JOURNAL

OF THE

FORESTRY COMMISSION.

No. 7 : APRIL, 1928.

Editing Committee :

R. L. ROBINSON,
H. A. PRITCHARD,
JOHN D. SUTHERLAND,
FRASER STORY.

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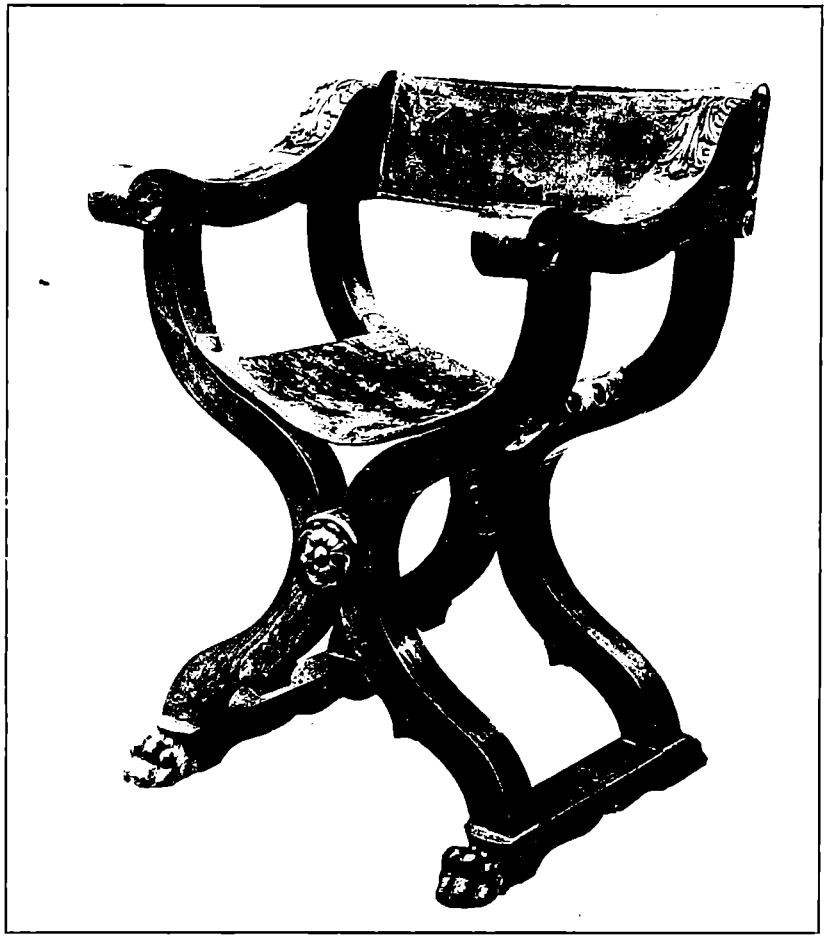

PRESENTATION TO LORD LOVAT ON HIS RESIGNING THE CHAIRMANSHIP, 1927.

JOURNAL

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EDITORIAL.

Presentation to Lord Lovat.

THE staff of the Forestry Commission decided to present to Lord Lovat some tangible token of their esteem and affection when he was appointed Parliamentary Under Secretary, Dominions Office, and Chairman of the Oversea Settlement Committee which, unfortunately, necessitated his resignation as Chairman of the Forestry Commission.

A Committee consisting of Messrs. Cameron of Inchnacardoch, Charters, Ditchburn and F. W. Hamilton was nominated to arrange the matter. Contributions were limited to a maximum of 1*s.* for every £100 of the contributor's annual cash salary, and all members of the staff from Foreman to Assistant Commissioner were eligible to subscribe. As was expected, the proposal met with unanimous approval, £32 6*s.* 3*d.* being collected.

Suggestions regarding the form the presentation should take were so varied that the Committee sought the confidential assistance of Lady Lovat. This resulted in an excellent solution of the difficulty as, on Lady Lovat's suggestion, a walnut cross-frame arm chair (Spanish—17th Century), which had been greatly admired by Lord Lovat, was brought from an antique dealer in Mount Street, London. The chair, a photograph of which appears in this issue, was delivered to Lord Lovat at his London residence on the 4th October last, together with an album containing the names of the 287 subscribers.

A small oxydised silver plate containing the following inscription was fixed to the outside of the left arm of the chair :—

> " Presented to the Rt. Hon. Lord Lovat, K.T., K.C.M.G., K.C.V.O., C.B., D.S.O., by the Staff of the Forestry Commission as a token of affection. March 1927."

The chair cost £30, the album 19*s.*, the printing of the names in the album 26*s.* 6*d.* and banking charges 9*d.*

The following extracts from correspondence have been circulated to the subscribers :—

Extract from letter from Lord Lovat to Mr. Herbert.

> " I have never been more pleased to receive a token of friendship than I have been by the gifts of the chair and album—both delightful. Will you thank everyone for me ?
>
> " I would like to get the addresses of the subscribers so that I can write letters to thank them one and all."

Extract from letter from Lord Lovat to Mr. Hamilton.

"I cannot say how touched I am by the Forestry Commission staff's gift and album. I shall always treasure both as a remembrance of our happy relations through some stirring times. Again very many thanks for the charming gifts."

Extract from letter from Mr. Herbert to Lord Lovat.

"Your proposal to write letters of thanks to everyone whose name appears in the album is very greatly appreciated, but the feeling is that no one would wish you to go to so much trouble. Your letter will however be circulated so that all will know of your kind intention."

The thanks of the Committee were duly conveyed to Lady Lovat for her kind assistance.

Forest Policy.

Forest policy for the decade 1929–39 has been under consideration during the last few months. There is reason to suppose that a programme of steady though not of spectacular development will be sanctioned.

Empire Forestry Conference, 1928.

Preparations are now well forward for the Conference, which opens in Perth, Western Australia, on September 1st. Great Britain will be represented by Lord Clinton, Messrs. Robinson, Pritchard, Oliphant (Forest Products Research Laboratory) and Professor Troup.

Collection of Home-Grown Seed.

Considerable difficulty is often experienced in obtaining supplies of seed or plants of the less common conifers and certain hardwoods for trial in this country and it is felt that opportunities are frequently lost of obtaining seed from trees growing in Britain. It is sometimes thought that a handful of cones is not worth collecting, but if every officer or forester would pick what cones, etc., he can when occasion offers, our requirements for many of these rarer trees could easily be met. Owners of trees on private estates or in ornamental grounds would often give permission for seed to be collected if they were approached.

The species which are of special interest include the following :—

Chamaecyparis nootkatensis	*Sequoia sempervirens*
Chamaecyparis Lawsoniana	*Cedrus atlantica*
Cupressus macrocarpa	*Abies grandis*
Libocedrus decurrens	*Abies nobilis*
Picea alba	*Tsuga Albertiana*
Cryptomeria japonica	*Robinia pseudacacia*
Sequoia gigantea	*Alnus incana.*

The importance of the seed being absolutely true to name will be realised. Collectors who have any doubt as to the reliability of the names should forward material to Headquarters for identification.

FOREST WORKERS' HOLDINGS.

By H. A. PRITCHARD.

The establishment of these holdings by the Commission has no doubt thrown a good deal of extra work on to the staffs at No. 1, Whitehall, and in the Divisions, but it is as well to realise that, with the erection of houses and buildings and the setting aside of the requisite area of land the problems are only in their initial stage, and, even if we succeed in letting all the holdings as soon as they are completed, our troubles are only beginning, and the bugbear of every land agent, *i.e.*, the general prosperity of each of the tenants, which means really their ability to pay their rents, keep their heads above water and their holdings in good cultivation, becomes an added burden to the Divisional Officer and his staff, since they are the nearest to the tenants. Year by year, in addition to new buildings, the question of repairs will crop up, and as the number of established holdings increase, so will the work and responsibility. It will be strange if we do not find, notwithstanding a careful selection of tenants, that we have made many mistakes, and we shall undoubtedly at the start have many disappointments, and for that reason it is as well to go slowly in the erection of the buildings on each holding in the early stages of development. Holding tenants should be encouraged to put up their own rough shelters of poles and wattled brushwood, which can usually be supplied from the forest, and are quite effective and not unsightly.

The trouble in this respect will be greater in these earlier days, as, once the holding has been established for some time, the type of building will not vary to any great extent, and the easiest time of all will come with the next generation, when it will be found that there is a tendency to return to the family holding by members of the family who may have taken up work in towns, and a very useful type they will prove to be, as they would usually have some capital.

I suppose our greatest difficulty will be in finding tenants with capital —at all events in the earlier stages—although where the holder has a large family all, even the youngest children, can by working in family groups in nursery and forest earn wages which should enable the accumulation of capital. So this difficulty need not be looked upon as insurmountable. In any case it will usually be desirable to keep the holdings as small as possible, say, 3–4 acres, but with further land available for their ultimate growth to 10 acres. Most men of the type who will be selected as holders will have had some experience in keeping pigs and poultry, but probably few will know much about the care of a cow or horse. Most of them have sufficient capital to buy a sow and some poultry, and possibly a goat. These breed up quickly, and with care a holder would in a comparatively short time be able to fully stock 3 to 4 acres or so with animals they know something about, and they will be gaining experience all the time.

In other cases, no doubt, it would be an advantage if some system for the provision of stock could be made possible. In the first instance, possibly the best way to assist would be to provide " in calf " heifers or

stocked sows, and where the scheme warrants it and the number of holders keeping stock is sufficiently large, then possibly the provision of a good type dairy bull or a good type of boar might be kept by the Commission for general use, or a tenant subsidised to enable him to do so. In the majority of cases the holding that appeals is, of course, the all-grass holding with a large garden, part of which can be devoted to a crop of mangolds or swedes for feeding to stock, and a fairly large area for potatoes. In the hill districts bracken will be the usual bedding, but in others, no doubt, a small area could, with advantage, be planted with a corn crop to provide straw, but very little would be required, and a forest worker could probably buy more cheaply than grow. What might, I think, be done with advantage is for the Commission to take over one of the derelict holdings in North or Mid Wales—there are any number of these in almost any of the forests—reconstruct the home and steading and re-erect the fences around the improved, *i.e.*, formerly enclosed land. This is in many cases either rapidly becoming a bog through lack of drainage or is over-run with dense bracken. These areas should be brought back into condition as quickly as possible by draining, liming and clearing the bracken, and the better area broken up and sown to a rape mixture with a corn crop. The whole of the area should be treated in this way and kept down for, say, 6 to 8 years. The land should be stocked to its fullest capacity and careful records kept of the food provided in the form of produce and stock sold. Good strains of poultry, goats, fowls and cattle should be kept and sittings of eggs, stock birds and stock animals should be available at cheap fees for holders. This would give the holders a better chance of success, and they would learn a lot from the demonstration area. I do not think there should be a great loss, if any, on such an area ; certainly any loss would be compensated for if it helped to ensure the success of the whole scheme.

I am convinced that the results would astonish even the most conservative of hill farmers, and I am satisfied that a better living could be obtained from a much smaller area, and this, together with the work provided, would soon enable a holder, with a family especially, to be sooner in a financially sound position. A successful experiment such as this would do more to popularise the work of the Commission and the holdings generally than almost anything else in the hill districts where sheep farming on a wide range is at present the common form of farming.

Of course, notwithstanding all our efforts, the success or otherwise of the scheme must depend upon the individual holder. I mention this to emphasise the necessity for the greatest care in selecting tenants.

It is quite common to be told the applicant wants no land, and so long as the rent of the holdings is not much, if any, higher than the rent of a cottage with the same accommodation there will be a tendency for holdings to be taken up without the holder having any serious intention to work or stock the land. Nothing will be more fatal than this if it is encouraged, and where it is seen that the land is not being properly dealt with the tenant should be made to give up the holding at the end of the first period of tenancy. Of course, where the maximum area is provided

the rent in most districts will be such as to discourage tenants of this description. These remarks will, I hope, show that the Commission by providing the holdings cannot ensure the success of the scheme. This will depend entirely on the care taken by the Divisional Officer and his staff in the selection of only suitable tenants, in the close observation of the use the land is put to and the methods adopted. Much can be done by assistance in opening up markets and by the encouragement of co-operation in working, buying and selling, but the essential of success will not rest with this, no matter how well done.

Another point that has occurred to me is whether we are taking full advantage of the agricultural organisers in the counties. It is usual for County Councils to provide experts in all branches of agriculture, horticulture and other subjects useful to the holders, and where a colony is formed the advice and assistance of these officials should be sought and, wherever possible, meetings should be arranged to be addressed by them and demonstrations given.

Where fruit trees are to be planted it is essential to get the best possible advice, and I strongly recommend the Divisional Officer or District Officer getting the Council's adviser on to the area for his advice on species and lay-out. I know that at times the work, with its infinite amount of detail and worry and the disappointments over tenants, added to the other exacting work of all the staff, must be a trial and an anxiety, but I think we all agree that it has its compensations. To me certainly it provides a welcome change from the purely silvicultural side of the work ; both are constructional, both are of undoubted value to the nation, and I gather most Divisional Officers find this ample compensation for the labour involved.

I have great hopes of seeing, at any rate in the Eastern Counties, and particularly in our own Welsh areas, every ruined holding with its bracken-invaded pastures and derelict arable fields once more inhabited and with thriving families remaining on the land, with ample work and means to satisfy all their reasonable requirements. A population, strong, sturdy and independent, with a love of land and a love of the forest deeply implanted in their natures. Vigorous bodily and mentally and capable in the end of doing something towards restoring the balance between rural and urban interests. If we are successful, and there is no reason why we should not be, then will be something done which was worth doing and we shall all have forgotten the toil, trouble and worry of conception and labour. Careful thought and careful work are, however, essential, otherwise the mountain in labour will produce but a mouse.

REVIEW OF PROGRESS IN RESEARCH AND EXPERIMENT.

By W. H. GUILLEBAUD.

The article on research in last year's Journal described the general organisation of the work and gave a broad summary of the results to date. It is proposed in this number to describe chiefly the work undertaken during the past year, referring to any developments in the earlier experiments which appear to be of interest.

NURSERY EXPERIMENTS.

These have been continued on the same lines as in 1926, but in view of the early publication of a Bulletin by Dr. Steven dealing with all the major nursery experiments since the work began in 1920 it is unnecessary to refer to them in the present article.

PLANTATION EXPERIMENTS.

ENGLAND AND WALES.

Beddgelert.

Experiments are in progress on two types of land :—

(*a*) A basin peat carrying a somewhat rich herbage resembling that at Glenbranter. In addition to cotton grass there are fine grasses and a number of herbs. Experiments include methods of planting, use of manures, trial of Norway and Sitka spruce, etc.

(*b*) Hummocky ground with rapidly varying conditions. The knolls have been planted with different species of pine and other conifers and the swampy hollows with spruces.

There are no black game in this area.

Smales.

The forest includes a wide range of conditions such as heather, scirpus on fibrous peat, deep and shallow molinia peat, and hard calluna ridges. Various methods of spruce planting are being tried on the peaty ground, and mixture of pine and spruce together with different methods of soil preparation on the calluna ground. Black game are a difficulty in this area, and it is proposed to cage in a small block this year. The experiments at both Smales and Beddgelert have only been running a year or two, and there is little to report yet as to the progress of the various plots.

Allerston.

Fairly extensive experiments have been started this year on the flat calluna and calluna-scirpus top land at Allerston. The greater part of the area contains a thin pan from 6 in. to 10 in. below the surface. Different methods of soil preparation, including ploughing, breaking up the pan with explosives, picking up with mattocks, etc., are combined with the trial of

a number of different species, such as Norway and Sitka spruce, Japanese larch, Scots pine, *Pinus contorta*, etc. An experiment on age and type of Scots pine plants has also been planned.

Thetford Chase.

Two compartments, one in the south and one in the centre of the forest, were planted in P.27 with a large number of different conifers in acre blocks, thus forming the start of a forest garden in this area.

Forest of Dean, Dymock and Alice Holt.

A series of experiments on the establishment of oak plantations was begun in the above forests in P.27. The basic principle was the use of closely-spaced one-year oak seedlings. Various spacings such as 3 ft. × 2 ft., 4 ft. × 1 ft., and 4 ft. × 2 ft., were tried. Transplants were also used for comparison. Close spacing of seedlings was further combined with hoeing in the rows to keep the soil below loose and free from weeds. Direct sowing was tried at Dymock with moderately good results. The experiments are being continued and extended during the current planting season.

Friston.

