than on partially burnt or unburnt ground.

It has been the general experience in this country that direct sowings of Scots pine and Corsican pine will often show an excellent germination in the spring, followed by a steady die-off of the seedlings during the summer, causing losses which may convert an apparently successful sowing into an 80 to 90 per cent. failure.

The deaths are probably due to a combination of many factors, but the part which may be played by parasitic organisms in the humus appears to be worthy of investigation.

(4) The remarkably fine growth made by the seedlings grown in the mixture of sand and humus compensates to some extent for the casualties due to the *Fusoma*, and proves the value of humus as a manure for pine seedlings, once the initial dangers are past.

W. H. GUILLEBAUD.

ZEITSCHRIFT FÜR FORST UND JAGDWESEN, JANUARY, 1926.

SEED EXTRACTION.

This number contains an important article by Dr. Schmidt, of the seed extraction station at Eberswalde, on the influence of moisture on the extraction and germination of the seed of Scots pine. In the first place mention is made of the first effect of extraction at various temperatures when the cones are moist. Thus with moist cones extraction at a constant temperature of 145° Fahrenheit produced seed with a germination of 66 per cent. Extraction for five hours at 145° and then at 135° produced seed with a germination of 67 per cent., while with extraction at 120° Fahrenheit, the germination rose to 95 per cent. On the other hand, dry cones collected in March are far less susceptible to high temperatures. Extraction for three hours at 140° Fahrenheit, followed by a temperature of 135°, produced seed with 94 per cent. germination.

The correct method of extracting cones is to put the cones into kilns as soon as they arrive and to start the kilns at a low temperature, gradually raising it to the maximum (120° Fahrenheit). Storing the cones, especially if they have to be heaped up owing to lack of room, inevitably leads to loss in germination.

In the past it has been the practice to moisten the seed before it is put through a machine for cleaning off the wings. Moistening undoubtedly facilitates this operation very considerably, but is risky. The necessity for removing the seed wings is that the seed must be put through a winnowing machine to remove the cone scales and hollow seeds, and if the wings are left on the seeds many good seeds are blown off with the hollow seeds and scales.

Schmidt investigated this problem in the following way :—

In June, 1925, freshly extracted seed was cleaned both dry and wet (*i.e.*, without and with the previous application of moisture to the seed), the process being carried out by hand rubbing. The seed was promptly tested and the dry-cleaned seed found to have a germination of 94 per cent. and the wet-cleaned seed a germination of 94·7 per cent. Moistening the seed thus did not in any way impair the germination, which was, in fact, rather accelerated in the case of the wet-cleaned seed. Further examples of the seed were stored in three different types of receptacle. In each case wet-cleaned and dry-cleaned seed were stored.

(1) Seed stored in cigar box.
(2) Seed stored in half-filled carboys sealed with paraffin.

These carboys were opened from time to time for the removal of samples for testing, thus the air was to some extent renewed, and

(3) In carboys filled to the top with seed and sealed with paraffin.

The seed receptacles were stored from June until October of the same year and then the seed again tested. The results are shown in the following table :—

Method of Storage.	*Germination.* Per cent.
(1) Cigar box, Dry-cleaned.. ..	87·5
do. Wet-cleaned ..	89·5
(2) Half-filled Carboys, Dry-cleaned	93
do. Wet-cleaned	60
(3) Full carboys, Dry-cleaned ..	86
do. Wet-cleaned ..	nil (62 per cent. of sound seed at the end of 20 days).

This investigation shows conclusively the danger of storing in sealed carboys the seed which has been moistened in order to remove the seed wings. There is, however, this important reservation to make: provided the seed is promptly dried again after it has been cleaned and winnowed, there would appear to be little loss in the germination, although Schmidt's article does not contain any figures to support his statement to this effect. The point is that it seems to be quite possible to clean the seed dry, and, in fact, the moistening process has been given up in most of the leading seed extraction stations in Germany. Schmidt points out that when working on a large scale it is difficult to ensure the proper drying again of large quantities of seed.

With regard to the machine employed for cleaning the seed, Schmidt quotes figures to prove that hand cleaning is by no means a satisfactory process. It is very slow and also incomplete. Schmidt has devised a machine which consists of an ordinary corn cleaning machine modified by the use of revolving brushes in place of the wooden flails provided in the standard machine. The machine has to be driven by a 3-horse power motor, as the brushes must make approaching 600 revolutions per minute. The machine is made by the firm of Neuhaus, of Eberswalde, and costs 180 marks.

At Alice Holt the wet process is employed. The seed is well moistened and the wings removed by rubbing between the hands—incidentally one of the men employed at Alice Holt recently got a scale into his hand and poisened it rather badly. After the seed has been cleaned in this way, it is allowed to dry slightly and then put through the winnowing machine driven by hand. The seed requires to be put through as many as five or six times, and even then it is certain that a considerable number of good seeds are lost.

After passing through the winnower the seed is bagged and placed in a kiln in which a very small fire is kept. This dries the seed more or less effectively, but, in view of Schmidt's work, it is questionable how far it is likely to be satisfactory in the case of seed extracted for the purpose of storage for another year. There has been plenty of work on the Continent to show that if seed has to be held over for one or more years by far the best method of storage is in sealed glass carboys; the essential proviso, however, is that the seed should be dry before it goes into the carboy, and the simplest way of ensuring this would seem to be the use of a machine which would clean the seed wings from the seed without requiring the previous application of moisture.

I should add that the process of rubbing off the wings by hand is a very lengthy one when a large quantity of seed has to be dealt with (five men are employed almost continuously on this work at Farnham), and the introduction of a machine would lead to a considerable economy in labour and also probably a higher output of good seed per bushel, apart altogether from the important question of maintaining the vitality of the seed, when stored.

W. H. Guillebaud.

CENTRALBLATT FÜR DAS GESAMTE FORSTWESEN.

Limestone Ash and Water Ash.

Review by Cieslar of an article by Dr. Münch and Dr. Dietrich which appeared in " Silva."

Ash is a tree of very wide range occurring typically at low elevations on the banks of streams and on alluvial soils, etc., but also in mountainous districts such as the Carpathians, where it grows up to 4,000 feet above sea level. It is found on limestone rocks, granite soils and moist sands. Münch and Dietrich distinguish two types or races, the one a lowland race found on the alluvial soils to which the name of Water Ash is given, and the other a tree of the mountains, named the Limestone Ash, and found largely on calcareous soils, but also, as Cieslar points out, on soils which are very deficient in lime.

Münch and Dietrich investigated the early growth of plants raised from seed of these two races. The seed was sown at Tharandt, in Saxony, and at Lichtenstein, in Würtemberg, and the seedlings were lined out at the end of one year. At first both types made good growth, but after a few months a drought set in and the Water Ash began noticeably to fail. At the end of the first growing season 100 plants of each race were lifted and examined. It was found that while the Limestone Ash had formed a well-developed, spreading and fibrous root system, the Water Ash plants were very poorly rooted. As far as the aerial portions of the plants were concerned, the Water Ash were much smaller but more uniform in growth.

In order to determine whether shortage of water was the determining factor, some of the Water Ash plants were watered daily. The watered plants made better growth than the unwatered, being heavier and better developed, but were no longer in the stem and thus still far behind the Limestone Ash.

The conclusion arrived at is that the two types are distinct races, and that this difference in character may explain some of the failures which have been experienced in the planting of ash in the forest generally.

Detailed anatomical and morphological investigation revealed no difference between the plants of the two races with the single, perhaps significant, difference that some of the leaves of the Limestone Ash bore hairs on the midribs and main veins.

W. H. Guillebaud.

FORSTWISSENSCHAFTLICHES CENTRALBLATT.
1924, PARTS 1 AND 3.

Frost Damage in Forest Management: Its Causes and Control.

By Staudacher.

Various kinds of frost in the forestry sense are differentiated, namely, early, late, winter, local, etc. Apart from season, the effect of frost depends on degree of cold, quickness of thawing, the condition of the soil and surface vegetation.

Two groups of frost damage are defined. First, damage caused by wind in conjunction with low temperatures, and secondly, damage under windless conditions through radiation under a clear sky and loss of heat by evaporation. This group is divided into two categories: what is termed " grass frosts " and the " frost hole " type.

" Grass frosts " seldom extend above the level of the grass herbage. On grassy areas tree shoots are often repeatedly killed back until a frostless growing season enables growth to be made. Such grass areas are liable to decreases in temperature, as they have a large area exposed to evaporation. These " grass frosts " are not limited to depressions, but occur in the open and at high elevations. The danger increases with extent of grass area, luxuriance of the grass and degree of soil consolidation.

The " frost hole " type of frost is due to the flowing on of cold air into depressions under windless conditions. These frosts are generally local. These " frost holes " may be topographical or clear areas within a stand. The damage depends on the depth of the cold air current and intensity of cold.

Frost damage can be avoided by silvicultural means, for example: the substitution of narrow strips for clear felling and delay in felling adjoining strips until the young growth is beyond the height of frost damage; the keeping down of rank grass by cultivation and early re-afforestation; the growing of agricultural crops between the lines of trees; the use of frost-hardy nurses; the use of tree races which flush late in the spring; the improvement of " air drainage " by pruning a thinning; drainage of wet hollows. Frost holes should not be enlarged, but gradually afforested by frost-hardy species. Areas subject to frost may be made into separate compartments.

1924, PARTS 2 AND 4.

THE BEHAVIOUR OF PROGENY OF FOREIGN RACES OF SCOTS PINE IN THE SECOND GENERATION.

By MÜNCH.

During the last few decades pine seed of foreign origin has been imported into Germany to a considerable extent. On the whole the results given have been unsatisfactory. The seed from the south of France is particularly unsuitable. Its growth is slow and it is liable to *Lophodermium pinastri*, Honey fungus and dryness of wood. The Scandinavian types are slow growing. The Baltic type is fine branched, but is more slow growing in early youth than the native race. Alpine types are useless.

This investigation started in 1912. The cone forms of the different races are discussed and illustrated. The foreign types have more strongly, developed and recurved apophyses than the native race.

A treatment of Busse for opening cones is mentioned. When half open they are moistened until they are almost shut again. When dried again they open with a little heat.

The differences in races showed themselves soon after germination. The difference in size of seedling increased during the summer.

Average heights and weights of seedlings and increment in subsequent growth are given. The increment of the best race is twice that of the worst. The Belgian and Palatinate seed gave the best results.

The general conclusion is that the rate of growth, form and colour of needles, form of stem, cone type and susceptibility to disease are transmitted to the second and third generations. Seed of unsuitable races should not be employed in practice, and existing plantations of bad races should be exploited before they seed themselves naturally or cross fertilise other races.

1924, PARTS 3 AND 4.

The Determination of the Acidity in Forest Soils.

By G. Krauss.

The importance of actual acidity of forest soils in terms of Hydrogenion concentration in stated.

The technique of soil sampling in forest sites is important because of the variations both on surface and in profile. Depth of sample was found to have an influence on acidity. Under spruce acidity was greatest near the surface, while under beech acidity increased with depth up to 3·9 inches, from which point the acidity of the soil under the above species showed little difference.

In considering Olsen's demonstration that the plant indicator theory has a measurable basis in soil acidity, it should be remembered that the acidity in the layer of tree roots is not the same as that utilised by surface vegetation.

The conclusion is that soil acidity is only one of the factors to be considered in forest soils, and that its principal importance may be indirect through its influence on the soil biology.

1924, PARTS 5 AND 6.

Stand Density a Period of Production.

By Hermann Künanz.

This paper discusses in great detail the influence of "B" (moderate) and "C" (heavy) thinnings. The basis of the comparison, which is both technical and financial, is Schwappach's yield tables for spruce, pine and beech and Wimmenauer's for oak.

The conclusion is in favour of "C" thinnings begun early and repeated frequently. The total yield may be increased, but the other advantages are more important. The current and mean annual increments culminate later and increase in volume ; value and quantity are greater and fall off more slowly. The maximum soil rental is attained in longer rotations in the "C" grade than the "B" grade. In spruce the rotations are 60 and 80 years for "B" and "C" respectively ; in pine 60, and 90 ; in beech, 70 and 110; and in oak, 90 and 140 years.

On the basis of 3 per cent., rotations which coincide with suitable ages for natural regeneration are financially possible.

1924, PARTS 7 AND 8.

THE DETERMINATION OF THE GENERAL RATE OF INTEREST IN FORESTRY.

By E. GRIBKOWSKI.

This is an elaborate inquiry into the rate actually earned. The general conclusion is that 3 per cent. is justified irrespective of species and other factors.

1924, PART 8.

FLOWERING AND FRUCTIFICATION OF ARTIFICALLY INJURED PINES (PINUS SILVESTRIS L.).

By BUSSE.

This study was begun owing to the difficulty of the time factor in experimental plant breeding in forestry.

In the early summer of 1920 an 18-year-old plantation of pine was divided into plots as follows :—

Plot 1. The leaders of the current year were removed (by hand.).
,, 2. The new shoots on both leading and side branches were removed.
,, 3. The roots were cut in a radius of 19·7 inches from stem by a sharp spade.
,, 4. Both shoots and roots were removed as in Plots 2 and 3.
,, 5. Control, no treatment.

The details of flowering are given for 1921, 1922 and 1923. The percentage of trees flowering was 52 per cent. in Plot 1, 69 per cent. in Plot 2, 30 per cent. in Plot 3, 16 per cent. in Plo t4, and 22 per cent. in Plot 5. The treatment in Plot 2 has, therefore, been the most effective. Tests of seed quality have not been made.

1924, PART 9.

A GENERAL INDICATOR FOR THE DETERMINATION OF SOIL REACTIONS.

By H. NIKLAS AND A. HOCK.

1924, PART 11.

A NEW SIMPLE METHOD OF DETERMINING SOIL REACTION.

By H. NIKLAS.

1924, PART 12.

A SIMPLE METHOD OF DETERMINING THE PLANT FOOD REQUIREMENTS OF SOILS, ESPECIALLY DEFICIENCIES IN POTASH AND PHOSPHORIC ACID.

These papers are of use to those interested in soil chemistry.

1924, PARTS 11 AND 12.

THE FORMATION OF TREE BOLES.

By W. HOHENADL.

This paper discusses the influence of different factors which affect the formation of stems of trees. There are two main sets of factors, namely, physiological and mechanical.

At the beginning of the growing period the first necessity is for conducting tissue. When growth of the crown results, increased strength of the bole is necessary and this requires supporting tissues. The form of stems is in the main dictated by mechanical factors.

Changes in crown development, exposure to wind and formation of heartwood all influence stem form through mechanical factors.

In the same way changes in stem form due to age and locality conditions as explained.

H. M. STEVEN.

THARANDTER FORSTLICHES JAHRBUCH, 1925.

Gross writes an interesting article on the history of the well-known Tharandt Forest. His remarks on the lay-out of the rides are worth noting. In 1811 the only system which existed was one of radial rides chiefly designed for hunting. They were wide (nearly 70 feet) and partially covered with coppice. About that time Van Cotta reorganised the whole lay-out and his alterations remain practically intact to-day, demonstrating the permanency of a well-thought-out system.

Formerly it would appear that it was customary to raise spruce by direct sowing, and the writer points out that this did not produce successful plantations, as the stockings in early years were too heavy, and after thinning the trees developed very slowly. Furthermore, the heavy stocking led to the formation of raw humus, perhaps on account of excessive abstraction of moisture from the surface. Those who know the Tharandter Revier will remember that the Scots pine are of good form—tall, clean and with small crowns. These appear to be the characteristic of the local race of this species, and Gross remarks how very poorly the trees derived from foreign (French) seed develop in comparison.

Turning to the vexed question of the marked fall in the final yield in pure spruce woods in the lower part of Saxony, the writer gives it as his opinion that this is partly due to the modern custom of taking out a very much larger proportion of the yield in the form of thinnings. Without defending the cultivation of pure spruce outside its "Optimun," Gross takes a fairly optimistic view of the future with regard to his own forests, and recalls that many "stands" which thirty years ago were not promising have developed satisfactorily.