This forest lies on the South Downs near Eastbourne, the slopes are mostly steep, and the soil very shallow over chalk. Experiments began in P.27 and deal with different methods of soil preparation and planting, the use of various species such as European larch, Japanese larch, grey alder and birch as nurses for beech, ash and sycamore and the trial of miscellaneous species in small groups. *Cupressus macrocarpa*, which has done so well at Poverty Bottom, near Friston, was planted as a belt on two sides of the experimental plots; both seedlings and transplants were tried, but the former failed almost completely; the transplants, on the other hand, were fairly successful.

Scotland.

The number of registered experiments in the West of Scotland is now as follows:—

Inchnacardoch	72
South Laggan	11
Glen Righ	13
Achnashellach	12
Portclair	1
Glenbranter	1
Glenduror	1
Drummond Hill	1
Inverliever	2

These include experiments on choice of species, mixtures, methods of planting, spacing, age and size, manuring, etc. In the course of the next few years many of these should yield valuable information.

Some of the earlier experiments at Inchnacardoch dealing with a bad type of basin peat are getting to an interesting stage. An area consisting of lines of Sitka spruce was planted in P.24 by various methods, including turfing. During the first year or two the turfed plants were markedly better than those notched direct into the peat, but now the former are going back badly and have little advantage over the latter. The peat here is very wet and the drainage system obviously inadequate. Examination of the turves shows that they are fusing with the surface peat and so have ceased to function as a means of providing the plants with better aerated conditions. This winter new drains are to be cut over a part of the plot, and it will be interesting to see if the plants respond.

Provisional results of manuring experiments with Norway and Sitka spruce planted in P.25 on turves are as follows (the figures are for the leading shoots in 1927 in inches) :—

——	Basic Slag.	Epsom Salts.	Nursery Soil.	Leached Soil.	Control (no application).
Norway Spruce—					
Belgian spade ...	1·1	0·7	0·9	0·7	0·6
Side notch	1·0	1·0	0·8	0·8	0·5
Sitka Spruce—					
Belgian spade ...	2·2	1·7	1·3	1·0	0·7
Side notch	2·8	1·9	1·3	0·7	0·9

These averages have not yet been worked out statistically, so it is unsafe meanwhile to lay much stress upon them, but the data for Sitka spruce in particular form such a consistently descending series from basic slag to control and the difference between the extremes is so great that it is very unlikely that the figures do not express a real tendency. Assuming that the data hold good as they stand, they indicate in the first place the value of basic slag as a manure on this type of peat, and, secondly, the superiority of Sitka to Norway spruce. The positive results given by the Epsom salts (magnesium) are also interesting. The experiment was repeated in P.26 with Norway spruce only and without nursery soil or Epsom salts. Data are as follows :—

——	Basic Slag.	Leached Moraine.	Control. (no treatment).
Belgian spade ...	0·8	0·6	0·4
Side notch	1·1	0·6	0·4

In another part of Inchnacardoch very badly checked Sitka spruce planted in P.21 or P.22 were treated in P.25 as follows :—Plants sheltered with wooden screens, plants sheltered and dressed with basic slag, plants

not sheltered but slagged, plants neither slagged nor sheltered. In P.25 the plants looked as hopeless as possible but those slagged and sheltered have made an astonishing recovery, the colour is good and some have put on leading shoots of several inches, the slagged but unsheltered plants have improved considerably but are a good way behind the first lot, those sheltered but not slagged are very poor, little better than the miserable-looking controls. Shelter alone has thus not made much difference but the combined effect of shelter and a dressing of basic slag has been very marked. The experiment shows that under certain treatment even the most hopeless-looking, checked spruce may recover—for a time at least.

An experiment suggested by Mr. Scott was the trial of planting spruce 2-year seedlings in small flower pots filled with good soil, placing the pots on the hill side near where the plants were to be used. At the end of a year the plants were put out into the peat with the ball of soil attached. Different planting methods were used. The plants have now been out a year and so far both in colour and growth those planted on turves are much superior to those put direct into the peat. The high cost appears a drawback to this method on a large scale.

Sir John Stirling-Maxwell's scheme of high elevation peat nurseries was carried out by establishing peat nurseries at 900ft. to 1,100ft. elevation at Inchnacardoch, Glenduror and Glenbranter. Each nursery consisted of a fenced-in area enclosing 3,000 turves planted with seedlings (in one case transplants) of Sitka and Norway spruce in P.26. The nurseries were situated close to the planting areas and the plant turves moved out to their final position in P.27. Of the three areas, that at Glenbranter, where there is a good mixed herbage, is looking extremely well, the plants in the other blocks though quite a good colour have not made the same growth as at Glenbranter.

A high elevation experiment started at South Laggan in P.22 is now quite interesting. Small plots of Norway and Sitka spruce were established at 1,900 feet elevation on a grass slope ; the Norway spruce are now, for the most part, out of check, the plants are a good colour and putting on up to 4 in. leaders. The Sitka spruce on the other hand have not moved in spite of the good soil conditions and look as if they had been repeatedly frosted. It is proposed to extend the area this year, planting the two species as before, but caging the plants against black game.

A new high elevation area has been enclosed this year at South Laggan at about 1,500 feet elevation, partly on grass land and partly on heather knolls. It is proposed to plant different races of Scotch pine and pine-spruce mixtures on the heather ground and spruces on the grass land.

The principal planting experiments in Mr. Annand's Division are at Teindland, Monaughty and Culbin. The Teindland area was described in the last number of the Journal. About 30 experiments are in progress there, the most extensive of which deals with different degrees of ploughing, *i.e.*, complete or partial ploughing, and was planted in P.27 with 1+0, 2+1, and 2+2 Scots pine and transplants of Norway spruce, Sitka spruce *Pinus contorta*, Thuja and Tsuga. The most interesting result so far is the initial success of the one-year seedling Scots pine, in which there have

been fewer than 5 per cent. of failures. The precentage of Class I plants, *i.e.*, plants of good colour and growth is 84 as compared with 25 per cent. for 2+1 and 24 per cent. for 2+2 plants. Both Sitka and Norway have started off comparatively well on the ploughed ground but the colour is poor and it is doubtful whether they will maintain their growth next season.

Another P.27 experiment with various ages of pine on unploughed ground again placed the 1-year seedlings in a favourable light. The losses in this case were as follows :—1+0, 0 per cent. ; 2+1, 1 per cent. ; 2×0, 12 per cent. ; 2+2, 10 per cent. ; 2+1+1, 10 per cent.

Pinus concorta planted in P.26 by various methods have made 5 in. growth in the 2 years and look vigorous ; plants mounded have not done appreciably better than those on screefs.

A choice of species experiment planted in P.22 in Monaughty Forest on a very poor piece of ground (soil a peaty clay loam on hard glacial till) near the top of the forest has proved difficult to assess owing to the changing vegetation conditions. The growth varies remarkably with the type of vegetation and it was found necessary to classify the types and assess separately the plants growing on each type. Sitka spruce, for example, on a good calluna type with hypnum and hylocomium mosses averaged 2 feet in height with leading shoots of 3 in. average (9 in. maximum). In a slightly poorer type, in which lichen was also present, the height fell off to 16 in. with 1½ in. leading shoots. Norway spruce on the latter type was much poorer than the Sitka, three quarters of the plants were either completely checked or dead, and the remaining growing plants were only 8 in. high with inch long leading shoots. In both cases the plants were put in along the drain sides on ridged up material obtained from the latter. Much of the ground is covered with still poorer vegetation types containing scirpus and bog asphodel as well as dwarf calluna and on these both spruces are still completely checked. These results indicate, among other things, the difficulty of establishing spruce on this type of land.

At Culbin, plots of various species were established in P.22 on part of the large tract of sandy waste behind the main dunes. The species used included European and Japanese larch, Norway and Sitka spruce, Douglas fir and *Pinus contorta*. All the plots look miserable with the exception of the *Pinus contorta* which is doing remarkably well.

A direct sowing in strips of Corsican pine on a dune only partially fixed with marram grass was very successful.

Sample Plot Work.

The year under review comprised a heavy programme of re-measurements and few new plots were established. During the autumn advantage was taken of the trees blown down in many parts of Scotland in the January gale to make form quotient studies of mature Douglas fir and Sitka spruce. A felled sample plot of Norway spruce was also measured. The data should be useful as a guide to the accuracy of our present method of measuring sample plots.

Research Work at Aberdeen.

Mr. Laing's work is now concentrated on a study of the tree mycorrhiza with special reference to the growth of trees in peat. He has devoted a considerable amount of time to the identification of the fungi concerned, among which are *Lactarius deliciosus, Boletus elegans* and species of *Russuella* and *Hebeloma*. These were all found in plantations or nurseries on mineral soil; efforts to identify the fungi giving rise to mycorrhiza in peat have so far been unsuccessful. The evidence up to the present appears to show that in normal cases plants raised from seed sown on peat do not bear mycorrhiza and that trees growing on peat which have mycorrhiza roots have brought the fungus with them from the nursery in which they were raised.

It was found by experiment that magnesium carbonate has a strongly stimulating effect on trees planted in peat while other elements such as potassium calcium. and phosphorus had no effect. When the plants were examined it was found that the rootlets of the magnesium treated plants were in the form of mycorrhiza, whereas those of the control and of the other chemically treated plants bore root hairs only. It would thus appear that the peat does contain hyphae capable of infecting rootlets and forming mycorrhiza, but that the mycelium is incapable of forming mycorrhiza without receiving some stimulus—in this case the addition of a magnesium salt. In this connection it is interesting to note that Mr. Laing has already shown that plants grown in water cultures deficient in magnesium are characterised by the presence of quantities of starch in the storage tissues. Plants in check on peat exhibit precisely the same features.

When the fungus forms typical mycorrhiza, the nursery root system—in certain types of peat at least—remains alive and active but does not expand to any marked extent, the covering of the root tips by the hyphae inhibiting, apparently, the growth in length of the roots. None the less the maintenance alive of the nursery root system is probably an important factor in the development of the tree on peat.

Mr. Fraser has continued his field and laboratory work in connection with the classification and composition of peats in Scotland. At Inverliever careful vegetation studies covering now a period of several years have shown that on some of the lower slopes the vegetation is definitely improving, scirpus is giving place to molinia, and there is a steady improvement in the growth of trees from the periphery towards the centre of some of the bad patches of ground. On the higher ground little change either way can be noted.

Laboratory work on the flocculation of peat suspensions with basic slag has led to the conclusion that, in the field, biotic agencies (fungi and bacteria) play the principal part in the change brought about by the addition of slag and that the effect of the slag is, on the one hand, its neutralisation of acidity and on the other hand its nutritive value to the soil micro-flora. These conclusions probably link up with Mr. Laing's observations above, *i.e.*, most basic slags contain a considerable proportion of magnesium, which is important for root growth in peat. The manuring

experiment at Inchnacardoch which placed magnesium (in the form of Epsom salts) second to basic slag in stimulating the growth of spruce on peat points in the same direction.

Mycology.

The outstanding events of the year have been (*a*) the appearance of *Rhabdocline Pseudotsugae* on Douglas fir in a number of widely-separated areas in England and Scotland, and (*b*) the discovery of what appears to be an outbreak of the much-dreaded Dutch Elm Disease on elms at Totteridge in Hertfordshire. *Rhabdocline* has been known for a number of years at Dawyck, where it attacked only the blue and intermediate forms of Douglas, and it is difficult to account for the sudden spread of the disease to such widely-separated areas as Alice Holt in Hampshire, Bagley Wood in Oxfordshire and the neighbourhood of Southampton. At Alice Holt and Bagley, green douglas were also attacked, though not severely, but it is too early as yet to say whether the disease is likely to prove a serious menace to this species.

Dutch Elm Disease is devastating the elms on the Continent, especially in Holland, and it is remarkable how little is definitely known with regard to the organisms responsible. The latest work in Holland and Germany attributes the disease to a fungus named *Graphium ulmi*, which was first isolated from diseased elms about four years ago. Dr. Wilson, working in collaboration with Miss M. Wilson, has succeeded in isolating *Graphium ulmi* from a large number of cultures taken from diseased wood at Totteridge, and it is much to be feared that the disease has established a hold in this country.

Dr. Wilson has continued his experiments on the spraying of European larch against *Meria laricis* in Tulliallan Nursery. The attack was not severe in 1927 in S.E. Scotland and in consequence the results of spraying at Tulliallan were not marked. Of the sprays used, Burgundy Mixture (10 lbs. copper sulphate dissolved in 20 gallons of water and added to 80 gallons of water containing 12½ lbs. of washing soda crystals) was the most effective. The foliage of the plants in the beds treated with Burgundy Mixture was darker and the plants had a healthier appearance than in the other plots. Frequent spraying—every three weeks from the beginning of April to the end of August—is necessary, and it is important to protect the plants against late spring frosts.

Mr. Waldie carried out some successful experiments on the spraying of oak seedlings and transplants against oak mildew. The work was done partly at Kennington Nursery, near Oxford, and partly in the New Forest. Several sprays were tried, of which colloidal sulphur was much the most effective. The appearance in the autumn of the sprayed and control plots was most striking; where the mildew was kept down the plants were much larger and healthier in appearance; many of the one-year seedlings were in fact as large as well-grown two- and three-year-old seedlings. Details as to the practical application of the method will be circulated in due course.

Entomology.

The intensive trapping of pine weevil in Hawkhill Enclosure has been continued with encouraging results. The loss to newly-planted trees has been small, and it is clear that the weevils are being kept under control. During the winter months (1927–28) a man has been employed collecting weevils from the stumps, and in this way large numbers have been caught —over 7,000 in October, November and December. It will be interesting to see what influence this has on the numbers caught in ordinary traps next season.

There was again last year a very severe attack of pine sawfly at Rendlesham, which did much damage during May and June. In July the caterpillars were attacked by a bacterial disease and almost completely wiped out. There was a second brood in the autumn, but this also succumbed to the disease. It is hoped that the forest will be comparatively free in 1928.

Mr. Chrystal is continuing his investigations on *Tortrix moliana* and has succeeded in breeding parasites from the pupae.

Forest Products Research.

Pitprops.

A large-scale trial of peeled and seasoned pitprops was carried out in a group of coal mines in South Wales. Home-grown props were tested alongside imported Norwegian props both at the face and in the main galleries. The species used were Scots and Corsican pine, European larch, Douglas fir and oak. The mines were twice inspected by Mr. Fletcher and Major Cosgrove when the props were in position, and the views of the miners themselves ascertained, as well as the opinion of the managers of the respective collieries.

The verdict was almost uniformly favourable ; the props used for face work were considered to be equal in every way to the Norwegian props, with the sole adverse comment that they were more difficult to cut. The latter remark applied to all species and is probably due to the home props being too dry owing to over-prolonged seasoning. The Norwegian props were chiefly Scots pine with some Norway spruce.

Laboratory tests carried out on home-grown props indicate, provisionally, that Scots pine and Corsican pine have almost identical strength values when used as props. Home-grown Scots pine is equal to that imported from Finland and better than the Polish props tested of the same species. Seasoned Douglas fir gives almost the same values as Scots pine. Imported Norway spruce appears to be stronger than imported Scots pine or any of the British conifers tested.

Kiln Seasoning of Corsican Pine Timber.

Corsican pine logs to the number of 121 were cut in the New Forest and sent to Farnborough, where they were converted to a bungalow specification supplied by the Forestry Commission. The sawn timber was loaded in January, 1927, into a kiln of the external blower type and the

temperature maintained at 60° C. over the greater part of a period of 30 days. The humidity was maintained at 85 per cent. for the first 17 days of the run and then gradually lowered to 60 per cent. The moisture content of the boards was reduced from an initial figure of 100 to 150 per cent. to a final figure of about 13 per cent.

The conclusion drawn from the experiment is that Corsican pine timber seasons rapidly and well in the kiln. The seasoned boards and scantling were sent to Thetford for the construction of a wooden bungalow. This is now almost completed.

A second experiment on kiln seasoning of Corsican pine was carried out on timber from the same New Forest consignment, but a much severer treatment was adopted. The temperature in the kiln was raised and the rate of drying further increased by lowering the relative humidity for the respective drying stages more rapidly and to a greater extent than in the first experiment. The seasoning process was complete in 11 days and in the final grading very little increase in seasoning defects was found. The results confirm the conclusion of the first experiment, namely, that Corsican pine is an easy timber to season artificially.

Investigation into the Utilisation of Oak Timber in the Districts around the Forest of Dean.