Lastly, this veteran forester sadly calls attention to the immense damage done to his spruce trees when it became necessary to tap them for resin during the War. While pine was able to seal the bark cuts and resist decay, the spruce appeared practically in every case to have become infected with a stem rot, and now the first 6 to 10 feet of such trees is of little use beyond firewood.

It is interesting to learn from the account given by Krutzsch of the use of aerial photography in Saxony that the average height of stands can be obtained with sufficient practical accuracy. This information combined with a knowledge of the density of the crop also obtained by the same means, leads with a little practice to the possibility of obtaining a usefully accurate estimate of the timber volume.

Bernhard discusses the relationship between silviculture and forest management in a lengthy paper and comes to certain conclusions, one of which is interesting. There is at present a considerable difference of opinion in Prussia as how far an independent Forest Management Branch should control the individual forests. With no or little control a forester in charge may allow his own idiosyncrasies to carry him too far in any one direction, and as foresters are well known for their individuality of ideas in management, this may lead to danger. On the other hand, too great interference from the staff of another branch in the service who cannot be so well acquainted with local peculiarities may produce even less desirable results. Quite apart from personal animosities which may thus be engendered, serious technical errors in silviculture might readily arise through a lack of a thorough appreciation of local conditions. There can be no doubt, as Bernhard says, that the only satisfactory method of solving the difficulty is by a whole-hearted co-operation between the officer in charge and the Forest Management Branch. Due weight must be given to the views of the former, particularly on silvicultural matters, whilst the efforts of the latter to co-ordinate and regulate management should not be unduely subjugated.

A. D. HOPKINSON.

REVUE DES EAUX ET FORÊTS.
MAY, 1925.

NEY FORESTS OF THE CÉVENNES.

By A. FLAUGÈRE.

The work of restoring the degenerated forest lands in the Cévenne was taken in hand some 90 to 100 years ago and one of the most important problems at that time was the choice of species calculated to effect the purposes in view, *i.e.*, the rehabilitation of the forest soil and to supplement the carefully conserved natural growth by the introduction of suitable colonisers. Certain of the pines were selected as the most suitable species.

The soils dealt with are described as granitic and schistose, and the region generally as subject to long dry summers. Altitude varies from 1,500 to 3,600 feet. The excessive dryness of the soil tended to militate against the chances of success with Scots pine, and Maritime pine failed everywhere above the 1,300 feet contour, so that the use of these species proved usually productive only of disappointments. It appeared indicated, however, to the pioneers of the day that both soil and climate might be suited to Corsican pine, and several trials with this species, made between the 1,500 and 3,300 feet contours on particularly dry ground, were remarkably successful. Seed was afterwards sown in quantity, the result to-day being a forest of Corsican pine in many places pure.

Results from a number of forest stations are quoted, and show that wherever Corsican pine has been introduced within the past 95 years or so, it has everywhere attained dimensions superior to those of Scots pine with which it has, in places, been grown in mixture. Corsican pine has also proved itself markedly superior to others of the conifers—Austrian and Maritime pines and European larch—which have also been introduced, besides having straighter stems. The writer gives a comparative table showing the dimensional growth of Scots and Corsican pines in four forests in the Cévennes, and in all cases the comparison is in favour of the latter species.

Soils, aspect and elevations vary. The soils mentioned are chiefly granitic and schistose, but examples from siliceous and dolomitic (calcareous) areas are also referred to. The most favourable aspects are given as north and east. The optimum elevation for Corsican pine is from 1,950 to 2,600 feet. In addition to its marked superiority in development generally, Corsican pine has been found to be far less susceptible to snow break than Scots pine.

Regarding the quality and commercial value of the timber, it is argued that Corsican pine will grow to 31·5 inches in circumference at breast height, while Scots pine will only attain a circumference of 23·6 inches in a like period. It is at these periods of growth respectively that the formation of heart-wood is found to commence, and conceding that the sapwood of Corsican is inferior to that of Scots, the former has the advantage of growing longer and straighter stems as well as the larger girth.

The first *coupes* were put on the market in the autumn of 1924, none of the timber cut being older than 60 years. 77,693 cubic feet sold for 76,500 francs or more, over bark and standing (this price not including expenses, etc., amounting to 9 per cent.), and 30,300 cubic feet also offered under similar conditions were sold for 23,400 francs.

These receipts are considered to be highly satisfactory and to give indication of the undeniable success claimed for Corsican pine in these districts.

Notwithstanding the success achieved and the fa t that a life equal in length to that which characterises Corsican pine in its own habitat is foretold for the species in the Cévennes, this tree is regarded by the writer as being in the nature of a transitional measure which, while yielding an appreciable revenue, will also enable a badly degenerated forest soil to be built up again. It is considered that the ever-present danger of fire in these regions will ultimately render it very necessary to mix hardwood trees with the conifers and to restore a system of hardwood coppice (oak, chestnut and beech) with standards, associated as frequently as possible with stands of coniferous high forest, in which scheme the pines, having performed the functions for which they were introduced, will in due course give place, at any rate at the lower elevations, to the shade-bearing species suited to the improved conditions which are at present being brough about by the aid of Corsicant pine in these new forests of the Cévennes.

W. L. TAYLOR.

NOTES AND QUERIES.

Local Purchase of Stores.

Foresters favour local purchase of stores on three main gorunds, viz., quickness, getting exactly what is wanted, and maintenance of local goodwill. But these advantages are only obtained at a price. Rough records kept in Divisions 3 and 4 for the past two years indicate that for the commonly used tools the prices ruling locally are from 15 to 40 per cent. higher than prices of similar articles obtained through official channels. For fencing materials (wire,netting, staples, etc.) the disadvantage of local purchase varies from 30 to 70 per cent. For stationery local prices are anything from 50 per cent. to over 100 per cent. greater than official prices. The extra expenditure in individual cases is perhaps only a few shillings; but over a long period for the whole of the Department these small items represent a large amount.

Urgency is the excuse usually put forward, but this does not bear examination. At stocktaking at September 30th a forester should make a careful estimate of his requirements for the coming season so that the stores may be ordered in plenty of time through Headquarters. This procedure has been adopted in Divisions 3 and 4. Some foresters responded well, others sent a meagre list of requirements, and then later, when work was in full swing, sent urgent requests for authority to purchase certain stores locally on the ground that otherwise the work would be held up. Others grumble that the stores obtained through official channels are never suitable. Usually this is because they do not say exactly what they want. They order, say, "spades", and then wonder when they do not get a particular pattern they have in mind.

A little care and forethought is all that is required to obviate delay and save the Department considerable unnecessary expense.

C. R. C. Pink.

Reproduction of Old Woods.

There has been much discussion recently about the old woods of the New Forest, some of which are already in an advanced state of decay. Theories have at different times been put forward as to how these old woods may continue to retain their natural appearance.

Woods like these would, in many parts, regenerate without any assistance from man, but here, in the New Forest, Commoners have rights by which they are entitled to depasture their cattle and ponies in the open forest; the public also have access over these open parts. Therefore, natural regeneration cannot take place, and planting would be of no use while these rights exist and are observed.

It has been said that the trees in these woods will eventually die or be blown down and in their place will spring up a mass of scrub consisting of holly, hawthorn and birch. The floor in the majority of these woods is at present very clean of scrub; had scrub been present natural regeneration would have taken place. In one wood where there has been a mass of thick undergrowth of holly and hawthorn a good crop of young oak has come on. This undergrowth was then cut at about breast height when the young trees had become well established. The top and top of the undergrowth was left lying around to protect the young trees from the cattle.

As regards other woods, where there is no scrub, they would have to be enclosed and treated in such a way as to produce natural regeneration. Some good examples of this may be seen in certain parts of some of the plantations which have been re-enclosed and a fair crop of beech has appeared.