Mr. Fletcher and Major Cosgrove carried out last year an extensive investigation into the utilisation of oak in manufacturing centres within a radius of from 50 to 100 miles of the Forest of Dean. Several hundred firms were interviewed and a large amount of useful information collected. Many of the firms used only imported timber. Various reasons were put forward to justify the preference over home-grown oak, such as the harder working nature of the latter, difficulty of obtaining supplies when required, defective sawing and seasoning, etc. The general conclusion from the investigation was that the economic marketing of oak in the Dean depends upon good conversion, proper seasoning and the development of markets for the off-cut material.

SHORT CUTS FOR WORKING PLANS.

By G. B. Ryle.

It is a very prevalent belief amongst all field officers that working plans are not really needed, and while such an idea is technically highly irregular, there can be no doubt that to a very large extent they are perfectly correct in their tenet so far as ordinary afforestation schemes or schemes where exploitation is entirely governed by regeneration (*e.g.*, the conversion of the third rate hardwood areas) are concerned.

After all, what happens in nine cases out of ten when a detailed working plan has been drawn up for a forest ? Firstly, the prescribed planting programme has to go by the board, and we are given instructions to plant up an extra couple of hundred acres ; secondly, there is a shortage of the plants we prescribed and we have to make shift with something else or we have to plant a different part of the forest where the available varieties will be more suitable ; and finally, an additional block of land is acquired and our forest has suddenly more than doubled its area. Result: the working plan finds its way to the " old files " compartment of the filing cabinet, nothing more is thought about it, and the work on the forest goes on as smoothly as before. The only snag is that the time and money spent on the plan (it may easily exceed £40 or £50) has been wasted ; one hesitates to throw away money in this way.

What then is to be done? We must find a practical alternative, for it is certain that a policy of total abolition would not meet with favour among the powers that be, and even the field officers agree that *something* ought to be down in black and white if only for the benefit of their successors.

The writer has come across more than one case where a working plan which has been prepared in some detail according to the old Code had come up for revision. It was found that the prescriptions of the plan had been fairly well carried out ; but nowhere was any fresh information to be found regarding the work which had actually been done, and even the maps were not up-to-date and not very trustworthy. There had been complete changes in the staff since the plan was prepared, and the result was that nobody knew what they had on their forest. A complete re-survey of the area was thus entailed and the old working plan was, of course, of very little use. A working plan and maps which are not annotated *every* year are as useless as no working plan or maps at all.

I take it, then, that the important functions of a plan for an afforestation scheme and those which everybody agrees should be down in black and white are (*i*) a general description of the area as a whole and (*ii*) a fully reasoned statement as to the proposed distribution of the species, the lay out of the ground into compartments, etc., and the approximate rate and order of working. Beyond this, any definite annual programmes laid down in advance are quite unimportant.

Such a plan for an indefinite number of years (normally the whole afforestation period of the property) could be written up very easily by a local officer who already knows his ground fairly intimately. A thing we should like to see is a more detailed description (accompanied if possible

by a map) of the main vegetation types, for it is apparent that these are becoming increasingly important as soil and site indicators.

The next thing is to keep the working plan always up-to-date in its information, and we would propose to do this by the addition each September of an annual working plan. This would similarly be divided into two parts : (*i*) would give a detailed description of the ground immediately to be planted (by compartments) and (*ii*) would prescribe the distribution of species in detail and with full reasons. Part (*ii*) would be typed on the left half of the pages only and then at the close of the planting season an explanation of any divergencies would be added. Since, however, this annual plan would be prepared shortly before the commencement of the planting season there should be no serious divergencies, as the plant-supplies and (usually) the area-programme would be known beforehand.

Appendices giving extra data upon any point of interest or importance would be added at every opportunity.

Thus at the end of the period when the compilation of a working plan proper is thought to be necessary we would have in existence :

(1) A general plan and argument.

(2) Detailed annual plans.

(3) Appendices (giving information on such points as the rate of growth of various species, special experimental work which has been carried out, occurrence of unforeseen difficulties or epidemics which were not mentioned in the first general plan).

It is, of course, assumed that accurate and detailed working maps are prepared and kept up-to-date every year, as without these the documents are of little practical value.

It does not really seem necessary to lay down any hard and fast key plan, as the particular points which require to be stressed differ much for each forest unit ; but the following skeleton indicates the kind of abbreviated working plan which is suggested by the foregoing remarks.

GENERAL WORKING PLAN.

..... *Forest.*

By..... *Date*.....

PART I.—*Description of Area.*

1. *Area and Distribution* (whether compact block or scattered ; tabular area statement).
2. Physiography.
3. Geology, soils and vegetation types (also short notes as to choice of species if necessary).
4. Meteorology.
5. Existing woods (including recent plantations by the Commission).

6. Probable production (if actual measurements have been made so that a reasoned estimate is possible).*
7. Risks and protective measures.

PART II.—*Management.*

8. General objectives (type of produce expected; sub-division of the forest into working units).
9. Lay-out (roads, rides, compartments).
10. Rate and order of working.
11. Choice of species (reference paras. 2–4 and 6 above).
12. Special instructions (advance drainage, special planting methods, treatment of any established woods, etc.).

ANNUAL WORKING PLAN.

.....*Forest* *Forest year*.....

By..... Date.....

PART I.—*Description of Area.*

This might take more or less the same form as paragraphs 1–4 and 7 of the general plan but would be much more detailed.† Compartment descriptions might be appended.

PART II.—*Prescriptions.* (On left hand side of pages only.)

6. Lay-out (formation of roads, rides, etc., being an amplification of para. 9 in the general plan)
7. Choice of species (in detail and with reasons; tabular plant statements).
8. Special instructions.

A plan as above would hold good even in the case of fluctuating area-programmes or of shortages in certain species. In the case of important additional acquisitions the general plan would have to be altered or re-written, but the annual plans for former years could be retained or could be embodied in the revised general plan. It would be short; it would not be a labour of weeks to compile, even in the case of an extensive forest, and furthermore it would have the advantage of unlimited elasticity.

The following comments on Mr. Ryle's article have been received from Messrs. A. P. Long, O. J. Sangar and D. W. Young:—

Mr. A. P. Long.—The opening thesis of "Short Cuts for Working Plans" is not new, being substantially the same as has been stated by Divisional Officers ever since working plans were first breathed.

* Several plans have been seen where the estimates as to production are not the result of actual measurements, but are merely the guesses or hopes of the compiler.

† In the case of very uniform forests all but the area statement might be omitted.

That something is required is obvious, but the two main difficulties are : (1) to limit the scope of the plan so as to ensure that only absolute essentials are embodied, and (2) to get even that amount of work done. The suggestion of two plans—general and annual—does not seem to fill the bill for, so far, it has not been possible to get one completed and, further, I have never yet been in a position during any one year until well into the planting season to say that such and such an area of any forest shall definitely be planted and nothing else. True, things are less indefinite than they were, but some uncertainty still remains, and until we do actually reach a stage of absolute certainty any plans drawn up are bound to be modified.

The main functions of a working plan are :—

(1) To lay down a certain course of action.
(2) To act as a guide to successive officers in charge.
(3) To keep a record of work done.

Under present circumstances it does not seem to be possible to adhere to function (1), and for the time being a plan presenting information under heads (2) and (3) would seem to be sufficient.

To give this information there should be compiled at the outset Part I, Description of Area, pars. 1–7, and also paras. 8, 11 and 12 of Part II, with as much of 9 and 10 as possible—10 being always subject to fluctuation, and 9 to a certain extent also, *e.g.*, in connection with forest workers' holdings. To this I would add a chapter containing some sort of control table giving total plantable area and progress year by year, to be read in conjunction with properly compiled and up-to-date plans and compartment records.

This should serve as the basis of a working plan to be compiled eventually ; *i.e.*, when the position has become stabilised.

Mr. D. W. Young.—Mr. Ryle's article contains a practical suggestion to meet a difficult position, but does not appear to me to go far enough. If we are frank, the position in which we find ourselves on new areas is one for which the working plan of text-book pattern or any approximation to it was never designed. Something is required, but we are only hampering our ideas by clinging to the conception of the working plan. It is here where I think Mr. Ryle misses his mark.

What is required is something which :—

(1) Will secure that the work shall be on a considered plan and not merely a conglomeration of improvisation to meet the needs of the moment.
(2) Will secure control. That is, the control of a living organisation with a growing experience and knowledge of the novel condition under which it is working rather than the control of ideas formed with incomplete knowledge and rapidly becoming obsolete.

Such control by a living organisation, if it is effective, implies freedom of interchange of ideas securing that mistakes made in one part are not repeated in another, and that full

advantage is taken of the growing experience of the part of the organisation in touch with the localities concerned.

(3) Is self-recording—recording both developing work and ideas.

(4) Is severely practical, eliminating all that is purely academic, but incorporating all essentials.

(5) Will fit in with existing returns.

(6) Will not be merely an addition to the returns required of us, but an instrument of utility in the division.

These requirements, it appears to me, would best be met by a file which might be called " Record of Establishment."

The first document in that file would be the acquisition report, as that contains much that it is pointless to repeat. This use of the acquisition report should have an effect on its drafting wholly beneficial.

The second document would be the report on taking over ; it would be supplementary to the acquisition report and contain all the information an officer would collect on taking over a new estate, especially additional information on tree growth.

The third document would be the proposals for working. This would deal with :—

(1) Allocation to forest and holdings
(2) The lay-out-main extraction roads and compartments } with plan.
(3) Early appropriation to forest.
(4) Silvicultural considerations (general argument).
(5) Provision of plants (nursery proposals).
(6) Protection (assessment of parks).
(7) Organisation.

To avoid the tyranny of obsolete ideas this should be in outline rather than detailed, and to avoid hasty ideas getting dominance on large areas it should be partial rather than complete, provided :—

(*a*) Comprehensive blocks are dealt with.

(*b*) No work is done on any area until the proposals for working the block of which it forms part have been submitted and approved.

In pursuance of the same principle, it would be sufficient if the compartmentation is done in blocks of compartments with well-defined boundaries to which series of numbers can be given, leaving the further sub-divisions to be dealt with in the yearly plan of operations for the area concerned.

Details of this kind are best left till the time comes to consider detailed work. The same remark applies to compartment description.

The fourth document would be the yearly plan of operations. This would be in three parts :—

(1) Report on previous year's operations, a statistical comparison of the previous year's plan and accomplishment ; in fact, the control form in working plan parlance.

(2) A prefatory note explaining what is proposed, briefly touching on choice of species and reasons therefor, and any departure from previous ideas.

(3) The plan of operation set out under financial heads—preparing ground, planting, etc.—describing the work to be done in detail for each compartment.

Appendices to this document would be :—

(*a*) A plan or tracing showing the elaboration of the proposals for working in lay-out, compartmentation and distribution of species.

(*b*) A detailed description of the compartments dealt with in the yearly plan, giving area, etc.

This document would serve as :—

(i) The instrument of submission to headquarters, securing department control. (Requirement 2.)

(ii) The instrument of instruction to the forester. (Requirement 6.)

(iii) The instrument of record. The fact that financial heads are used will link with other records (*e.g.*, cartage and accounts) and ensure our having a source—with chronological cross reference—from which detailed compartment records can be obtained at any time. (Requirements 3, 4 and 5.)

(iv) The basis of yearly estimates and plant requirements schedule.

Such a scheme should not mean more work—it merely standardises what has been the practice heretofore, but subjects it to rules which ensures that the work shall not be haphazard. It is frankly not a working plan, but does all that a working plan can do under the conditions in which we are working.

Mr. O. J. Sangar.—In general I agree with Mr. Ryle's article as to the impracticability of the system as now laid down, unless special staff is provided, but I cannot altogether subscribe to the detail of his suggestions. My experience is to the effect that in an established forest (*e.g.* Tintern), the working plan can scarcely be too detailed ; I find also that the official form (with slight adaptations) is quite convenient. Such a plan cannot be drawn up in full detail in less than two or three plan-periods with our present staff.

For an afforestation area, of the information, etc., which should be available in the Divisional Office, I consider the following to be the minimum requirements (in order of importance). In the first stage of plan-preparation for an established forest, the position is much the same :—

(i) An accurate map, 6 in.=1 mile, showing

(*a*) Compartments (including nurseries) with areas and numbers (groups of two or more compartments can be used temporarily in difficult places, if necessary) ;

(*b*) Main fire lines, and access and extraction routes ;

(*c*) Areas felled and/or planted to date with dates, areas and species as per Code legend, also areas beaten-up as " established " (by some simple legend).

(ii) An accurate map 6 in.=1 mile, showing, by a simple legend :—

(*a*) Tenancies as obtaining at date of acquisition ;
(*b*) Present position, as to above, and land resumed ;
(*c*) Proposed final allocation as between farms, forest workers' holdings, etc.

(iii) Acquisition reports, leases and conveyances of the areas concerned with summary area-statement (kept up-to-date).

(iv) A general statement of instructions and decisions as to fellings, etc. (if any), selection of species, draining policy, planting methods, and amenity considerations. Prescriptions as to policy in *re* width, etc., of fire-lines, rides, and inspection paths to be included.

(v) Up-to-date estate book shewing details of tenancies, land resumed, planted, in hand, etc., by O.S. numbers and parishes.

(vi) An amplification of summary in (iii) above, giving brief details of tenure, restrictive covenants, etc.

(vii) General notes as to labour, piece-work rates, farming practice, local attitude, etc., and possible maximum planting rate per annum.

(viii) A statement of all observed data as to growth, meteorology and other features of interest or importance.

With the above information it should be possible for any Divisional Officer to take over a forest from another Division, and manage it efficiently, proceeding very much on the lines indicated by Mr. Ryle ; *i.e.*, each year in spring and summer the planting proposals would be formulated, the compartmenting completed if necessary, the subsidiary fire-lines and inspection-paths laid down, the compartment descriptions written up and the final selection of the species made. On completion of planting each season, the maps would be marked up, correctly, to date. The keeping up-to-date of the tenancy map would be a matter for attention, not annually, but immediately upon every change of tenure. Immediately upon the completion of an acquisition extending the forest, the maps would be marked and documents amended.

No one likes to write the descriptive part of a plan unless it be done properly ; and without the expenditure of a great deal of time it resolves itself merely into the presentation of information which is apparent on one's first visits to the forest or (in greater detail) from a perusal of the acquisition reports and the summary statements mentioned in paragraphs (iii), (vii) and (viii) above, which may, indeed, be regarded as the beginnings of paragraphs for incorporation in Part I of the working plan. The proper precis-ing of this information and incorporation into a formal working plan is a long job which is, as Mr. Ryle says, often wasted before it is finished owing to some new acquisition.

Compartmenting admittedly offers some difficulties (and its very importance is such that one must say " dangers," also) if it be done hurriedly, but of its urgent necessity on the score of accurate and efficient control there can be little question, and these advantages are largely

retained (and the risks avoided) if the " grouping " system be used for difficult blocks pending the time necessary for sub-division.

One difficulty sometimes put forward in the laying-out of compartments is the possibility of future changes as regards the limits of the plantable area, where it verges upon either forest workers' holdings, farms, or unplantable land. It is suggested that this difficulty can be overcome without vitiating records by reserving the letters A, B, C, etc., for sub-*divisions* of compartments in the usual sense (*e.g.*, if part of C.52 is taken for forest workers' holdings this will be called Sub-compt. 52 B, leaving 52 A only in the forest) whilst reserving the letters X, Y, Z, for addition (*e.g.*, if there be put into the forest an acre or two adjoining C.52, which were originally allotted to a farm, then this addition to the compartment would be called Compt. 52 X). The fear that the sequence of compartments may be upset by later acquisitions is also present, but as all our forests are (we hope) extending, no numbering would ever be done if one were to await absolute security and finality on this count.

Provided any arrears can be overtaken, the observance of the above suggestions should be practicable with our present staff, and, by the time cleanings commence and a more detailed plan is necessary, the basic information will be available in convenient form. The absolutely essential information for the running of the forest will, meanwhile, have been to hand, without any expenditure of time upon a formal plan which will probably have proved of little value in the control of operations and barely of even academic interest.

UNOFFICIAL NOTES ON AN OFFICIAL VISIT.

By A Non-Technical Officer.

Being a mere office wallah, it was a pleasant and instructive privilege to visit Tintern and the Dean in the company of foresters. I use the word foresters in the wide sense, as the party included Forestry Commissioners and Forest Officers.