If some of the old woods in the New Forest are treated in this manner a little work will have to be done in the way of a preparatory cutting The dead and badly decayed trees will have to be felled and removed and a fence erected. Another point to be considered is the gathering of dead leaves during the autumn, as many of the small holders in and around the forest use them for litter. If this practice is till carried on a large number of the small seedlings will probably be pulled up.

F. H. Parker.

Marketing of Coppice Underwood.

In some parts of the country there still remains a good market for coppice underwood, if not for the standards. East Kent, in particular, cannot be included, for I was much surprised at the deplorable state of the local small timber and underwood market. In the case of the former, this must be admitted as mainly due to the large supplies already on the market, influenced by the inferior labour one now has to employ and the heavy cost of transport. Both of the latter items are applicable to the sale of underwood.

Of the classes of produce obtained from underwood, only for the poles from hurdle size upwards can a fair sale be found. This was not the case a few years ago, for the comparatively poor classes of underwood found a ready market. Consequently, all waste land here was utilised for the growing of coppice irrespective as to whether conditions were suitable or not. At that time good markets were assured for the following :—

(1) *Small hop poles* were in great demand; wire is now being used as a substitute.

(2) *Oven wood* is rarely sold to-day, and what little sale remains is rapidly diminishing owing to so many steam ovens being installed in bakeries.

(3) *Faggot wood* being rather cumbersome and of little value, transport is a great drawback to this market.

(4) *Flower sticks.*—Bamboo is now preferred.

(5) *Thatch rods.*—There is still a fair sale, but string is often used, being less expensive though not so satisfactory.

(6) *Stakes and binders.*—At one time the demand was greater than the supply, but the market is now gradually falling off. Wire fences cost much less to maintain than hedges. Admittedly, the demand for posts and spiles increases accordingly, yet it is not so advantageous to the underwood market.

It is fairly obvious that the class of underwood required to meet the present and future market must be good, with the lowest percentage of small as possible. So, as there is little demand for coppice-grown timber, I should suggest growing coppice without standards, for when both are grown together half of the underwood is small and inferior, consequently it helps to flood the portion of the market that is already rapidly on the decline.

A. E. JOHNSON.

HOW NATURE CHANGED THE SPECIES.

About 25 years ago a swamp of considerable size in North Devon contained a crop of pure alder of little value. On the outskirts grew several large ash trees the seeds from which blew across the swamp. Owing to the ash seed taking two seasons to germinate, only those that fell on the alder stumps remained sound, and all other seeds rotted owing to the wet nature of the land. The owner, noticing very healthy young ash trees coming from the centres of the alder clumps, had the latter cut and sold. Cutting back the alder coppice for a couple of years thus gave the ash a chance. The writer has been through this swamp with the owner, who gave him the very interesting history. It is very pleasing to see a crop of clean healthy ash springing from old alder stools a foot or two above the level of the ground, with a straggling crop of feeble alder below. The ash are now about 30 feet high and promise to be a valuable crop on land almost impossible to walk through in summer. Ash could certainly not have been grown if planted by man without a lot of draining at big expense.

T. BROWN.

HARMFUL AND USEFUL BIRDS.

This season (for the first time at Monaughty) very considerable damage is being done by Blackgame on newly planted Scots pine. It is suggested that the reason for this may be the fact that about 80 to 100 acres of ground were cleared last year of birch scrub just adjoining this year's plantation. Efforts to scare or kill the birds have proved of little avail and now treatment of the plants before planting is being tried, but it is too early yet to say whether such dressings with obnoxious material will have any effect.

This dressing applied to the Scots pine buds consisted of two parts tallow and one part Stockholm tar. This dressing was previously tried by Mr. Alexander Murray when forester at Merthly (see *Transactions R.S.A.S.*, Vol. XXVIII, 1914, part I, p. 117).

On Monaughty there are also considerable numbers of grouse, and I am personally suspicious of these birds as well as Blackgame after our experience at Teindland. In the past two seasons (P. 24 and P. 25) extensive damage was done to Scots pine by grouse, this being exactly similar to that done by Blackgame, *i.e.*, all the leading buds were eaten out. This season no damage has so far been done by grouse at Teindland.

In 1924 a grouse was shot amongst P. 24 plants and was found to contain 14 buds of Scots pine ; in the previous week another was found with 23. No other food was in either birds' crop. Very few sportsmen, and *no* gamekeeper, believes that this bird does the forest any damage, but experience has proved otherwise at Teindland. This damage by grouse may be exceptional, but it would be interesting to hear of the experience of others in this matter.

In the same season, however, we found rather an unexpected bird friend. A Curlew (*Numenius Arquata*) was shot on the hill and its crop was found to contain 14 Pine Weevils (*Hylobius*). I consider this bird should be protected.

J. McEwen.

The New Red Sandstone in Summer.

During the summer of 1925, in the course of erecting a fence, the writer was surprised to find that it was practically impossible to drive the posts into the ground in the normal way. The New Red Sandstone, which, in the earlier part of the year, proved to be quite loose and permeable, had formed into what might be termed a thick pan of from 9–15 inches, through which it was difficult even to get a spade, and then only small pieces could be chipped out at a time. This state was worse on grass than on bracken, and is due no doubt to the lack of organic matter in the soil, which would account for its inability to attract and condense moisture from the atmosphere, and at the same time retain its permeability.

T. E. Anderson.

Labourers' Huts.

On large areas or compartments, where a great amount of work is to be undertaken, I think it would be to the advantage if a small hut or shed was erected for the use of the workmen. In a great number of cases I have known it to rain hard when the men came to work, and keep on till after their dinner time ; the men are wet through and go home. About 2 o'clock it clears up for a fine afternoon and there are three hours of fine weather lost for perhaps 4 or 6 or more men ; this may occur many times through a year. A hut would save this loss of time, and could be used while men are working on adjoining areas. Tools, such as saws, axes, spades, hook lines, etc., could be stored in the hut, which could also be used by the paymaster when paying the men.

Taking it on the whole, a hut would be useful in many different ways.

Again, in my opinion, the workmen should be considered a little on this point, as the provision of a hut would tend to make them more considerate and contented during wet weather.

N. Spicer.

Californian Redwood (Sequoia Sempervirens).

Much is to be said for the use of this valuable tree in our plantations. I have seen a few food specimens in England used as ornamental trees. It thrives well on rough, gravel soils and its timber is one of the best in the world. In America it grows at the rate of 1 inch in diameter each year. It is almost immune from decay and ravages of insect pests, and it produces an excellent crop of second growth after the stumps are cut—commonly called coppicing in England. Another great advantage is that it is almost immune from destruction by fire. Redwood timber is of far better quality than that of Douglas fir, consequently it sells at a much higher figure for lumber.

A. Wensley.

CORRESPONDENCE.

FOREST HOLDINGS.

I should like to give my experience as a small-holder under the Commission. I was a farm labourer up to October, 1924; at that time a lot of the land in this district was taken over by the Commission. I decided to take a holding under them and with their help in finding me work in carting for them I hope to make a success of my venture. I have a large family of boys, and these have been employed by the Commission in connection with tree-planting when I have not wanted them for work on the holding. I may say that during my first year I have had my losses and gains, but on the whole it has been successful, and I really think that a man with the will to work will find the Forestry Commission's method of small-holdings the most likely one to give him that lift up the ladder he has been looking for.

H. BENNETT.

[Divisional Officer's note:—This man, with seven sons, holds, about 100 acres of land at Thetford. The land is very sandy and poor. Taking the month of January as an example, the sons earned £18 7*s*. 4*d*. during the period of four weeks and £7 0*s*. 6*d*. was paid to the father for hauling plants, timber and other materials for the Commission.]

The Forestry Commissioners are forming a number of small-holdings in the forest area of south-west Norfolk, and it is hoped these will encourage and enable a number of men to get established on the land, also to provide skilled workers for the forest when most needed.

The small-holder will work his land as far as possible during the summer, and in winter will assist with the planting and after-care of the trees.

The wages received by the small-holder for his work in the forest will be most useful, as he will earn this money in what would otherwise be a slack time.

As the soil in south-west Norfolk is light and some crops on it fail during a rainless period, probably the best line of action for small-holders will be to grow drought-resisting crops such as lucerne and mangolds; and to get some well-bred stock to feed these crops to. A small acreage of sugar beet well cultivated will be helpful.