Foresters appear to be able and willing to explain those things which a layman wants to know, and when asked questions they do not take refuge in scientific jargon. Foresters have, however, some idiosyncrasies. For example, they are never satisfied with the result of their labours, but are always aiming at a forest Utopia; and while they may become ecstatic over some self-regenerated oak which the ordinary mortal would not have eyes to see, they will refer to a cathedral of 150 feet larch of overwhelming beauty as "nice sticks."

Before visiting the woods I heard an exposition by the Deputy Gaveller with regard to the Dean mines and their levels, the Free miners and their gales, all of which impressed me as to the magnitude of this side show of the Commission's. These mines provide a million tons of coal annually and will continue to do so for 150 years.

The points of interest seen during my first two hours in the field included (*a*) a pure beech plantation which appeared to find favour, (*b*) a 5-year Douglas plantation in a sorry plight from disease, (*c*) Pritchard's Hill, so named before the advent of the Assistant Commissioner, where oak seedlings and transplants of varying ages seemed to be living happily together, while close by was an example of the attractive-looking group system of planting, (*d*) a giant oak which is to be left standing (New Forest residents please note), and (*e*) a plantation 16 years old and 26 feet high!

When visiting the high point at Symonds Yat, with its bird's-eye view of the winding River Wye, I saw the Deputy Surveyor pounce upon a vendor of soft drinks who had strayed from the spot allotted by the Commission for the erection of booths.

I received a private demonstration on how to grow a walking stick from a cutting suitable in shape to form the handle, and an explanation why the roller moth eats the leaves of one kind of oak and not another, and I then saw the interesting old Court Room of the Verderers.

And so to the Deputy Surveyor's office, where matters of import were discussed and settled by the Commissioners, and I had the pleasure of making the acquaintance of the staff who in future will no longer be mere names to me. Then to an enclosure *nomine* Nagshead with some wonderful natural regeneration of oak, and on to a hill where regeneration and plantation were combined.

Passing alongside a Roman road on part of which the original blocks of stones are visible, but for the most part planted over, we walked through Cockshoot, a delightful spot with alternating sun and shade, old oaks and baby oaks in profusion. This was being cut over, but the beauty of the place was unimpaired.

We then saw a bungalow under construction by the Whiting method; it is of the Achnashellach type, with 4 rooms and offices. Then to an

occupied pair of two-floored cottages built by the same method. Nearby in the heart of the woods was coal outcrop worked by miners from South Wales during the strike until, owing to non-propping, one of them lost his life. Some of these " mines " did not exceed a cubic yard in extent.

After a glimpse of the Severn Broadwater and of the Cotswold Hills beyond, and refreshed by the hospitality at Whitemead Park, where the snapdragons are a feature, we entered a nursery which looked A1, but is regarded with suspicion, as the under-spit had been put on the surface. On the return to Tintern some of us took the upper road and saw the Technical Commissioner's favourite larch, and most impressive they were, reaching up some 80 feet with very slight taper.

The next day we all set forth armed with slashers. There is a Scottish saying, " Through a wood walk in front, through a marsh walk behind." Personally, if I ever walk with an amateur slasher I shall walk behind.

We drove to the area Chepstow Park Wood and walked up and over a large flat-topped ridge. To the casual observer the hillside carried only tiny scrubby oaks, but the land was in fact planted up with Douglas, Japanese larch and other species. The doctors disagreed as to the treatment of the lower slope, whether to cut over the scrub again or not ; this is an example of the forester's trouble—keeping the balance between certainty of success and excessive expenditure.

I was interested to learn that larch should have large crowns, to which end thinning must not be neglected ; we were shown an experimental area in this connection.

After a glance at a tiny Corsican pine nursery we entered the Fairoaks houses for forest workers, some completed, others under construction, some new and some adaptations. The officers concerned are justifiably proud of this group. Space prevents description of the interesting details, but I must mention one attractive arrangement which provided an inset fixed dresser of various natural-coloured woods in the living room and an inset large hanging cupboard in the best bedroom ; a good effect was secured by the mantelshelf being supported by the split half of a dining-table-leg shaped piece of turned wood.

The Forbes wall of specimen concrete blocks was interesting. It contained blocks made of 3 parts sawdust to 1 of concrete (all rights reserved), blocks consisting mainly of large imbedded stones, blocks faced with small pebbles for decorative purposes, and blocks bearing the date and the letters F.C. (presumably the initials of the Finance officer). Someone suggested H.M. " F.C." presumably with the desire to perpetuate the memory of the First Assistant Commissioner for England.

I was intrigued by the home-made tool of a weeder in the nursery ; it consisted of a piece of thick wire shaped like a button-hook.

In another direction we visited an old grist mill, shortly to be occupied with a fruit holding, and then into Manor Wood. To the uninitiated this is a charming spot with its larch, beech and oak and plenty of sunlight to draw up the little oaks from the decayed beech leaves. I gathered that the foresters consider this wood to be a star turn, so that beauty and forestry on commercial lines are not inconsistent. My attention was drawn to old

charcoal hearths and to larch with a one-way bend, useful in the construction of lifeboats.

The rest of the day I spent with those of the party who visited reconstructed houses occupied by forest workers and a number of cottages in various stages of decay which the Assistant Commissioner will no doubt cause to blossom into comfortable homes.

After I had received instruction in the use of the water-divining rod, cut from a thorn bush on the roadside, we had a strenuous walk up and over the hills and down into Tintern. Here I had time to revisit the ruined Abbey which was included with the Tintern Estate, acquired by the State for £49,000, a bargain in view of the revenue already being secured. Apparently there is a ready market for anything which comes out of the woods.

The next morning, after a glance from the eyrie known as " The Watch Pocket " over the Wye and surrounding country, we visited the Sedbury area, where scrub clearing was actively proceeding. The scene of devastation was relieved by the beauty of the wild flowers and the groups of ancient yews, which are to be left standing. On the way down the glen I saw as I thought two boys below enjoying themselves with boxes of matches firing heaps of " slash." On approaching I realised that they were the Assistant Commissioner and Divisional Officer. The Costing Return " Prep. ground (Labour and Materials only) " may consequently disclose a high figure for this area !

Among other " things seen " was Turnips Grove, which ought to have been a failure but which carries a most successful crop in spite of the fact that it was not weeded after the first year and sheep browsed there. After planting was complete it was discovered that the Grove was not the Commission's property ; it has since been acquired.

Wandering up a squadgy ditch and discussing the advantages in " the field " of plus fours over trousers, we saw a bargain lot of timber being cleared at profiteer prices, and further on a plantation of spruce with poplar standards.

Passing a cleaning gang and a trapper at work, we came to " White Walls," which will be a more extensive holding than is usual, and " The Chase," with an adjacent nursery which will revert to a holding.

A beautiful walk down hill through a mixed wood over an alleged Roman bridge and then over the Wye brought us back to Tintern ; the visit ended at the Turnery works, where chair legs were being made out of rough bits of wood at the rate of 50 seconds per leg.

BUILDINGS FOR FOREST WORKERS' HOLDINGS.

By R. G. FORBES.

In any scheme for the provision of forest workers' holdings it is of paramount importance that the necessary accommodation be provided at a minimum of cost. To this end it is desirable to take full advantage of all existing structures with a view to economy on external walls, etc. Plans should be on simple lines avoiding projections on wall surfaces and complicated roofs, and preference should be given to materials obtainable locally to reduce transport costs.

Where existing houses or buildings are not available the siting of houses or holdings will be largely governed by the requirements of the afforestation schemes, the forest workers being located as near as possible to their work and where they can command a good view for forest protection. Preference should be given to a site where a good water supply is conveniently available. As a rule it will be found that transport costs will be heavy but unavoidable where the foregoing conditions are complied with. In any case the site selected should be on a hard road and it is important to build as near as possible to the road.

Where several similar houses or holdings are being erected at one time and contiguous to one another it may be possible to obtain a firm contract for the whole of the work on advantageous terms. As a general rule, however, more economical results have been obtained by a system of purchasing the materials and letting the labour to skilled tradesmen. The labour contractor is made liable for all insurances and makes his own arrangements for obtaining assistance and can thus take advantage of local unskilled or semi-skilled labour for work not requiring skilled labour.

Where aggregate is available and a concrete mixer could be provided $4\frac{1}{2}$-inch concrete blocks provide the most economical medium for walling. With very little training unskilled labour can be utilized for making the blocks and for building. Where bricks are readily obtainable a compromise may be effected with $4\frac{1}{2}$-inch external brickwork, a cavity and 3-inch coke breeze or sawdust block internal lining. The coke breeze or sawdust blocks can be made on the site or at a convenient centre.

Cement, floor framings, flooring, doors, windows, grates and other fittings can be provided at considerably reduced cost if obtained in bulk, under contract, from builders' merchants, tenders being obtained on a competitive basis. The provision of ready made doors, windows, etc., reduces the amount of skilled labour to be provided on isolated sites. In order to avoid work coming to a standstill owing to bad weather and frost it is an advantage if the carcases and roof be proceeded with first so that when the weather conditions are bad, there is work under cover available. A little forethought in this way reduces cost considerably.

In order to obtain the full benefit of this system of purchasing, it is desirable to obtain tenders for as great a bulk as possible, and to this end it is advisable, as far as practicable, to budget some time ahead and obtain the tenders accordingly. In like manner by obtaining labour contracts for a series of buildings in any area tradesmen will be found willing to quote reduced prices.

Where suitable timber is available in the Commission's forests it can be utilised for scantlings with considerable saving in cost, and has been found quite satisfactory.

Waste in timber can be avoided by care in ordering to correct lengths all timber required for framings. The adoption of standard sizes for doors and windows simplifies building and further tends to reduce initial cost.

For the floors of the living room and scullery a concrete finish with cement rendering tinted with red oxide is found very satisfactory. For other floors in the case of bungalows, red deal flooring laid on bitumen and nailed to battens bedded in concrete is recommended.

Roofs can be most economically covered with an asbestos slate which is light, does not require heavy timbers and can be fixed by comparatively unskilled labour. "Double" asbestos roofing is preferable, though the cost is about one-third more than the "single" diamond pattern.

The accompanying sketch A illustrates a forest worker's cottage built at an all-in cost of £330, summarised as follows :—

		At			
		s.	d.	£	s.	d.
1	3-ft. oven and closed range (cottage)	—		1	19	0
1	3-ft. hob register	—		1	5	6
2	20-ft. registered grates for bedrooms	15	6	1	11	0
1	9-in. gall. copper with grate, etc., complete	—		0	15	3
1	E.C. pail	—		0	4	9
1	24-in. × 18-in. × 6-in. sink, plug and waste complete...	—		1	4	0
24	2-ft. 3-in. glazed stoneware socketted pipes, first quality	1	3½	1	11	0
1	Gulley trap and grating	—		0	7	3
5	18-in. chimney pots	2	6	0	12	6
5	Rim latches, complete with furniture	1	10	0	9	2
2	Rim locks complete and furniture	2	9	0	5	6
6	Suffolk latches and catch...	0	9	0	4	6
8	Cockspur fasteners, complete with screws	0	4¾	0	3	2
8	Casement stays and pins	0	6½	0	4	4
100	ft. sup. 21-oz. glass, cut to sizes	0	4½	1	17	6
2	stones of putty ... ... per cwt.	17	6	0	4	5
20	6-ft. lengths of O.G. guttering	3	8	3	13	4
4	Angles for O.G. guttering	2	0	0	8	0
2	Outlets for O.G. guttering	2	0	0	4	0
2	6-ft. outlets for 2½-in. downpipe	4	4	0	8	8
2	Swannecks for O.G. guttering, with nails	3	0	0	6	0
2	Shoes for O.G. guttering, with nails	1	9	0	3	6
40	Fascia brackets	0	2½	0	8	4
24	Gutter bolts ... ... doz.	0	4	0	0	8
6	pairs 3½-in. butt hinges and screws	1	0	0	6	0
8	pairs 2-in. butt hinges and screws	0	6	0	4	0
6	pairs 20-in. T-hinges	2	0	0	12	0
3	lbs. red lead	0	8	0	2	0
7	lbs. red oxide	1	4	0	9	4
1	gall. linseed oil	—		0	4	6
1	gall. turps.	—		0	6	6
14	lbs. floor brads	0	3	0	3	6
14	lbs. 1½-in. oval wire nails	0	4	0	4	8
14	lbs. 2-in. cut nails	0	3	0	3	6
	Carried forward ...			21	7	4

		At s. d.	£ s. d.
	Brought forward ...	—	21 7 4
14 lbs.	3-in. round wire nails	0 3	0 3 6
28 lbs.	4-in. round wire nails	0 3	0 7 0
1 cwt.	distemper in two colours	—	1 15 0
28 lbs.	white paint	0 6	1 8 0
28 lbs.	chocolate paint		
12	cast ventilators, 9-in. × 3-in.	0 8	0 8 0
2 tons	cement	66 6	6 13 0
2 tons	lime	25 6	2 11 0
2 tons	sand	10 0	1 0 0
12,000	bricks	65 0	39 0 0
110	yds. sup. coke breeze slabs and ties (delivered rail-head, per yd.)	2 9	15 2 6
1,000	asbestos slates, 15¾-in. × 15¾-in.	—	14 2 6
1,000	copper rivets for ditto	—	0 17 6
100 ft. run	asbestos coping	0 11	4 11 8
20 yds.	sup. corr. asbestos sheetings, screws and washers...	2 7	2 11 8
90 ft. run	5 in. × 3 in. best red deal	0 $3\frac{3}{4}$	1 8 2
200 ft. run	4 in. × 3 in. ditto	0 $2\frac{3}{4}$	2 5 10
900 ft. run	4 in. × 2 in. ditto	0 $1\frac{3}{4}$	6 11 3
172 ft. run	3 in. × 2 in. ditto ... ... per 100 ft.	11 6	0 19 10
300 ft. run	2 in. × 2 in. ditto ... ... ,,	8 6	1 5 6
8 ft. squares	4-ft. run, 3-ply.	12 0	4 16 0
600 ft. run	plain moulding ... ... per 100 ft.	7 0	2 2 0
178 ft. run	plain picture moulding ... ... ,,	8 6	0 15 2
300 ft. run	architrave ... ... ,,	10 0	1 10 0
100 ft. run	4 in. × 3 in. planed door jambs...	0 4	1 13 4
100 ft. run	3 in. × 2 in. ditto ... ... per 100 ft.	14 6	0 14 6
100 ft. run	4 in. × 3 in. ditto window frame	0 4	1 13 4
1,000 ft. run.	2 in. × ¾ in. lath, creosoted ... per 100 ft.	4 0	2 0 0
126 ft. run	4 in. × 2 in. eaves lath, creosoted ,,	12 0	0 15 3
400 ft. run.	4 in. × 3 in. bevel floor battens, creosoted ...	0 3	5 0 0
8 squares	1-in. plain red flooring	23 0	9 4 0
2 squares	⅞-in. red matching, T. and G.	25 0	2 10 0
100 ft. run	7 in. × 1½ in. bracing	0 $2\frac{1}{2}$	1 0 10
5	1½-in. panel doors, 6 ft. 6 in. × 2 ft. 6 in.	15 0	3 15 0
1	2-in. ditto, 6 ft. 8 in. × 2 ft. 8 in.	25 0	1 5 0
120 ft. run	window style, 2 in. × 1¾ in. ... per 100 ft.	12 6	0 15 0
30 ft. run	window rail (bottom), 3½ in. × 1¾ in. ,,	17 6	0 5 3
50 ft. run	sash bar ... ... ,,	8 3	0 4 2
200 ft. run	7 in. × 1 in. skirting ... ... ,,	16 0	1 12 0
200 ft. run	7 in. × 1 in. fascia ... ... ,,	15 0	1 10 0
80 ft. run	9 in. × 1½ in. ridge and hips ... ,,	0 $3\frac{1}{2}$	1 3 4
	Pitch, tar and bitumen	—	1 6 7
			£170 0 0
	Labour Contract	—	150 0 0
	Hauling	—	10 0 0
	TOTAL ...	—	£330 0 0

Sketch B illustrates a forest worker's bungalow built to a similar specification. This type has been erected at a cost of £200.

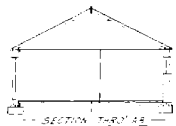
Sketch C illustrates a forester's bungalow, also of similar specification, but making provision for a bath, w.c., and soft water storage. This is estimated to cost £350.

—TINTERN—

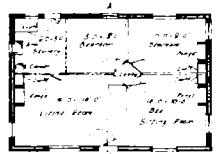
FOREST WORKERS HOLDING BUNGALOW

PLAN B

— ELEVATION —



— SECTION THRU AB —

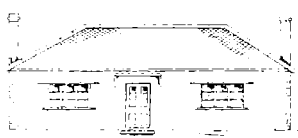


— PLAN —

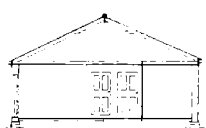
—MARGAM—

FOREST WORKERS HOLDING BUNGALOW

PLAN A



— ELEVATION —



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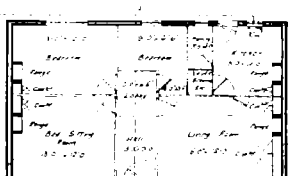

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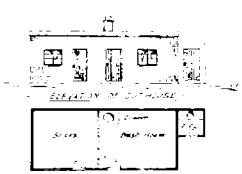


— PLAN —

—GLANGWILI—

FORESTERS BUNGALOW

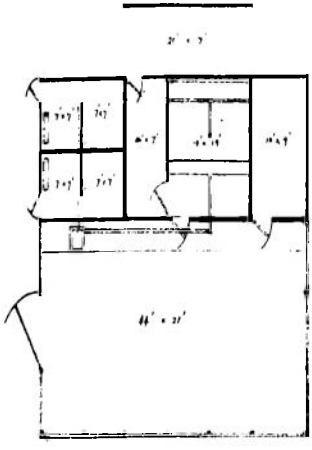
PLAN C

— ELEVATION —

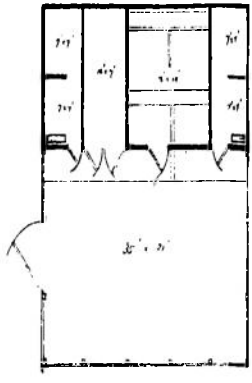
— SECTION THRU AB —

— PLAN —

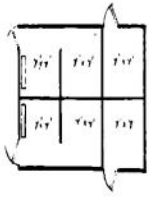
BUILDINGS FOR FOREST WORKERS HOLDINGS.



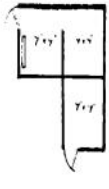
Plan **D** -



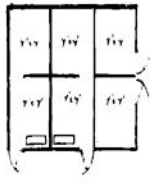
Plan **E** -



Plan **F** -



Plan **G** ~



Plan **H** -

Buildings.

The accompanying sketches D, E, F, G, H illustrate buildings suitable for various types of holdings. These can be constructed with advantage as follows :—

Concrete floors with open channels for cowshed and pigsties and boarded platform for pigs-cots. Drainage from cowshed and pigsties by open channels to small sump.

Walls built with $4\frac{1}{2}$-inch concrete base walls, deal framing over, and covered with square-edged (country cut) boarding fixed vertically with $\frac{1}{2}$-inch strips over joints.

Roofs covered with corrugated asbestos sheeting on purlins.

Mangers of elm boarding and oak posts, or with concrete base 6 inches thick, 2 feet wide, and 12 inches by $1\frac{1}{2}$ inches elm front board fixed to back of manger posts.

Doors of the same material as walls hung with strap hinges and fitted with plain latches.

Windows of hit-and-miss pattern with fixed light over.

The main item of expense is the creosoted boarding, which costs 29*s.* per square. This cost can be reduced considerably by using boarding from the Commission's own saw mills and tarring or creosoting *in situ.* Other materials also are often procurable in various localities, including "scouts" (square-edged) from railway sleeper works and obtainable in one area at 12*s.* per square, and dunnage boarding from ships, generally obtainable at very low rates.

Buildings similar to those illustrated have been provided at the following costs :—

Sketch.	Materials.	Labour.	Total.
	£	£	£
D	45	25	70
E	40	20	60
F	20	10	30
G	15	5	20
H	20	10	30

THE IMMEDIATE CONTROL OF OPERATIONS.

By C. E. L. Fairchild.

This is a vast subject on which reams could be written, but, on account of my own limitations, the fact that other officers may require a few pages of the Journal and the patience of my readers, I will endeavour to condense it as much as possible.

I propose to treat the subject under a few heads, commencing with :—

Maps.—The first point that is of importance in "control" is to get one's own and the forester's maps compartmented, at least as far as the next season's planting is concerned. Extraction routes and inspection paths are first planned out, and these are used as far as possible for compartment boundaries.

Control is rendered vastly easier if a map is well laid out, and if areas of compartments are entered on it. It assists not only in the allocation of labour, but also in keeping a check on the amount of work done. It also helps the forester in obtaining his areas for progress reports, piece-work rates, etc.

Preparation of Ground.—The next step is to go over the area carefully, accompanied by the forester, and to mark out on the ground any extraction routes or compartment boundaries which are likely to prove difficult to fix accurately.

The preparation of ground required can be discussed with the forester, noting which parts can be prepared by piece-work, on account of their regularity, and which parts will have to be prepared by day-work. The time the different parts will take to complete can be arrived at, and thus the number of men needed may be calculated.

Fencing.—The fencing is discussed and a note made of the amount of material on the ground that can be used for making stakes. As a rule, before preparation of ground is begun, men are sent in to cut and prepare this material.

The line of fence and the type are marked on the maps, any uncertain points marked on the ground, and places where gates or stiles will be required are also indicated.

The piece-work rates for each type of fence are fixed, and also the rates for preparation of stakes and haulage, and the date by which the fence should be finished is arranged.

Arrangements are made as to when the wire may be expected, in order that the forester will know how he stands. No fence is passed as completed until it has been carefully inspected for gaps beneath the wire, loose stakes, and the height near banks, etc.

Drainage.—This is also examined with the forester and the system of main drains marked out on the ground with pegs. These are cut out as quickly as possible, and on the next visit a system of cut-off and subsidiary drains is laid out. From time to time further drains are added in those places which are still wet or unaffected by the previous work.

Piece-work rates are fixed and new methods to cheapen costs are tried on different areas. It often stimulates the men if rival gangs are made up and their work compared as to neatness and speed.

Planting.—Selection of species is carried out on the ground in accordance with Divisional Officers' policy, and the boundaries for each marked on the map. The species and planting line are then checked by the Divisional Officer and, after final approval, a planting map or tracing is marked out for the forester's use. Compartment and species boundaries are marked in different colours, species and spacing are entered, and extraction routes and areas. Inspection paths can often be run along species boundaries. The forester is shown on the ground these boundaries.

The planting area being known, the acreage per week to be done is calculated and the number of men required arranged with the forester. This weekly acreage can be checked from progress reports and from these also the number of plants used can be checked.

Dates are arranged as far as possible on which the forester will receive his consignments of plants. As haulage is often a difficulty in these mountain areas, with early knowledge of arrival of plants, he can arrange his haulage well in advance. From a perusal of progress reports it can be seen how the plant supply stands and arrangements can be made in good time.

One point that has been found of importance is to calculate the number of men who will be necessary to deal with the main planting area, to select these men, and to let them carry on steadily at the same work. Two or three extra men can generally be added, if necessary, to do other jobs or to speed the planting if it is not keeping up to the estimate, and if it is necessary to plant an additional area at the last minute it causes no disturbance, as the area is treated as quite distinct and the necessary additional staff to cope with it is engaged and kept separate.

There are several important operations that have not been discussed, such as nursery work, weeding and thinning, beating-up, etc., but the control of these can be compared with that of the operations outlined above.

Financial and Piece-work Rates.—Cash, payments to men, insurance cards, stores and produce are checked at varying intervals, and as a note of the balances at the end of each month and of all imprests is received from the Divisional Office, a complete check can be made.

Piece-work rates are generally fixed in consultation with the forester. A fair rate, as far as can be judged, is settled, but in the first case on the low side, as it is more difficult to reduce rates, once fixed, than to increase them if it is found necessary to do so. The forester then notes what the men earn the first few days as compared with day-work, and the necessary adjustment of the piece-work rate can be made, but there are certain special points that must be taken into consideration. If it is work to which the men are unaccustomed, the first week or so is of little guide. At one forest, for instance, where twelve months ago the conversion of standing oak into stakes cost 4*d.* each, now that the men have grown

accustomed to handling an axe the cost has been reduced to 1*d*.–1½*d*. per stake, and the men still make good wages.

Another point of importance in fixing piece-work rates is the weather. In these parts of the country where the rainfall is high and bad weather expected for prolonged periods, lost time is an important factor and must be carefully considered in deciding piece-work rates, especially during the planting season.

Frosty Weather, etc.—All men taken on in the winter months are given to understand that they are being employed for a certain job, *e.g.* planting, and that if the planting is held up we cannot undertake to find other work for them. With regard to regular workmen and men who have been employed throughout the summer, these are on a different footing, and arrangements are made to provide work for them, as far as possible, during prolonged periods of frost or snow. Odd days and ordinary bad weather are, of course, allowed for in the piece-work rates. As a rule, work is planned for six months ahead, and in the spring and summer when staffs are at their lowest, they are purposely kept down so that, at the commencement of planting, a proportion of preparation of ground, preparation of stakes, fencing, etc., is left over in the most sheltered parts of the area to tide the men over these difficult times.

Further methods of control are (1) by visits, (2) by progress reports. These are the two chief ways by which information is gained as to how the work is progressing, how the staff is keeping to its fixed hours, how costs are working out, and how economies and improvements can be effected.

If a notebook is kept for each forest and notes are made of things that crop up between visits, improvements that have been thought out, and of points that are noted on visits, it can be constantly referred to. Instructions or points noted are given to the foresters. In matters of importance the forester should keep a notebook in which to write the instructions. On the next visit it can be seen how far these have been attended to, and any matters still outstanding or incompleted can be carried forward. The forester should also note in his book any points which he wished to put before the District Officer at his next inspection.

With regard to progress reports and pay sheets, a close study of these is of the utmost importance and gives the information required as to areas covered and the amounts of work done. From this one can reckon how much still remains to be completed. Costs of operations, the actual number of plants planted, can be checked with the original estimate of plants required, and thus shortages or losses can easily be noted. It can be seen, too, whether the work requires speeding up or the staff requires reducing. The amounts spent on the different operations can be checked with the expenditure estimates, and the forester warned in good time that there is only a certain sum left to finish certain work.

From pay sheets and summary sheets, the way piece-work rates are working out, and whether they are satisfactory or otherwise can be seen, absences can be noted and excessive time spent on any operation. In fact, there is so much information to be gleaned from an intelligent

study of the fortnightly sheets that it is impossible to outline more than the fringe, as is done in the above summary.

From the foregoing short notes it can be seen that if a District Officer is to be responsible to his Divisional Officer for control of operations, he must give very detailed instructions to his foresters, and he must be cognisant of every detail to an extent which can only be achieved if, *inter alia*, the pay sheets, time sheets, progress reports, haulage bills, etc., pass through his hands.

THE IMMEDIATE CONTROL OF OPERATIONS.

By A. H. H. Ross.

Several articles which have appeared in the *Journal* of recent years have dealt with the work of the District Officers, and in the following notes the subject will be again pursued with especial reference to the immediate control of operations.

This duty falls chiefly upon the shoulders of the District Officer, and on the method or lack of method with which it is executed depends to a great extent the efficiency of the various forests under his charge, and, in addition, the amount of extra time which he has to devote to other important duties such as, for example, working plans, acquisitions, experiments and the hundred and one details connected with forest workers' holdings.

As the present writer has discovered during the course of his short experience, it is easy to get into the way of making a full-time job of the control of operations at the expense of other works of which examples have just been given. This does not necessarily result in a commensurate increase in the efficiency of the operations, and may indeed have the opposite effect.

The matter is one that demands the striking of the happy mean, and in doing so the District Officer must give due weight to several considerations. First, a District Officer is directly responsible for the efficient carrying out of every operation in all the forests under his charge : then, although his subsidiary duties are essential and important, there is no question but that the work of preparation, planting, maintenance of plantations and in the nursery is of the most vital importance.

These matters have a prior claim before all others on the time of District Officers, foresters and foremen. Much of this work, however, the District Officer should be able to entrust to his foresters, and it should be his endeavour so to train them that on his having gone thoroughly into the matter of work to be done with the foresters on the ground during his visits he may confidently leave them to carry out his instructions during his absence.

The frequency of his visits to any one area largely depends on the amount and importance or intricacy of the work to be done and on the number of different operations being carried out at the same time.

The matter would, of course, be much simplified were it possible to concentrate on one operation until it was complete and then to switch all one's labour on to another operation, but forestry work by its very nature seldom permits of this being done.

The effective control of operations depends to a great extent on the arrangements which the District Officer makes with his foresters for the sequence of operations and the size of the gangs to be employed on each work.

A fair test for the necessity of a visit to any forest can be made by the District Officer asking himself :—

(*a*) Can I say with a fair degree of accuracy what work is being done, how many men are employed on it, and to what stage it has progressed ?

(*b*) Am I sure that my instructions to the forester are being correctly interpreted ?

(*c*) Am I satisfied that the forester knows exactly how to proceed in the meantime ?

Should the answers to any of these questions be in the negative it is time for another visit, unless, of course, the matter can be dealt with effectively by letter.

The question of the duration of visits to forest units is one that must depend on circumstances, *e.g.* on the size of the area, the amount of work in progress and the distance from one's station. In the case of the writer's district the areas are with one exception grouped within a radius of about 20 miles from his station, and with the indispensable assistance of a car any of them can be visited within one day.

Apart altogether from the inadvisability of too frequent visits to any one forest on the grounds of economy of time and travelling expenses, this procedure tends to lessen the forester's initiative and makes him more dependent on the District Officer. In certain cases also it possibly tends to lessen the respect in which the forester is held by his subordinates and so lowers the standard of discipline. This should be avoided at all costs if only in fairness to the forester, who, being in direct touch with his labour, depends for the success of his work on the goodwill and ready discipline of his men.

During his visit to a forest the District Officer will usually go into all the current work and will instruct the forester in what is to be done during the ensuing few weeks. His instructions will be as clear and concise as possible and are all the better for being confirmed in writing as soon as may be. This, while helping to relieve the forester's memory from overstrain, provides the District Officer with a record, in the shape of copies of his letters, which will be useful to refer to on the occasion of his next visit.

When visiting an area the writer has often gained a useful insight into methods employed, especially in the case of planting, by watching gangs at work from a distance. Slip-shod and incorrect methods of planting can be noticed in this way and subsequently checked. On the other hand, if the men are conscious of being watched, as is the case when their work is viewed from close quarters, they naturally take special pains to do it right, only to relax again when one's back is turned.

There are probably no two men participating in this business of forestry who have quite the same ideas about how to do a given piece of work. Each man has his own opinions, and rightly so, provided they are tempered with reason.

To take an extreme example, one forester if instructed to prepare a scrub area for planting and left to work out his own salvation, might leave it, plantable perhaps, but with the ground littered with unburnt lop and top and crooked branches, which would make weeding a most difficult and expensive operation, likely in the long run to cost several times more than the amount which would have been required to leave the ground reasonably clean and tidy.

Another forester, observing a counsel of perfection and certainly taking a pride in his work, will, with the help of axes, saws, billhooks, fire and tushing, leave the area in such a condition as would cause the fairways of sundry golf courses to turn green with envy.

Both foresters think they are doing right and both are wrong. The former, in his laudable zeal to save money, merely creates conditions necessitating increased expenditure: the latter, keen to do the job thoroughly, overdoes it.

The above illustration serves to emphasise the need for consideration of the economic aspect when embarking on nearly every kind of operation, and of vigilant control by District Officer and forester.

Then, again, owing perhaps to lack of forethought or to sudden severe weather conditions, a large gang of men is brought off its normal work and put, for example, into the nursery or on to draining work where there is room for only a very few men to work efficiently. If the men are on day-work this is sure to result in very high costs; if on piece-work the result is low wages and discontent. In both cases the work is likely to be bad. Such misadventures will only be obviated by careful organisation.

A matter requiring forethought and control during the planting season is the supply of plants, so that, with due allowance for severe weather and other emergencies, forests may be assured of a steady supply enabling planting or lining-out to continue unchecked and at the same time avoiding the necessity of having plants heeled in for long periods. In ordering plants the District Officer would also have regard to the seasons best suited for planting various species; for instance, he would usually make sure of regulating his supplies of Corsican pine and larch so that they were lined-out or planted before the end of February.