The Ministry of Agriculture could help the new venture by the loan of a pedigree bull and boar, and by giving advice and help in establishing a co-operative system of grading and marketing the produce of the small-holder.

Lack of sufficient capital will hinder the small-holder, but by hard work and thrift he should be in a better position in a year or two.

When the Commissioners have satisfied themselves as to the character of the small-holder, it would help the latter if he were allowed to pay the rent once a year instead of quarterly as at present. He could then carry more stock.

The present writer is one of the new forest small-holders, and believes the new scheme to be a sound one which will be helpful to both parties.

R. QUADLING.

[Divisional Officer's note :—This forest worker, in company with three brothers, holds about 80 acres of land on the Methwold estate of Thetford Chase. They have ploughed this season 340 acres for planting, at a rate of 5*s*. per acre.]

As a forest worker at Olley's farm, Thetford, I must thank the Forestry Commission for what they have done during the year 1925 for helping me to get a living. They have given me the chance of carting wire netting, etc., the money for which was very handy for improving the state of my ground. I have always found them very ready to help me if I am in any difficulty.

G. F. WYATT.

LIST OF TECHNICAL STAFF.

Officers on Divisional, District and Analogous Scales.

Since the last issue of the *Journal* changes have occurred as follows:—

Headquarters.

Mr. J. Macdonald appointed District Officer (after probation).

England and Wales.

Mr. V. F. Leese retired from Deputy Surveyorship, New Forest.

Mr. L. S. Osmaston appointed (acting) Deputy Surveyor, New Forest.

Mr. D. W. Young appointed (acting) Deputy Surveyor, Dean Forest.

Mr. O. J. Sangar appointed (acting) Divisional Officer, Division 2.

Mr. L. A. Newton, District Officer, transferred from N. Division (Scotland) to Divisions 3 and 4.

Mr. L. E. MacIver, New Forest, regraded as a District Officer.

Mr. I. L. Simpson, District Officer, deceased 8.5.25 (Division 2).

Mr. E. Wynne Jones appointed Assistant to Acquisition Officer on probation (District Officer Grade).

Mr. G. B. Ryle appointed District Officer (after probation).

Mr. R. G. Broadwood transferred to Division 2; appointed District Officer (after probation).

Mr. J. H. Mackay appointed District Officer on probation, School Division.

Mr. D. C. D. Ryder appointed Forest Officer on probation, Divisions 3 and 4.

Mr. C. E. L. Fairchild appointed Forester Officer on probation, Division 5.

Scotland.

Mr. J. W. Mackay, District Officer, transferred from N.E. Division to N. Division (vice Mr. L. A. Newton).

Mr. J. K. Leven appointed Forest Officer on probation, N.E. Division.

Foresters.

A revised list is appended. Promotions since the last issue of the *Journal* are indicated by an asterisk :—

Name and Address.	*Grade.*	*Forest.*
	England and Wales.	
Division 1.		
*Anderson, J. T.; Forestry Commission Office, Bishopswood, Milford, Yorks.	II	Selby.
*Anderson, T. E.; Blooms Gorse Farm, Rufford, Notts.	I	Clipstone.
Argent, C. D.; Red Lodge Farm, Cockley Cley, Swaffham, Norfolk.	II	Swaffham.
*Cottenham, W.; c/o Mrs. Fox, Wood Newton, Peterborough.	II	Apethorpe, Westhay

Name and Address.	*Grade.*	*Forest.*
	England and Wales.	
Gulliver, H. ; Hazelborough Lodge, Syresham, Brackley, Northants.	—	Hazelborough, Brackley Hatch.
Jones, T. ; Piddington Lodge, Northampton.	—	Salcey.
*Meldrum, J. A. K. ; Jessamine Head Villas, Thornton Dale, Yorks.		Allerston.
Division 2.		
*Anderson, J. W. ; Alwyn Cottage, Tynycefn, Corwen, Merioneth.	II	Cynwyd.
Clark, J. S. ; Pool House, Pottal Pool, Penkridge, Stafford.	II	Cannock Chase.
Dyer, H. C. ; Linmere, Delamere, Northwich, Cheshire.	II	Delamere.
*Harrison, P. M. ; Castle View, Wigmore, Kingsland, Leominster.	I	Mortimer.
Price, A. ; Dolforgan Villa, Kerry, Newtown, Mont.	II	Kerry.
Shaw, J. L. ; Diosgydd Isaf, Bettws-y-Coed, Carnarvonshire.	II	Gwydyr.
Squires, C. V. ; Brookbatch, Acton, Bishops Castle, Shropshire.	II ..	Walcot.
*Williams, Jack ; 2, Cambrian Terrace, Dolgelley, Merioneth.	I	Vaughan.
Williams, John ; Dolavon, Llanrwst, Denbighshire.	I	Gwydyr.
Divisions 3 *and* 4.		
*Boddey, W. ; 3, Feeder Row, Cwmcarn, Cross Keys, Newport, Mon.	II	Llanover.
Brown, T. ; New Lodge, Chawleigh, Chumleigh, Devon.	I	Eggesford, Halwill.
*Butter, R. ; Underdown, Haldon, Exeter.	I	Haldon.
Edwards, J. ; Crown Lodge, Tintern, Chepstow, Mon.	I	Tintern, Chepstow.
Hollis, G. W. ; 100, Tan-y-Groes Street, Port Talbot, Glam.	II	Margam.
Jones, H. W. ; Gurllus Grove, Trelleck Road, Tintern, Chepstow, Mon.	II	Tintern.
Kennedy, D. ; c/o Powell, New Mills, Whitebrook, Monmouth.	II	Tintern.
*McDougall, J. ; The Cottage, Rheola, Resolven, S. Wales.	I	Rheola.
Walker, A. E. ; Crown Lodge, Oxenhall, Newent, Glos.	— ..	Dymock.

Name and Address.	*Grade.*	*Forest.*
England and Wales.		
Wallington, A. W.; Parish's Lodge, Over Stowey, Bridgwater, Somerset.	II	Quantocks.
*Wallington, H. J.; Targets Lodge, Cardingham, Bodmin.	II	Bodmin.
Williams, D. N.; Broadwood Farm, Dunster, Taunton, Somerset.	II	Exmoor.
Division 5.		
Butler, R.; Jewsley Cottage, High Street Green, Chiddingfold, Godalming.	II	Chiddingfold.
*Forgan, W.; The Centre, Eversley, Basingstoke.	I	Bramshill, Wokingham.
Hankins, C.; Tangham Farm, Capel St. Andrew, Woodbridge.	Head	Rendlesham.
*Johnson, A. E.; Park Villa, Stelling, Nr. Canterbury, Kent.	II	Lyminge.
*McGlashan, J.; The Nursery, Lynford, via Brandon, Suffolk.	II	Thetford Chase.
Nelmes, F.; Priors Heath, Goudhurst, Kent.	II	Bedgebury.
Simpson, A.; Forest Lodge, Alice Holt, Farnham, Surrey.	—	Alice Holt, Woolmer
School Division.		
Bewick, W. J.; Thrunton, Whittingham, Northumberland.	II	Rothbury.
Laney, H.; Rose Cottage, Thornthwaite, Keswick, Cumberland.	II	Thornthwaite.
New Forest Division.		
*Aston, O.; Signal House, Parkhurst, Newport, I. of W.	II	Parkhurst.
Aston, S.; Wood End Cottage, Nr. Wickham, Hants.	— ..	Bere.
Gulliver, Herbert; Wilverly Lodge, Nr. Sway, Lymington, Hants.	Keeper	New Forest.
Sims, S.; Ashley Lodge, Nr. Godshill, Salisbury.	Keeper	New Forest.
Smith, Edward; Denny Lodge, Beaulieu, Brockenhurst, Hants.	Keeper	New Forest.
Dean Forest Division.		
Smith, Frank; Worcester Lodge, Nr. Coleford, Glos.	Head	Dean Forest.
Watson, W.; Herbert Lodge, Nr. Cinderford, Glos.	Keeper	Dean Forest.