Both in intensity and scope the work of a District Officer grows year by year, and if he is to keep pace it must be by a process of devolution. But here, again, we find the forester saddled with increasing duties. Returns slowly but surely multiply in number and threaten to restrict the time he should spend out in the forest. The necessity of having in all large units a capable and responsible subordinate staff of foremen and gangers thus becomes more and more important.

Should suitable men not be forthcoming for appointment in these grades the work of the forester is greatly handicapped. It would therefore appear that, in order to obtain the greatest efficiency in the control of operations, every effort should be made to build up a subordinate staff capable of meeting present and future requirements.

In addition to the task of putting into effect the programme of work laid down by his Divisional Officer, the District Officer has other duties intimately connected with the control of operations, which include the checking of nursery returns and of stores, the keeping of maps and records up to date, and the endeavour to make ends meet when money is short and operations not correspondingly cheaper. However, as space does not permit of the elaboration of such matters, it is hoped that the foregoing notes, though of a general nature, may serve to recall to our minds a few problems on which thought expended is thought well spent.

DUTIES OF A DISTRICT OFFICER.

By G. B. Ryle.

Mr. de Uphaugh's letter in the last issue of the Commission's Journal opens up a wide field for controversy, and at present the position of the District Officer in the general scheme of working in the Service is perhaps less well defined than any other grade.

If the District Officer's function is merely to point out his mistakes to the forester, on the one hand, and to receive instructions from his Divisional Officer on the other hand, then we may start straight away with another "economy axe" and abolish the rank altogether; for with competent foresters the number of mistakes made is reduced to the minimum; the Divisional Officers can quite as easily instruct the foresters direct, and the foresters for their part can correspond direct with their Divisional Officers.

Naturally the conditions vary a good deal from one Division to another and according to the amount of responsibility which can be placed on the shoulders of a more or less recently-appointed District Officer; but everywhere it is found that the exact status of the man in his District is somewhat vaguely defined. One Divisional Officer will say that his District Officers are in charge of definite forests only, and any time spent outside of them, unless actually doing acquisition surveys, is wasted. He may even consider acquisitions to be outside the sphere of the District Officer. In other words, he likes to make his District Officers into glorified head foresters, and he presumes (or even hopes) that his foresters are merely "dumb, driven cattle."

We, on the other hand, prefer to think that a forester is capable of carrying on indefinitely on his own with the minimum of outside assistance. A District Officer must certainly know his forests inside out and he must know precisely what work wants doing, not only immediately but for some years to come. He should, in fact, be responsible in every way for the smooth running of each forest in his District. He should be prepared and expect to take the blame for any mistakes made. But beyond all this—which in itself entails plenty of work—the District Officer should know something about all the country and especially the wooded and plantable land throughout the whole of his area. Grant Schemes are of value in this respect, and they are good means of getting to hear of ground which may be coming into the market. A nodding acquaintance with the landed gentry and their agents, factors and foresters is valuable, though too friendly relations with some of them have been known to lead to difficulties (especially is this the case with sporting tenants).

In short, he should consider the forests in his district not as a number of isolated units each to be treated on its own merits, but as one scattered whole to be worked so far as possible as a self-contained group and with possibilities of steady expansion.

It is the nature of all men to consider their boss to be the man from whom they draw their pay. To the labourers the boss is the forester; to most foresters the boss is the Divisional Officer and the poor District

Officer is left on the shelf. Until District Officers are entrusted with some measure of financial responsibility for the areas in their Districts this state of affairs is bound to continue.

Every Divisional Officer keeps calling out for additional office assistance. Why not give this extra clerical assistance to the District Officers and relieve the Divisional headquarters of a great part of their work? Of course, to give every District Officer a clerical assistant would involve too great an increase in the staff, but the senior men, who are in more or less complete charge of their Districts, could, with one clerk, relieve the Divisional Officers of a great burden and, moreover, could save a good deal of repetition and duplicated correspondence.

SOME PROBLEMS IN LAND ACQUISITION.

By L. A. Newton.

In the last number of the Commission's Journal there appeared an article giving "Some Impressions on Land Acquisition" from the pen of one of the officers concerned with acquisition in England and Wales. It may not be inopportune for that officer's colleague in Scotland to add his own observations on similar problems as they appear in the northern kingdom.

While much that Mr. Wynne Jones has written applies equally throughout Great Britain, there are certain features in the problem of acquisition in Scotland which, it is submitted, make it a more difficult one than in England and Wales. How far this is caused by tendencies in the Scottish character is not for an Englishman resident in Scotland to define. But this he may say: The Scotsman generally expects a bargain, and a bargain often means the realisation of one's own advantage rather than its strict sense of an equal exchange of *quid pro quo*.

In the second place, rural land in Scotland appears to have a definitely higher market value than similar land in the South. This is possibly due to the fact that there is less of it, possibly to a greater love of ownership in Scotland, possibly to a more intensive utilisation resulting in a higher economic return. A cup of water in the desert may be worth more than a bumper of Heidsieck at the Ritz. Whatever the reason, it is undoubtedly true that land of equal afforestation value has a markedly different market value in the two countries. Rough hill grazings in the South of Scotland will often fetch rents of six, seven, or even eight shillings per annum to the acre.

Coupled with this higher value there is often no very marked desire to sell. It is true that estates are constantly in the market, but they are very frequently withdrawn owing to insufficient bidding.

The sporting values are high. Scotland has been in the past, and to some extent still is, the Englishman's (and the American's) playground. A Highland chieftain once bitterly complained at a public meeting of the exorbitant railway charges which were robbing the local Lairds of their legitimate prey. With the high rents that are obtainable for sporting properties, the rates which the Commission are empowered to offer will often be unattractive to the owner.

Efforts can often be made, and constantly are made, to persuade the proprietor that his shooting will not seriously be curtailed by the planting of trees. He is usually, however, mightily suspicious, and it is probable that a deliberate and not always scrupulously fair campaign is sometimes set afoot to show that the Commission's activities do definitely lead to destruction of sporting values. Incidentally it may be remarked that foresters and forest officers, who are concerned for the expansion of the Commission's work, cannot be too careful to avoid giving grounds for malicious statements of this kind.

Setting aside for a moment the shooting values, which present difficulties—it is true—but difficulties by no means insurmountable, we may

turn next to the sheep walks which in Scotland provide the areas on which the planter turns his most envious eye. It has been stated that the best of these obtain rents out of reach altogether of the forester's purse. There are, however, many poorer grazings which let for three or four shillings. These, unfortunately, frequently include a considerable acreage of inferior peat land, and the price per *plantable* acre often again surmounts the figure which is economic from a forestry point of view. There are, indeed, rare cases where for some combination of reasons a sheep farm falls within the Commission's limit; where the land is right, where the price is right, where every prospect pleases, and yet there remains something that is vile. For what can be more vile than acclimatisation values tacked on to so-called "market values." These "values," whatever their origin, are now a convention by which an incoming farmer is compelled to pay for every ewe and lamb anything from seven and sixpence ("market value" only) to thirty shillings (including acclimatisation value) more than he could get if selling the stock in the market.

The inquisitors who fix the values are sheep owners whose whole interest is to keep the sheep stock value high, and who attach to "market value" not what the term in its simplicity means but the conventional sense of an exorbitant seller's "bargain."

Complaint is idle; the fact remains a standing discouragement to the forester who would acquire a sheep farm for afforestation purposes.

The foregoing remarks may present a somewhat gloomy picture, but they may serve to explain why acquisition does not proceed in Scotland with express train rapidity. At the same time acquisition is steadily progressing, and it is the object of this paper to explore all possible ways of expediting it.

Assuming that present conditions are more or less stable—that is to say, that a sudden collapse in sheep values or the bankruptcy of some big owner is not imminent—there are three or four problematical, not to say controversial, methods of proceeding which ought to at least be examined. These are:-

(1) Compulsory purchase.

(2) The purchase by the State of large estates for breaking up.

(3) The payment of much higher rates for good afforestable land.

(4) The acquisition of poor and doubtful areas with the deliberate object of improvement at pre-recognised high costs.

(5) The acquisition of groups of small areas.

Let us take these in their order. First, the pros and cons of compulsory purchase are perfectly well known and need not here be enumerated. On balance of the considerations the present writer is generally opposed to this method. If it be adopted the land so purchased may be put into classification (3) above for all intents and purposes.

The second method involves heavy risks, and it calls for great application and skill on the part of the officers responsible for estate management. The method might in some cases meet with triumphant success and in others with heavy expense, of which the recovery might be unduly delayed.

While the G.B.P. (Great British Public) would pass over the triumphs in satisfied ignorance, their more vocal representatives would wax noisy over the delayed recoveries. This method is actually practised at present to a limited extent and hitherto with success. The authorities might consider whether greater risks may be taken.

The question of the payment of much higher rates for good forest land is largely a question for our actuaries and statisticians. Two things only need be here emphasised. First, on really good land early returns on short rotations, with probably improved prices combined with less costly formation, should justify fairly high land costs. Secondly, no statistician working on purely financial yields has traversed the whole question when he omits the immense value of rural employment and re-population.

The fourth method, that of the acquisition of poor and doubtful lands, is one that has been attempted with more courage in other countries than in our own. This is not to say that bad land has never been acquired in the past. Many of us know very well that it has. But it was not acquired with the eyes fully open and with the deliberate intention of spending money on its improvement. While Divisional Officers are primarily, secondarily, and ultimately responsible that acquired land shall carry good crops, their natural and inevitable tendency is to refuse to recommend any land that they do not feel to be comparatively easily afforestable. If the Commissioners are willing to include the improvement of land for the ultimate production of forests within their sphere of operations, they might advise Divisional Officers that they may recommend "C 3" land on the understanding that preliminary heavy cultural operations should result in eventual afforestation, even if delayed till the second rotation. The costs of preparation when averaged over both good and bad land might not after all be found to be prohibitive. At present Divisional Officers simply refuse to recommend any land that is not fairly promising and, with their existing responsibilities, they are probably right.

Lastly, we come to the method of acquisition by small areas. The duty of planting up small areas primarily belongs to the landowners. "Can't; Won't"; in either case "Don't" is frequently, though not always, the issue. It would be interesting to enquire how much of the forest land of Great Britain exists in woods of under one hundred acres in extent. The figures are presumably available from the Census Returns. The proportion must be high. If the owner does not plant, even with the State Grant, ought the State itself to take an interest in this necessarily large area of existing or prospective woodland? Hitherto the acquisition of small areas has been definitely discouraged. The writer would put in a plea for reconsideration. In dealing with small areas the troubles of acquisition, formation and tending may be multiplied and the expenses of formation slightly increased. The areas, however, would be of a high standard of productivity or would not be acquired. Divisional Officers do not welcome small acquisitions owing presumably to difficulties of administration. But what do these difficulties amount to? A small area of thirty or forty acres can be fenced, drained and planted by local labour

in a few weeks. It would then be left under the care of a local cottager at a wage of, say, ten shillings a week. His duties would be to keep up fences and kill any odd rabbits, occasionally to walk through the plantation and report to the forester, who must be resident within ten miles, if anything unusual is observed. The forester himself would visit the plantation once or twice a week. There will, of course, be risks, but not much more so than in a big forest area with a resident forester. In fact the fire risk would actually be less.

The acquisition of a number of small areas in one locality would provide a forester's charge. Their very dissemination adds to the amenities of the district and increases the rustic interest in forestry generally. Such areas are not difficult of acquisition at moderate rates and in the aggregate might amount to a substantial total. The existence of woods of small area is traditional to the country side. Farmers like them; sportsmen like them.

When large areas are not available it is submitted that small areas should be taken. Half a loaf is better than no bread.

ATTITUDE OF THE POPULACE IN WALES TOWARDS THE COMMISSION'S OPERATIONS.

By C. E. L. Fairchild.

I have been asked to write a short article on the attitude of the inhabitants in Wales towards the operations of the Forestry Commission.

We may take the farmers first, as in most cases they are the holders of the land suitable for our purpose. Their attitude varies. If they wish to sell, then there is no limit to the glowing accounts they give of the land and its usefulness to the Forestry Commission. If they do not wish to sell, it appears that the best sheep walks in Wales are being taken, while arguments are frequently advanced to the effect that trees will never grow in those areas. Particularly is this the feeling round the Kerry Forest district. This forest lies on the borders of England and Wales; consequently the inhabitants are either members of the English or the Welsh clique, and people who have been there as long as twenty years are still looked upon as strangers and newcomers. In this district, when the different cliques are tired of abusing each other, both sets turn with relief to the Forestry Commission.

Statements of the above character are made even where fully two-thirds of the area was woodland ten years ago and where the old woodland which the farmers themselves have acquired has not been cleared, but has been left feet deep in lop and top and gorse.

Another familiar complaint is that the new plantations will harbour foxes. The real root of the matter is that for many years adjoining farms have had free grazing on these areas, which we are now enclosing, thus enabling them to keep large stocks on other people's land. Now that they are restricted to what is their own they are annoyed and at times a few sheep are dropped over the fences for a free night's grazing, gates are left open, and the wires of fences cut or slackened. I am glad to say that these things are now far less frequent, as the people are getting used to us and recognise that we have come to stay.

They think, too, that as the Forestry Commission is connected with the Government, work should be found for all the unemployed of the district.

In other parts of Mid-Wales, among the mountains, farm owners are much more tolerant, but here again the erection of fences is unpopular.

Having been in touch with a good number of the farm owners on acquisition work, perhaps a few remarks on their attitude will not be out of place. One gets used to the ordinary opening moves and expects always to be told that the finest larch in Wales was taken from this land. "You ask so-and-so: he hauled them to the station." So-and-so has probably left the district or has died years ago.

One is always asked a price at least one-half as much again as is expected, and I have often thought that, if one accepted at the first figure mentioned, the sellers would be most disappointed, as there is nothing they like better than a little bargaining when they have the feeling that

they are well on the safe side. (This applies also to tenancy-agreements.—O. J. S.) They invariably insist that the greatest secrecy must be observed and one promises that their wishes will be respected. There is little purpose in this secrecy, however, as here, and doubtless elsewhere, local news spreads more quickly than any conveyed by the wireless; even when on a preliminary visit one knows the matter is already being discussed between those who happen to see one and the others whom they chance to meet, and on return home one is greeted with the remark, "I hear you have bought such-and-such a farm"—that farm is usually the one just inspected.

More seriously, however, the general attitude of the people is in favour of the Forestry Commission. The farmers are quick and understanding, and they recognise that the planting helps many of them to tide over the winter months. Few of our regular workmen leave us, though they know they are quite free to take up any more permanent work that they can get. There is a great amount of unemployment in these sheep-farming and slate-quarrying districts, and one finds plenty of men willing to walk five miles back at night and to cycle much greater distances.

Taking the better-educated classes of people, I have found the great majority in favour of our work. They recognise that it means large amounts of money spent in the neighbourhood, relief of unemployment, and possibly lower rates. They recognise, too, that it is the turning-over of land from mixed-farming to sheep-farming that has reduced and is still reducing the rural populations, and that the reintroduction of intensive management such as under the Commissioners is likely to be a big factor in countering this trend. Many farms which at one time supported five or six large families have now only one shepherd; the evidence is plain in the many ruined farm-houses dotted about the valleys. Again, they are quite ready to acknowledge that the most practicable of the recent schemes of resettlement is the Commission's system of forest workers' holdings.

I am afraid that in places I have rather digressed from my heading, but, to sum up in a few words, I consider that the attitude of the populace of Wales, taken as a whole, is distinctly favourable to the Forestry Commission and its work.

TIMBER PRICES, 1927.

By W. S. FLETCHER.

That there has been more industrial peace and confidence than during the previous year is evident.

Trade has certainly improved a little, but there is no swing to it yet. Although wood is our immediate interest, we look to the revival of the Iron and Steel Trade as our hope for the better conditions in the demand for timber.

We have but just a few lots outstanding unsold. There has been little or no competition for the lots. There has, of course, been a little competition in some cases when the timber was sizeable and good, with the result that oak fetched 1*s.* 8*d.* in the wood, larch 1*s.* 4½*d.*, and ash 3*s.* All this with a haul of several miles to rail.

The demand for oak suitable for wagon scantlings has been fairly good all the year. The price has not been what it should be; in many cases merchants have been selling at very little above pre-war prices. Competition amongst merchants to get orders caused the low prices. Prices have now hardened, and we hear of no cheap selling.

The large quantities of small and medium-sized oak held by the Commission, most of it at its best, is a problem. The limited market for such material, the heavy stocks of similar class stuff held by merchants, and also the large quantity on various estates that owners are willing to sell, makes the marketing difficult. We need a good general demand in the towns for small-sized timber to stir up the general saw miller and merchant, and to reduce the stocks so many of them hold.