Name and Address.	*Grade.*	*Forest.*
Scotland.		
S.E. and W. Division.		
Anderson, R. T.; Glenbranter, Strachur, Argyll.	II	Glenbranter.
Cameron, H.; Crown House, Ford, Argyllshire.	II	Inverliever.
*Fraser, A. M.; Aros Mains, Salen, Mull, Argyll.	II	Salen.
*Graham, A.; Eshiels Cottage, Peebles.	II	Glentress.
*Kennedy, J. A. M.; 16, Station Road, Dalbeattie, Kirkcudbrightshire.	II	New Galloway, Aucheninnes, Screel Hill.
Macintyre, J. F.; 4, Doncaster Street, Newcastleton, Roxburghshire.	II	Newcastleton.
Paterson, S. H.; Red Lodge, Barcaldine, Argyll.	II	Barcaldine.
Reid, J. M.; c/o Cameron, Auchindarrock, Duror, Oban.	II	Glenduror.
Simpson, A. N.; Tulliallan Nursery, Kincardine, Fife.	II	Tulliallan Nursery.
Spraggan, D; Guithas Cottage, Ardgarten, Arrochar.	II	Ardgarten.
Watson, H.; Stranfearnan, Fearnan, Aberfeldy.	I	Drummond Hill.
N.E. Division.		
Lamb, J. A.; Seaton Nursery, Hayton Road, Woodside, Aberdeen.	II	Seaton Nursery.
*MacEwen, J.; Teindland Cottage, Orton, Morayshire.	Head	Teindland.
Mitchell, F. M.; c/o Kennedy, Kintessack by Forres, Morayshire.	II	Culbin.
*Robbie, J. D; c/o Miss Davidson, The Crook, Alves by Forres, Morayshire.	II ..	Monaughty.
*Shaw, R.; Fetterdale, Tayport, Fife.	I	Tentsmuir, Edensmuir.
Sinclair, W.; Craibstone Nursery, Bucksburn, Aberdeenshire.	I	Craibstone Nursery.
Northern Division.		
Anderson, W.; Pollock Glenfinnan, Inverness-shire.	I	Glenhurich.
Cameron, J.; Auchterawe, Fort Augustus, Inverness-shire.	Head	Inchnacardoch, Port Clair.
*Gunn, J.;	II ..	Inchnacardoch.

Name and Address.	*Grade.*	*Forest.*
	Scotland.	
MacAlpine, J. A.; Ratagan, Shiel by Kyle of Lcohalsh.	II	Ratagan.
McClymont, W.; Craig Cottage, Achnashellach, Ross-shire.	II	Achnashellach.
McEwan, J.; Portclair, Invermoriston, Inverness-shire.	II ..	Portclair.
*Macintosh, W.; Alltsigh Cottage, Invermoriston.	II	Craig-nan-Eun.
Mackay, K.; Slattardale House, Loch Maree, Achnasheen, Ross-shire.	II	Slattadale.
Mason, W.; South Laggan, Invergarry, Inverness-shire.	II	South Laggan.
*Murray, W.; Shore Street, Strome Ferry.	II	North and South Strome.
*Rose, A.;	II	Culloden.
Warren, A.; Beaufort School, Beauly, Inverness-shire.	I	Beaufort School.

REGISTER OF IDENTIFICATION NUMBERS.

Forest Year, 1925.

The order of arrangement is as follows :—

Serial number (preceded by the last two numbers of the forest year in which supplies were received) ; quantity ; species ; crop year ; origin ; vendor.

25/1 40 lbs. ; *Pinus Laricio* ; 1923 ; Corsica ; Vilmorin-Andrieux.

25/2 2 lbs. ; *Pinus ponderosa* ; 1923 ; Canada (Salmon River, British Columbia, altitude 2,100 feet) ; Canadian Government.

25/3 5 lbs. ; *Pinus ponderosa* ; 1923 ; Canada (Long Lake, British Columbia, altitude 2,100 feet) ; Canadian Government.

25/4 464 lbs. ; *Pinus Laricio ;* 1923 ; Corsica ; J. Grimaldi.

25/5 2,580 Lbs. ; *Picea sitchensis ;* 1921 ; Canada (Queen Charlotte Islands, British Columbia) ; Canadian Government.

25/6 400 lbs. ; *Pseudotsuga Douglasii* ; 1923 ; U.S.A. (Washington Coast) ; The Manning Seed Co.

25/7 30 lbs. ; *Pseudotsuga Douglasii* ; 1923 ; Canada (coastal region and Vancouver) ; Canadian Government.

25/8 643 lbs. ; *Larix europaea* ; 1924 ; Italy (Tyrol) ; A. Grunwald.

25/10 200 lbs. ; *Larix europaea* ; 1924 ; Austria (altitude 3,280 feet) ; J. Stainer.

25/11 100 lbs. ; *Picea excelsa* ; 1924 ; Austria (Waldviertler, altitude 984–1,312 feet) ; J. Stainer.

25/12 100 lbs. ; *Picea excelsa* ; 1924 ; Austria (Karawanken, altitude 328–1,312 feet) ; J. Stainer.

25/13 112 lbs. ; *Larix europaea* ; 1924 ; Austria (Northern Calcareous Alps, altituse 2,625–3,937 feet) ; Wallpach-Schwanenfeld.

25/14 112 lbs. ; *Larix europaea* ; 1924 ; Austria (Mica-slate and grison-slate, altitude 2,953–4,265 feet) ; Wallpach-Schwanenfeld.

25/15 504 lbs. ; *Picea excelsa* ; 1924 ; Austria (Alps, altitude 1,640–2,625 feet) ; Wallpach-Schwanenfeld.

25/16 360 lbs. ; *Picea sitchensis* ; 1924 ; Canada (Queen Charlotte Islands, British Columbia) ; Canadian Government.

25/17 2,642 lbs. ; *Larix europaea* ; 1924 ; Switzerland (Munstertal, altitude 4,265–4,593 feet) ; J. Roner.

25/18 721 lbs. ; *Picea excelsa* ; 1924 ; Switzerland (Vintschgau, altitude 2,625–3,117 feet) ; J. Roner.

25/19 10 lbs. ; *Pinus montana* var. *pumilio* ; 1924 ; Switzerland ; J. Roner.

25/20 448 lbs. ; *Pinus maritima* ; 1924 ; France (Landes) ; Vilmorin-Andrieux.

25/21 336 lbs. ; *Quercus rubra* ; 1924 ; origin unknown ; Vilmorin-Andrieux.

25/22 35 lbs. ; *Pinus insignis* ; 1924 ; origin unknown ; Vilmorin-Andrieux.

25/23 ½ lb. ; *Pinus strobus* ; 1924 ; Canada (Petawawa, Ontario) ; gift from Canadian Government.

25/24 1½1 lbs.; *Picea alba*; 1924; Canada (New Brunswick) gift from Canadian Government.

25/25 ½ lb.; *Pinus sylvestris*; 1924; France (Haguenau); M. A. Gambs.

25/26 225 lbs.; *Larix europaea*; 1924; Austria (Tyrol, altitude 1,969–2,625 feet); J. Jenewein.

25/27 1 lb.; *Pinus sylvestris*; 1924; Finland (Viborg, altitude 164–328 feet); gift from Finlands Industrikontor.

25/28 331 lbs.; *Larix europaea*; 1924; Silesia (Sudeten); A. Gebauer.

25/29 ½ oz.; *Eucalyptus hemilampra*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/30 ½ oz.; *Eucalyptus punctata*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/31 ½ oz.; *Eucalyptus radiatas*; 1923; Melbourne Botanic Garden; gift from Mr. F. B. Tucker.