A little flutter of excitement was caused by the receipt of a very large enquiry for 9 ins. to 13 ins. q.g. oak, together with a smaller enquiry for a similar specification. For a few days there seemed to be hopes of effecting the sale of 100,000 cubic feet, but the price quoted was too high and no order resulted. An interesting feature we found out was the price delivered. To have had the order we should have got just 4*d.* per foot for the timber, and that subject to inspection.

There is at present just this same position in the town yards as existed a year ago. The average value of oak 9 to 12 ins. q.g. is 1*s.* 6*d.* to 1*s.* 8*d.* in the yards. The railway rate is, say, 6½*d.*, felling and haulage on an average 7½*d.*, which leaves no margin of value for the timber.

We can scarcely hope to reduce these costs. The only possible solution seems to be to convert on the spot or near thereto and so eliminate the haulage cost as much as possible and save the cost of transport on other than the actual timber for use.

In the Dean Forest there has been a considerable improvement in sales: hardwood pitwood to the mines, some considerable cuts of underwood, birch and alder poles for turnery, and quite a respectable-sized sale of small oak timber in three sales. There has also been quite a large sale of big beech timber, some of which will not be delivered until next fall. Prices in each case have been quite fair, and the fact of this

little revival gives hope of better conditions in an area hard hit by the industrial troubles of the past.

From the New Forest there has been some good sales of Scots pine timber, and the prices obtained, 8*d.* and 8½*d.*, are considered quite good.

Unable to secure a satisfactory tender from merchants, we have been compelled to break new ground and sell to consumers. This has resulted in some quite good sales and an increase of some importance in the income from this source.

High railway rates and costly extraction prevent us making sales from Mortimer as we could wish, but we hope for a better market for the wood ready to sell.

Several sales have been made of Scots pine pitwood, with some hardwood, to the Bristol and Radstock coalfield. This has meant fresh ground and has been a profitable movement.

So much for our own activities. The position of dealers in timber, North, South, East and West, has not been a very happy one. There has not been the amount of business to prove that there is in the native timber trade a healthy industry in our midst.

There are always to be found favoured localities, as well as some favoured stocks of timber. There have ever been good timber merchants and some, well, not so good. We can allow for peculiarities even for the man who said he would not look at it if he could have it for getting it out.

We can quite understand that it is easier in these days to complain of bad trade and conditions generally than to be at all ready to purchase. It might mean a penny off. It is so natural to see all the bad places and speak of them when offered a parcel of very ordinary oak logs. And it is human to keep quiet about the swings that are paying and tell of the roundabouts that are losing money every minute. The truth, however, remains that we feel more hopeful—industrial conditions being more settled, demand a little brighter, and stocks a good bit less at the yards.

TIMBER PRICES, 1927: DIVISION 1.

By A. D. Hopkinson.

It may be said generally that business in home-grown timber is quiet at present. The greatest proportion of the conifer timber is consumed in the collieries, and at present they are not working to anything like their full capacity, and the tendency is to close down more and more seams rather than to open up fresh ones. This depressed condition of the main industry reacts upon all other industries in the district, with the result that money is scarce and business difficult. The only bright point is the improving condition of the Tyneside shipbuilding industry. Here things are definitely better and there is quite a good demand for good quality oak for finishings. Selected oak is being bought at about 2*s*. 7*d*. per cubic foot in the round delivered to the shipyards for this purpose. Sawn and seasoned, it is worth about 6*s*. per foot.

The general prices being paid for standing timber appear to be:—

Oak	1*s*. to 1*s*. 6*d*. per cu. ft.
Ash	1*s*. to 2*s*. per cu. ft. (according to quality).
Beech about	6*d*. per cu. ft. (poor demand).
Larch	10*d*. to 1*s*. per cu. ft.
Scots pine	4*d*. to 6*d*. per cu. ft.
Spruce	4*d*. to 6*d*. per cu. ft.

With regard to actual sales within the Division, the following prices were obtained for standing timber in Chopwellwood:—

Species.	No.	Cu. ft.	Price per cu. ft. q.g., no allowance for bark
			s. *d*.
Larch	1,507	15,621	1 0
Scots pine	82	1,002	0 6
Hardwoods (mixed poor) ...	1,743	10,114	0 3
Larch (blown)	33	386	0 $10\frac{1}{2}$
.. ..	3	36	0 6
Scots pine	5	54	0 5

In addition, some 3,000 Scots pine pit props specially prepared for experimental purposes, but not required, were sold. These were cut to a size not in common use in the locality, and were marketed with difficulty direct to a local colliery at a price that did not even cover the cost of preparation, which included barking and careful selection. The total price received was £25, buyer taking delivery on roadside in wood.

The prices realised for each size can be taken roughly as follows :—

Top diameter, inches.	Length in feet.	Price per 100 lineal feet.
		s. d.
4 to 5	5 to 6½	4 6
4 ...	4½ ...	4 3
3 to 3½	3¼ to 4	4 0
2½ to 3	2 to 3	3 6

The expense of barking pit props by hand is quite prohibitive, and I suggest that, if this operation is necessary in order to compete with imported material, a machine should be made for the purpose and brought into use where large quantities of rough Scots pine have to be converted. This machine should remove the bark, level up irregularites caused by branches, and generally " true up " the props.

The following shows the approximate present prices for Baltic pitwood delivered into the colliery sidings in the Tyneside area :—

	Size.	Price per 100 lineal feet.
		s. d.
Props...	1 ft. 9 in. × 2½ in.	3 6
..	2 ft. × 2½ in.	
..	2 ft. 3 in. × 2½ in.	
..	2 ft. 6 in. × 2½ in.	
..	3 ft. × 3 in.	4 10
..	3 ft. 6 in. × 3 in.	
..	4 ft. × 3½ in.	6 10
..	5 ft. × 4 in.	8 6
..	6 ft. × 4½ in.	11 3
..	7 ft. 5 ft.	14 0
..	8 ft. 6 in.	19 3
..	9 ft. × 6 in.	
Splits	6 ft. × 5 in. × 2½ in.	8 0
..	5 ft. × 5 in. × 2½ in.	
Crowns	6 ft. 5 in. × 2½ in.	10 4

As far as I am aware, there is practically no wood-turning industry in the north-east of England, and this is a considerable drawback where the disposal of birch is concerned, as it has practically no market except as firewood.

On the Raby estate near Barnard Castle there is a firm at work making clog soles from beech by machinery which employs fifteen or twenty hands. This firm, I understand, pays about 10*d.* per foot standing for its timber, which is good, clean material about 150 years old.

In view of the difficulty often met with in marketing certain classes of produce, I would suggest that an effort be made in each division to obtain

a much more complete knowledge of the home timber trade than at present exists.

There should be a complete list of all home timber merchants giving some indication of (1) their financial standing, if known to the Commission officers ; (2) their normal radius of operation ; (3) the plant they possess ; (4) what section, if any, of the trade they specialise in, *i.e.* pitwood, high class oak, etc. ; (5) their ability to carry out contracts and notes of any difficulties that may have arisen in connection with the firms if previously dealt with.

If a map was prepared showing a firm's headquarters as a centre of a circle in which it normally operates it would be possible to see at a glance what firms were likely to tender at any given spot. The centre of each circle would be numbered with the number of the firm on the register of timber merchants.

In addition to timber merchants, possible purchasers of small stuff, such as thinnings for rustic garden work, clogwood, wood for turning, wood for charcoal, etc., should be recorded systematically. Furthermore, collieries and other mines that buy direct should be listed with, if possible, some note as to their general requirements.

In the case of buyers with a radius of operation extending into two or more divisions, the information could be circulated to all officers concerned.

TIMBER PRICES, 1927: DIVISION II.

By O. J. SANGAR.

During the year under review there has been little of interest to report as regards this Division. With the exception of Delamere Forest, sales have been confined to pitwood sizes and minor produce in only moderate quantities, and such timber as has been sold at Delamere has been mainly the oak which has been so exercising the minds of the public, or rather of the newspaper correspondents, and which, nevertheless, is not very highly prized by timber merchants; as the stand per acre varies from 300–500 cubic feet and the highest price that can be obtained is 11*d.* per cubic foot, the stand is hardly a profitable one from a forester's view-point. A certain amount of larch and spruce timber has also been sold at Delamere, but the quantities have been so small that only 1*s.* and 10*d.* per cubic foot, respectively, have been realised.

The largest yield from sales has been at Delamere, with a figure of £1,513, Wyre coming a close second with £1,505, Mortimer with £410 comes third. Corris next with £282, and Haugh last with £169. Sales from other forests are negligible, except Hafod Fawr, where the income amounts to only £21, but it is interesting in that, in an inaccessible spot, it is derived entirely from thinnings from young conifer plantations, these being sold as fencing poles, or worked up into rough gates and stakes in wet time. The revenue at Corris is mainly from a sale of about 40 acres standing, the purchaser being under covenant to leave the ground clear for planting, and having deposited a sum which will cover the cost of this work. Haugh is interesting in that little grading or sorting has to be done, and the purchasers buy everything, including a proportion of the lop and top, just as it lies after felling and trimming out; the poles, which are of small pitwood and sprag-pole sizes fetch from 10*s.* to 13*s* 6*d.* per ton in the wood. Mortimer sales are entirely pitwood, and the only outstanding feature is the variation according to different markets in the prices obtained for birch poles and pitwood, the extremes per ton f.o.r. being 16*s.* for pitwood and 25*s.* (presumably for bobbin-wood) with pretty similar produce. At both Wyre and Delamere local cash sales are of great importance, especially at the latter, where they account for about 40 per cent. of the total receipts from produce, and where the utilisation is almost, I think, closer than it was at Tintern. The birch brush used for seed bed protection is cut in such a way that in spring it can be sold as pea sticks or jump stuff, conifer cleanings down to almost bean rod size are sold at £4 a thousand on road side, and a large percentage of the 11*d.* per cubic foot oak (and chestnut) is cleft for rails and stakes, or hewn for posts, being sold so as to yield a net profit of over 2*s.* per cubic foot. Readers will be interested to hear that from Delamere the Commissioners supply the material for the jumps at the Grand National and all the other imporant steeplechase meetings in the district, even as far afield as the High Peak; this provided from the young birch cut in late weedings

and first cleanings of conifer plantations, sells at 40*s.* per ton f.o.r. and, whilst showing only a small profit, covers most of the cost of this usually unprofitable operation. The supply is getting short, and prices have been advanced 10*s.* per ton during the year; there seems every prospect of a further advance. The smallest conifer poles, like big bean rods, 2-in. butts, are sold to nurserymen as packing rods and stakes at £4 the thousand. Fence posts sell at 7*d.* to 10*d.* each according to size, cleft rails about 1*d.* per foot run, gate posts at 7*s.* 6*d.* each, strainers 2*s.* each. Conifer poles (Corsican and Scotch pines) of varying grades, selling at from 2*s.* 6*d.* to 10*s.* per score at roadside, and up to 2*s.* 6*d.* per pole, together with firewood and minor produce mainly of the types indicated, account for nearly 90 per cent. of the total Delamere produce receipts (cash and credit).

At Wyre sawn pitwood, pitwood poles, pottery poles, and crate rods are the main items, but here charcoal burners can be secured, and pay 5*s.* per small cord for cordwood; the local sales are of less magnitude and less diverse than Delamere, but include items like line poles (for garden clothes lines) at 1*s.* a piece. The local factor as affecting sales is here very apparent: very extensive fellings are in progress in neighbouring woods, markets are swamped and merchants are cutting prices, and consequently, as there is no desperate hurry, fellings on the Commissioners' area have been virtually suspended, but not, fortunately, until we had reaped the benefit of the post-strike boom in pitwood to the extent of a useful contract at 28*s.* per ton at roadside. Unfortunately, this contract had its disadvantages; it put us in bad odour with some reliable buyers and even now that it has been concluded things might be difficult if fellings were continuing; even the small stocks now in hand are not proving easy to dispose of, especially as local prices are now down to 21*s.* or so.

No really new ground has been broken in the Division during the year; progress has been confined to the development of existing markets, especially the local cash sales at Delamere and Wyre, where the foresters have shown considerable keenness and initiative. Very shortly the cleanings at Delamere will be up to date, serious thinnings will have to be undertaken, and then a market for Scots and Corsican of pitwood sizes will be necessary. During and after the coal strike small firewood buyers were encouraged to set up motor push benches at Delamere and one or two sales were made in which the buyers came on the ground and themselves trimmed out the tops of the trees, cut them on their benches and paid us 8*s.* per ton. At one time rough lop and top was selling, for firewood, at 18*s.* per ton at roadside.

It is apparent that the writer has been little in touch with the timber trade generally and is barely competent to express an opinion, but the general impression amongst merchants is that the home trade is improving as regards oak and other hardwoods, and it certainly is now possible to sell (at a price) small oak of 9 ins. q.g. or so, which, a short while ago could hardly be given away. Many are pessimistic as to the future of larch owing to the increased use of steel arches in the mines, a satisfactory form having at last been evolved: on the other hand, many authorities do not believe larch will be ousted for many years, and at present there

seems no lack of demand. Scots and spruce are, as usual, a drug in the market, with no immediate prospect of any improvement. From preliminary advances enquiries made in respect of the disposal of thinnings ex Delamere, there seems no reason why it will not be possible to sell to the Lancashire coalfields provided only the produce is sold as props, and these are well trimmed and cut true to specification. Good big oak, as always, has been in good demand, espcially as the railways have been paying a low price for scantlings and the margin of profit on sawing any but the most suitable timber has been very small.

TINTERN WOODS: PRODUCE AND PRICES.

By J. EDWARDS.

The actual results of clear fellings in the Tintern woods which are well known to various officers of the Commission will probably be of interest, and I give below the actual figures of three separate areas of six acres each. The Tintern woods are divided into three foresters' beats and one felling has been selected from each beat.

The areas referred to have been thinned periodically, probably three times, and the figures as to the amounts realised represents the final crop only; this shows that the roughest land can be made remunerative when properly utilised. The cuts were made in 1927.

(1) Compt. 16, South beat, six acres, consisted of oak timber about 80 years' growth, larch about 50 years' growth, with an under crop of mixed hardwood coppice 50 years' growth, grown on a loamy soil of limestone formation, with a north aspect and elevation 450 ft.

				£	*s.*	*d.*
Oak timber, 12-in. q.g. and up	2,264	cube ft., t.o.b.				
Less 10 per cent. allowance for bark	226					
	2,038	,, ,,	f.o.r. at 1*s.* 10*d.* per ft.... ...	186	16	4
Larch	2,090	,, ,,				
Less 10 per cent. allowance for bark...	209					
	1,881	,,	t.u.b. in wood at 1*s.* 4*d.* per ft. ...	125	8	0
Ash trees and poles	709	,, t.o.b.				
Less 7½ per cent. for bark ...	53					
	656	,,	t.u.b. f.o.r. at 2*s.* per ft.	65	12	0
Pitwood—						
13-ft., 27 tons, f.o.r. at 28*s.* per ton				37	16	0
9-ft., 120 tons, f.o.r. at 24*s.* per ton				144	0	0
6½-ft., 75 tons, f.o.r. at 24*s.* per ton				90	0	0
4½-ft., 20 tons, f.o.r. at 24*s.* per ton				24	0	0
Cogwood, 30 tons, f.o.r. at 15*s.* per ton				22	0	0
Cordwood, 90 tons, f.o.r. at 12*s.* per ton				54	0	0
Pea sticks, 620 bundles, f.o.r. at 5*d.* per bundle				12	18	4
				763	0	8
Cost of cutting, hauling and measuring ...				232	9	10
				£530	10	10

Total yield per acre—£88 8*s.* 5*d.*

(2) Compt. 74, Central beat, six acres, consisted of a mixed hardwood coppice suitable for pitwood, chiefly beech, birch and oak, about 40 years' growth, including a few small oak, grown on a heavy loam on old red sandstone at an elevation of 50 to 500 ft. with a south-east aspect.

	£	s.	d.
Oak timber, 120 ft., at 1s. 6d. per cube ft., in wood	9	0	0
Pitwood, 13, 9 and 6½ ft., 9,801 at 8d. per cube ft., in wood	326	14	0
Cogwood, 67 cord, at 14s. per cube ft., cord	46	18	0
Cordwood, 90 cord, at 9s. per cube ft., cord	40	10	0
Turnery poles, 300 score, at 1s. 6d. per score	22	10	0
Bean rods, 200 bundles, at 10d. per bundle	8	6	8
	453	18	8
Less cost of cutting and measuring	139	10	0
Total	£314	8	0

Total yield per acre—£52 8s. 0d.