25/32 ½ oz.; *Eucalyptus macrocarpa*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/33 ½ oz.; *Eucalyptus magacarpa*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/34 ½ oz.; *Eucalyptus longifolia*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/35 ½ oz.; *Eucalyptus saligna*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/36 ½ oz.; *Eucalyptus santalifolia (diversifolia)*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/37 ½ oz.; *Eucalyptus eximia*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/38 ½ oz.; *Eucalyptus sieberiana*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/39 ½ oz.; *Eucalyptus botryoides*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/40 ½ oz.; *Eucalyptus dealbata*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/41 ½ oz.; *Eucalyptus linearis*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/42 ½ oz.; *Eucalyptus lehmannii*; 1923; Melbourne Botanic Gardens; gift from Mr. F. B. Tucker.

25/43 ½ oz.; *Eucalyptus marginata*; 1923; West Australia; gift gift from Mr . F. B. Tucker.

25/44 ½ oz.; *Eucalyptus tereticornis*; 1923; India (Himalayas); from Mr. F. B. Tucker.

25/45 1,577 lbs.; *Larix europaea*; 1924; Switzerland (Vintschgau, altitude 3,281–3,937 feet); J. Roner.

25/46 32 lbs.; *Larix europaea*; 1924; Switzerland (Engadine); J. Roner.

25/47 10 ozs.; *Pinus Thunbergii*; 1924; Japan (Ibaraki); gift from Japanese Government.

25/48 9 ozs.; *Pinus Thunbergii* var. ; 1924; Japan (Kumamoto); gift from Japanese Government.

25/49 12 ozs.; *Pinus densiflora;* 1924; Japan (Kumamoto, Kyushu); gift from Japanese Government.

25/50 7 ozs.; *Pinus densiflora;* 1924; Japan (Ibaraki); gift from Japanese Government.

25/51 10 ozs.; *Pinus koraiensis;* 1924; Japan (Corea); gift from Japanese Government.

25/52 3 ozs.; *Abies sachalinensis;* 1924; Japan (Hokkaido); gift from Japanese Government.

25/53 3 ozs.; *Larix dahurica;* 1924; Japan (Sachalin); gift from Japanese Government.

25/54 1 oz.; *Larix dahurica* var. *Principes-Ruprechtii;* 1924; Japan (Hozan, Corea); gift from Japanese Government.

25/55 1 oz.; *Chamaecyparis obtusa;* 1924; Japan (Tochiki); gift from Japanese Government.

25/56 1 oz.; *Chamaecyparis picifera;* 1924; Japan (Kiso); gift from Japanese Government.

25/57 1 oz.; *Cryptomeria japonica;* 1924; Japan (Tochiki); gift from Japanese Government.

25/58 110 lbs.; *Larix europaea;* 1924; Gneiss and Granite (Near Swiss frontier); Silvaterra.

25/59 5 lbs.; *Pinus contorta* var. *Murrayana;* 1924; Canada (Mt. Ida, British Columbia, altitude 2,700–3,500 feet); gift from Canadian Government.

25/60 2 ozs.; *Pinus contorta* var. *Murrayana;* 1924; Canada (Canoe, British Columbia, altitude 1,600 feet); gift from Canadian Government.

25/61 4 ozs.; *Pinus contorte* var. *Murrayana*; 1924; Canada (Long Lake, British Columbia, altitude 4,200 feet); gift from Canadian Government.

25/62 560 lbs.; *Pinus sylvestris;* 1924; England (East); own collection, extracted Bentley.

25/63 33 lbs.; *Pinus montana* var. *uncinata;* 1924; origin unknown Vilmorin-Andrieux.

25/64 14 lbs.; *Alnuis incana;* 1924; Switzerland; J. Rafn.

25/65 2 lbs.; *Abies balsamea;* 1924; Canada (New Brunswick); Canadian Government.

25/66 2 lbs.; *Pinus resinosa;* 1924; Canada (New Brunswick); Canadian Government.

25/67 7 ozs.; *Pinus sylvestris* var. *rigensis;* 1924; Riga; gift from Riga Government.

25/68 ½ lb.; *Pinus sylvestris* var. *lapponica*; 1919–20; Alvsby revir.; gift from Swedish Government.

25/69 ½ lb.; *Pinus sulvestris* var. *lapponica;* 1925; Finland (Kittila, altitude 656 feet); gift from Finnish Government.

25/70 ½ lb. ; *Pinus sylvestris Uralensis;* 1924; Russia (Urals); gift from Russian Government.

25/71 138 bushels; *Quercus pedunculata* and *Quercus sessiliflora*; 1924; England (East); own collection.

25/72 50 lbs.; *Castanea vesca;* 1924; England (East); own collection.

25/73 2,617 lbs.; *Fagus sylvatica;* 1924; England (East); own collection.
25/74 8,968 lbs.; *Quercus pedunculatar;* 1924; England (East); own collection.
25/75 401 lbs.; *Fraxinus excelsior;* 1924; England (East); own collection.
25/76 5 bushels; *Larix europaea;* 1924; England (East); own collection.
25/77 3½ bushels; *Larix leptolepis*; 1924; England (East); own collection.
25/78 215 lbs.; *Acer Pseudoplatanus*; 1924; England (East); own collection.
25/79 30 lbs.; *Castanea sativa;* 1924; England)East); own collection.
25/80 109 lbs.; *Acer Pseudoplatanus;* 1924; England (West); own collection.
25/81 108 lbs.; *Fraxinus excelsior;* 1924; England (West); own collection.
25/82 15 lbs.; *Cupressus macrocarpa;* 1924; England (West); own collection.
25/83 40 lbs.; *Quercus pedunculata;* 1924; England (West); own collection.
25/84 86 lbs.; *Carpinus Betulus*; 1924; England (West); own collection.
25/85 95 lbs.; *Pinus sylvestris*; 1924; England (North); own collection.
25/86 25 lbs.; *Pinus Laricio;* crop year unknown; origin unknown; gift from F. J. Green.
25/87 2 lbs.; *Larix europaea;* crop year unknown,; Western Alps; gift from F. J. Green.
25/88 50,000 seedlings (2 years); *Pinus Laricio;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/89 50,000 seedlings (2 years); *Pseudotsuga Douglasii;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/90 25,000 seedlings (2 years); *Larix leptolepis;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/91 50,000 seedlings (1 year); *Larix europaea;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/92 4,000 transplants (2 + 1); *Pinus Laricio;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/93 15,000 transplants (2 + 2); *Pinus sylvestris;* crop year unkbown; origin unknown; J. O. Boving, Tring.
25/94 25,000 transplants (2+1; *Pseudotsuga Douglasii*; crop year unknown; origin unknown; J. O. Boving, Tring.
25/95 20,000 transplants 1 + 1); *Larix europaea*; crop year unknown; origin unknown; J. O. Boving, Tring.
25/96 7,000 transplants (2 + 2); *Larix europaea;* crop year unknown; origin unknown; J. O. Boving, Tring.
25/97 10,000 transplants (2 + 2); *Larix Leptolepis;* crop year unknown; origin unknown; J. O. Boving, Tring.

25/98 45,000 transplants (2 + 1); *Larix leptolepis*; crop year unknown; origin unknown; J. O. Boving, Tring.

25/99 134,000 seedlings (2 years); *Pinus Laricio;* crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/100 100,000 seedlings (2 years); *Pinus sylvestris*; crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/101 183,000 cuttings; *Populus serotina*; 1925; England (East); own collection.

25/102 74,000 seedlings (2 years); *Larix europaea;* crop year unknown; origin unknown; Sebire et Fils, France.

25/103 41,000 transplants (2 + 1); *Larix europaea;* crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/104 127,000 seedlings (2 years); *Pseudotsuga Douglasii*; crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/105 140,000 seedlings (3 years; *Pseudotsuga Douglasii;* crop year unknown; origin unknown; Landowners' Co-operative Forestry Ltd., Edinburgh.

25/106 324,000 seedlings (2 years'); *Picea sitchensis;* crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/107 87,000 seedlings (3 years); *Picea sitchensis;* crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/108 200,000 seedlings (2 years); *Pinus sylvestris*; crop year unknown; origin unknown; Landowners' Co-operative Forestry, Ltd., Edinburgh.

25/109 450,000 seedlings (2 years); *Picea sitchensis;* crop year unknown; origin unknown; English Forestry Association, Ltd. (Smith & Meldrum, Forfar).

25/110 71,000 seedlings (2 years); *Pseudotsuga Douglasii;* crop year unknown; origin unknown; English Forestry Association, Ltd. (Smith & Meldrum, Forfar).

25/111 183,000 seedlings (2 years); *Pseudotsuga Douglasii;* crop year unknown; origin unknown; English Forestry Association Nurseries, Tring.

25/112 200,000 seedings (2 years); *Pinus Laricio;* crop year unknown; origin unknown; English Forestry Association Nurseries, Tring.

25/113 9,000 transplants (1 + 2); *Fraxinus excelsior*; crop year unknown; origin unknown; Didlington Estate, Norfolk.

25/114 8,000 transplants (1+1); *Fraxinus excelsior*; crop year unknown; origin unknown; Didlington Estate, Norfolk.

25/115 1,00 transplants (1 + 1); *Quercus pedunculator;* crop year unknown; origin unknown; Didlington Estate, Norfolk.

25/116 200 seedlings (2 years); *Larix europaea*; crop year unknown; origin unknown; Sebire et Fils, France.

25/117 16,100 cuttings; *Populus nigra* var. *italica*; 1925; England (East); own collection.

25/118 30½ lbs.; *Larix europaea*; 1924; Scotland (East); own collection, extracted at Seaton and Tulliallan.

25/119 13½ lbs.; *Larix europaea;* 1923; Scotland (East); own collection, extracted at Seaton.

25/120 50 lbs.; *Larix eurolepis;* 1924; Scotland (East); Duke of Atholl.

25/121 5 lbs.; *Larix eurolepis*; 1924; Scotland) East); G. Ralston, Glamis.

25/122 2½ lbs.; *Larix leptolepis;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/123 1¾ lbs.; *Larix europaea;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/124 97 lbs.; *Abies nobilis*; 1924; Scotland (West); own collection, extracted at Tulliallan.

25/125 121 lbs.; *Abies nobilis;* 1924; Scotland (East); own collection, extracted at Tulliallan, and Beaufort.

25/126 4 lbs.; *Acer platanoides;* 1924; Scotland (East); own collection, extracted at Tullaillan and Beaufort.

25/127 4½ lbs. ; *Acer Pseudoplatanus;* 1924; Scotland (East); own collection, 3xtracted at ulliallan and Beaufort.

25/128 37 lbs.; *Acer Pseudoplatanus*; 1924; Scotland (West); own collection, extracted at Tulliallan.

25/129 1½ lbs.; *Cupressus Lawsoniana*; 1924; Scotland (West); own collection, extracted at Tulliallan.

25/130 4½ lbs.; *Cupressus Lawsoniana;* 1924; Scotland (East); Altyre Estate.

25/131 ½ lb.; *Cupressus nootratensis;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/132 17 lbs.; *Fraxinus excelsior;* 1924; Scotland (East); own collection, extracted at Tulliallan.

25/133 53 lbs.; *Fraxinus excelsior;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/134 3½ lbs.; *Pinus sylvestris*; 1924; Scotland (West); own collection, extracted at Tulliallan.

25/135 16 lbs.; *Pinus sylvestris*; 1924; Scotland (East); own collection, extracetd at Tulliallan and Seaton.

25/136 6 lbs.; *Picea excelsa;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/137 19 lbs.; *Picea excelsa*; 1924; Scotland (East); own collection, extracted at Tulliallan and Beaufort.

25/138 2½ lbs.; *Pseudotsuga Douglasii*; 1924; Scotland (East); own collection, extracted at Tulliallan.

25/139 43½ lbs.; *Pseudotsuga Douglasii*; 1924; Scotland (West); own collection, extracted at Tulliallan.

25/140 15½ lbs.; *Thuya gigantea;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/141 4½ lbs.; *Tsuga Albertiana;* 1924; Scotland (West); own collection, extracted at Tulliallan.

25/142 ¼ lb.; *Tsuga Albertiana;* 1924; Scotland (East); own collection, extracted at Tulliallan.
25/143 120 lbs.; *Fagus sylvatica;* 1924; Scotland (East); own collection, extracted at Tullaialln.
25/144 1 lb.; *Pinus Strobus,* 1294; origin unknown; B. Reid & Co., Aberdeen.
25/145 3½ lbs.; *Betula;* crop year unknown; Newfoundland; gift from Lord Glentanner.
25/146 172,300 seedlings (2 years); *Larix eurolepis;* 1922; Scotland (East); Duke of Atholl.
25/147 8,000 seedlings (3 years); *Larix leptolepis;* 1922; origin unknown; gift from H. G. Younger.
25/148 2,000 seedlings (2 years); *Larix leptolepis;* 1922; origin unknown; J. Jones & Son, Huntly.
25/149 4,600 transplants (2 + 1); *Larix leptolepis;* crop year unknown; origin unknown; Landowners' Co-operative Forestry Society, Edinburgh.
25/150 seedlings (2 years); *Larix europaea;* 1922; origin unknown; gift from H. G. Younger.
25/151 240,000 seedlings (1 year); *Larix europaea;* 1923; Scotland (East); J. Jones & Son, Huntly.
25/152 seedlings (2 years); *Larix europaea;* 1922; origin unknown; J. Jones and Son, Huntly.
25/153 88,000 seedlings (2 years); *Larix europaea;* 1922,; Scotland (East); J. Jones & Son, Huntly.
25/154 20,000 transplants (1 + 1); *Larix europaea;* crop year unknown; origin unknown; J. Jones & Son, Huntly.
25/155 1,200 seedlings (2 years); *Cupressus Lawsoniana;* 1922; origin unknown; gift from H. G. Younger.
25/156 3,600 seedlings (2 years); *Picea sitchensis;* 1922; origin unknown; gift from H. G. Younger.
25/157 12,000 seedlings (3 years); *Picea sitchensis;* 1922; origin unknown; gift from H. G. Younger.
25/158 20,000 seedlings (1 year); *Picea sitchensis;* 1923; origin unknown; J. Jones & Son, Huntly.
25/159 3,500 transplants (3 + 1); *Picea sitchensis;* crop year unknown; origin unknown; J. Jones & Son, Huntly.
25/160 600 seedlings (2 years); *Thuya gigantea;* 1922; origin unknown; gift from H. G. Younger.
25/161 14,000 seedlings (2 years); *Thuya gigantea;* crop year unknown; origin unknown; Landowners' Co-operative Forestry Society, Edinburgh.
25/162 7,000 seedlings (3 years); *Pseudotsuga Douglasii;* 1922; origin unknown; gift from H. G. Younger.
25/163 14,000 seedlings (1 year); *Pseudotsuga Douglasii;* 1923; origin unknown; J. Jones & Son, Huntly.
25/164 2,500 transplants (2 + 2); *Pseudotsuga Douglasii;* crop year unknown; origin unknown; J. Jones & Son, Huntly.
25/165 40,000 seedlings (2 years); *Pinus sylvestris;* 1922; Scotland (East); Innes Estate.

25/166 336,000 seedlings (1 year); *Pinus sylvestris*; 1923; Scotland (East); J. Jones & Son, Huntly.

25/167 117,C0 seedlings (2 years); *Pinus sylvestris*; 1922; Scotland (East); J. Jones & Son, Huntly.

25/168 150,500 transplants (2 + 1); *Pinus sylvestris*; crop year unknown; origin unknown; J. Jones & Son, Huntly.

25/169 120,000 transplants (2 + 1); *Pinus sylvestris*; crop year unknown; origin unknown; Smith & Meldrum, Forfar.

25/170 43,000 seedlings (2 years); *Picea excelsa*; 1922; Scotland (East); J. Jones & Son, Huntly.

25/171 40,000 transplants (3 + 1); *Picea excelsa*; crop year unknown; origin unknown; J. Jones & Son, Huntly.

25/172 9,200 transplants (2 + 1); *Fagus sylvatica*; crop year unknown; origin unknown; J. Jones & Son, Huntly.

25/173 7,500 transplants (2 + 1; *Abies pectinata*; crop year unknown; origin unknown; J. Jones & Son, Huntly.

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