(3) Compt. 117a, North Beat. Six acres consisted of oak timber 70 years' growth, also larch about 70 years' growth, with an under crop of hardwood coppice, chiefly oak and beech, about 70 years' growth.

It may be interesting to know that the ground this timber stood on was literally strewn with large grey sandstone boulders with a light sandy marl soil and north aspect at an elevation of 700 ft.

				£	s.	d.
Oak timber, 12-in. q.g. and up .	1,055	cube ft., t.o.b.				
Less 10 per cent. bark allowance	105					
	950	„	at 1s. 6d. per ft. in wood	71	5	0
Ditto, under 12-in. q.g. ...	300	„	at 1s. 0½d. per ft. in wood	15	12	6
Larch, timber and poles ...	11,153	„	at £6 10s. per 100 ft., t.u.b.	18	9	0
Pitwood, 13-ft.	1,445	„	at 8d. per ft. ...	48	3	4
No. 1385, 9-ft.	2,279	„	at 8d. per ft. ...	75	19	4
No. 257, doz., 6½-ft.	1,718	„	at 8½d. per ft. ...	60	16	11
Cogwood, 19¼ cords				15	12	0
Cordwood, 30¼ cords				15	2	6
Spragg poles, 12 score				1	0	9
Peeled oak stakes, 5,000 ft. run, length from 6 to 8 ft.				13	10	0
Total				1,035	11	4
Less cost of cutting and measuring				120	8	9
				£915	2	7

Total yield per acre—£152 10s. 5d.

Sales of Produce.

These are conducted in various ways, timber, including oak, larch and Scots pine, are sold by the cubic foot in the wood or f.o. station, subject to an allowance of 10 per cent. for bark. Pitwood is chiefly sold on measurement basis, and is also largely sold on a tonnage basis to suit customers' convenience. All bundled material, including rustic poles, etc., are sold by the bundle in truck loads or by the acre.

A statement showing the cost of production and prices realised for each class of produce is attached.

Cost of Production.			Prices Realised. 1928
s.	*d.*		
12	0	per 100 ft. cube, T.U.B.	... 12 in. q.g. and up, 2*s.* per ft., f.o.r.
6	3	per 100 ft. cube, T.U.B.	... Under 12 in. q.g., 1*s.* 8*d.* per ft., f.o.r.
6	3	per 100 ft. cube	... At £6 10*s.* per 100 cube ft. in wood.
12	6	per 100 ft. cube	... At 27*s.* and 28*s.* per ton, f.o.r.
2	6	per doz., 5 in. to 8 in. dia.	... At 23*s.* and 24*s.* per ton, f.o.r.
1	0	per doz., 3 in. to 6 in. dia.	... At 23*s.* and 24*s.* per ton, f.o.r.
0	9	per doz., 3 in. to 6 in. dia.	... At 24*s.* per ton, f.o.r.
7	0	per cord (Imperial 128 cube ft.) ...	... At 14*s.* and 15*s.* per ton, f.o.r.
7	0	per cord (Imperial 128 cube ft.) ...	... At 15*s.* and 16*s.* per ton, f.o.r.
6	0	per cord (Imperial 128 cube ft.) ...	... At 12*s.* per ton, f.o.r.
12	6	per 100 ft. cube, 5 in. to 8 in. dia. butt	... At 18*s.* per ton, in wood.
1	6	per score, 3 in. to 3½ in. dia. butt ...	... At 16*s.* per ton, or 4*s.* 6*d.* per score.
0	9	per score, 2 in. to 3 in. dia. butt ...	... At 1*s.* 7*d.* per score.
0	9	per score, 1½ in. to 3 in. dia. butt ...	... At 1*s.* 7*d.* per score.
0	9	per score, 1½ in. to 3 in. dia. butt ...	... At 25*s.* per ton, f.o.r.
3	6	per ton, 1½ in. to 3 in. dia. butt ...	... At 18*s.* and 19*s.* per ton, f.o.r.
0	6	per bundle (of 50)	... At 1*s.* 10*d.* per bundle, f.o.r.
0	5	per bundle (of 50)	... At 1*s.* 1*d.* per bundle, f.o.r.
0	1½	per bundle (of 25)	... At 5*d.* and 6*d.* per bundle, f.o.r.
0	2½	per bundle (½ cwt. each), or 10*s.* per ton	... At 37*s.* per ton, f.o.r.
0	8	per bundle (of 60)	... At 1*s.* 6*d.* per bundle, f.o.r.
0	5	per bundle (of 25)	... At 1*s.* 1*d.* per bundle, f.o.r.
0	5	per bundle (of 25)	... At 1*s.* 1*d.* per bundle, f.o.r.
0	6	per bundle (of 25)	... At 1*s.* 6*d.* per bundle, f.o.r.
0	9	per bundle (of 50)	... At 2*s.* 6*d.* per bundle, delivered locally.
1	0	per bundle (of 60)	... At 3*s.* per bundle, f.o.r.

Conifer poles for pergola and rustic work, including E. L. & Dg. :—					
1st class, 12 ft. to 20 ft.	1	0	per score, 3½ in. to 3½ in. dia. butt	...	At 11*s.* per score, f.o.r.
2nd class, 10 ft. to 18 ft. ...	0	8	per score, 2 in. to 3½ in. dia. butt	...	At 5*s.* 6*d.* per score, f.o.r.
3rd class, 8 ft. to 10 ft.	0	3	per score, 1½ in. to 2 in. dia. butt	...	At 2*s.* per score, f.o.r.
Gate posts, 6 ft. 6 in.	1	0	per unit, 7 in. to 10 in. dia. butt (yew) ...	...	At 7*s.* 6*d.* each.
,, 6 ft. 6 in.	0	6	per unit, 5 in. to 7 in. dia. butt (yew) ...	...	At 3*s.* 9*d.* each.
Fencing sticks. 6 ft.	0	4	per unit, 3 in. to 5 in. dia. butt (yew) ...	...	At 1*s.* 1*d.* each.
,, 6ft., oak cleft ...	0	3	per unit, 3 in. to 4 in. dia. butt (oak) ...	...	At 1*s.* each.
Hedging sticks. 5 in....	0	6	per score, 1½ in. to 2½ in. dia. butt	...	At 8*s.* 6*d.* per 100 ft. run.
Peeled oak fencing stakes	6 ft. and 6 ft. 6 in., 3*s.* 6*d.* per score ; 7 ft. and 7 ft. 6 in., 4*s.* per score ; 8 ft. long × 3 in. dia., 4*s.* 6*d.* per score				6*s.* and 6*s.* 6*d.* per 100 ft. run.

Cost of transport—

Timber, 3*d.* and 4*d.* per ft. cube. Pitwood, 6*s.* 6*d.* per ton. Cordwood, 6*s.* 6*d.* per ton.

Rustic poles, crate poles and all bundled material at 3*d.* per bundle ; pea sticks, 2*d.*

OFFICE ORGANISATION.

By F. W. HAMILTON.

It is obvious to all concerned that the office work of the Commission has and will increase in some sort of ratio to the extension of the planting programme and other activities of the Department, and efficient office organisation is necessary to ensure that the staff available is sufficient and competent to carry out the clerical duties. In Government Departments general "Service" conditions are, or should be, taken into consideration in connection with office establishments, and any scheme of organisation must be based on the personnel authorised by the Treasury.

The following brief statement regarding the organisation of this office might be of interest to the readers of this Journal. There is not much to record regarding the period prior to October, 1923—there being practically no staff to organise—except that valuable experience was obtained in connection with the work of the new Department and the importance realised of getting things done to avoid accumulation of arrears. It was also decided that the registration of papers in and out was not justified in view of the work involved. Our real difficulties and need for efficient organisation were, however, apparent when, during October, 1923, we took over the Royal Forests and Woodlands and were given a staff considerably less in numbers to the previous establishments, for the combined work. The first essential was, therefore, to make certain that the work was apportioned so that the best use was made of the existing personnel and to ensure that a nucleus of a staff was trained which, later on, would be capable of training additional men as the work expanded. It was also realised that it would be necessary for the staff to help one another at times of pressure; *i.e.*, the division of the work was not to be arbitrary. By working on this basis it has been possible, owing to the keenness of the clerks concerned, with only minor additions to the staff, to cope with the extra work which has from time to time been added, such as Survey of Woodlands, Census of Production, Forest Workers' Holdings, and the increase by over 100 per cent. in (*a*) the number of operations, and (*b*) the acquisition, planting, etc., programmes.

Apart from stating briefly that the duties are divided into sections, each of which is more or less a one man job, it would not be of general interest to set out in detail the scope of the clerical work in this office and how it is apportioned. As far as is possible with a small staff at least two men are trained to carry out the work of any particular section so as to cover contingencies such as holidays and sick leave. It is intended, as opportunities occur, to transfer officers from one section to another; thus, before the Commission's second lease of life is over, it is hoped that each member of the existing staff will be capable of performing all or any, of the necessary clerical duties. This method should ensure that there is a nucleus of a staff ready to deal with emergencies and any normal expansion of work, also that qualified men are available for taking charge of the Divisional Offices.

Keenness on the part of the staff is an important factor in connection with the scheme outlined above, as it is, and will be, impossible, unless the office is entirely regraded, to exercise normal supervision as is the case in other Departments where the blocks of work are larger and more clerks employed. A policy of " ca' canny " or quibbles about the grading of the various duties might cause endless difficulties and confusion. In my opinion this spirit of keenness with which is closely allied initiative and power of taking responsibility, can only be fostered if a reasonable avenue of promotion is open to the officers concerned. It is, of course, understood that automatic promotion in the Government Service is impossible owing to general " Service " conditions, but unless chances of promotion do, or are likely to, exist, the recommendations made annually in the staff reports under the heading " Degree of Qualification for Promotion to the next Grade " appear to serve no useful purpose.

Proper supervision is also necessary in any efficient office organisation, but this can be reduced to a minimum in small Departments as far as discipline is concerned, providing that the men are keen in carrying out their particular duties. Supervising officers should have an intimate knowledge of the duties to be carried out and should be able to judge the capabilities of the clerks under their control so that, under normal conditions, they can arrange the staff to the best advantage and, in times of stress, do all that is possible under adverse circumstances.

It would be as well at this stage to point out that punctual attendance and zeal on the part of an office staff might easily be equivalent to the services of additional clerks, as if the time lost or wasted by each person is only 20 minutes per working day this represents approximately a full day's work for one officer if, say, 18 men are employed.

Suitable accommodation is another matter which should not be overlooked or treated as of minor importance when dealing with staffing arrangements. The quality and quantity of clerical work is bound to deteriorate if proper accommodation is not provided. Overcrowding or bad ventilation is sure to reflect in days lost through sick leave which, in Departments where there is little or no margin for such contingencies, often results in increased work for the remainder of the staff.

There is one other point which I should like to mention before concluding, that is the good moral effect on the office staffs if the Commissioners and Technical Officers have confidence in their clerks and appreciate that clerical work carried out efficiently is an essential part of the Commission's machinery.

DIVISIONAL ORGANISATION.

By M. E. W. Mackenzie.

It is probable that after eight years' experience the internal organisation adopted in the various Divisions to meet the requirements of the Commission have developed along somewhat divergent lines though having a common object, and the procedure adopted in Division 2 (England and Wales), viewed from a clerical angle, may be of interest, especially as in this Division normal forest operations, nursery work and estate work, are probably all fully represented, with the possible exception of extensive sales.

This Division is divided territorially into three districts each of which is in charge of a District Officer who is responsible to the Divisional Officer, not only for field-work at the forest units therein, as well as a certain amount of the estate and forest workers' holdings work, land acquisition negotiations, grant schemes, etc., but also for the proper submission of returns, etc., by foresters (arithmetical accuracy excepted). Except for certain returns and urgent correspondence (*e.g.*, fires and accidents), the forester communicates with his District Officer on all matters, and it will be realised that this arrangement relieves the Divisional staff of many routine and relatively unimportant matters whilst it at the same time materially assists the District Officers' control; it is, however, almost more important to bear in mind the personal touch involved, as thereby much lengthy correspondence is avoided, whilst also efficiency is secured in that the District Officer, who has intimate knowledge of all the conditions obtaining, himself deals with the points raised.

Some two years ago it was found that a code of some sort was indispensable to the efficient control of the Division and a set of standing instructions was compiled and copies were issued to all ranks down to and including acting foremen. This has not only secured uniformity and reduced correspondence, but has enabled the junior divisional staff to perform work of a higher character than that previously obtaining. These instructions (which are adequately indexed) are, of course, based on Finance and General Instructions but are more comprehensive and detailed, and a new forester or foreman with no knowledge of the Department might reasonably be expected to understand and properly apply them.

There are one or two points in the system which may be of interest, the most important being fortnightly payment of wages at every forest, the advantages of which are apparent. Progress reports, prepared by the foresters, include a complete allocation of labour costs to the various heads of account and these are test-checked at Divisional Office from the time-sheets. This procedure has been criticised as facilitating the possible concealment of high costs, but in any circumstances the time-sheets prepared by the foresters are the fundamental data, and if they are analysed at the Divisional Office the position arising differs not at all from that by the method under consideration providing the check in the latter case is properly carried out.

Time-sheets, pay-sheets and progress reports reach the Divisional Office *via* the District Officer who is able to satisfy himself as to the adequacy or otherwise of piece-work rates, scrutinise costs, submit reports thereon to Divisional Office, or annotate progress reports in the case of extraordinary items, and exercise adequate control over the forest in his charge. Besides materially assisting Divisional Office staff, as mentioned before, this enables District Officers to become familiar with the clerical and accounting work which is to their and the Commission's advantage in the event of promotion to Divisional Officer rank.

One more point deserves mention, namely, that District Officers are responsible for keeping expenditure at their forests within the approved estimates. Annotated copies of the analyses of receipts and payments (Forms A. 46) are supplied to District Officers from the Divisional Office and where estimates are exceeded or funds run low a report containing recommendations is submitted to the Divisional Office.

No real difficulty has been experienced at any stage in the evolution of the organisation outlined, although on the first issue of the standing instructions queries became more numerous. Obviously we could not expect the foresters to assimilate immediately the many changes involved at this stage, and they were in some cases apt to proceed on the old lines without reference to the regulations. Instructions numbers were introduced into queries wherever possible and the foresters thus gradually became conversant with the changes with the gratifying result that queries now consist mainly of arithmetical inaccuracies, and even these are comparatively rare.

Generally speaking the foresters submit their accounting documents very well indeed. Progress reports especially call for comment, as they are in the main excellently prepared. I have a little trouble with the foresters' produce returns at times, but as these are submitted *via* the District Officers and are annotated by them where necessary, the mistakes are primarily arithmetical and are disposed of without very much bother.

It will be seen, then, that decentralisation is carried out to as great an extent as has yet been considered possible, each district being more or less self-contained; and having outlined the general organisation I would like to dwell for a moment on some aspects of the work inside the Divisional Office.

The Divisional Office Staff (Divisional Officer, Accountant, Shorthand-typist and Typist) is concerned with the management (through District Officers), accounting and estate work of seventeen forest units, agency and advisory work, land acquisition negotiations, grant schemes and various miscellaneous duties. The Accountant's chief duties include office organisation, correspondence, returns and, of course, accounting. The typists, in addition to their ordinary work, assist in the examination of accounts and perform routine office work under supervision. I suppose this arrangement of work is common to all Divisions, and without going into details I will pass on to points of special interest.

Forms play an important part in Divisional Office routine and, while those prepared in the Division have been drawn up, amended and cancelled

as required, the forms issued from Headquarters have not, in one or two cases, kept pace with requirements, and a cumbersome form is irritating and expensive. I do not wish to tread on anyone's corns and, indeed, realise the difficulties attending the preparation of standard forms to please everybody, but I think the matter might be reviewed, say, once a year, and that the observations of Divisional staffs should be invited.

One of the accountant's most pleasing duties is an occasional visit to a forest, usually to make a surprise check. Unfortunately, owing to the scarcity of time and money, such visits are rare but there is no doubt as to their value, inasmuch as the accountant gets to know the foresters and to appreciate outdoor conditions and difficulties, thereby increasing his efficiency, and is sometimes able to amend or introduce local procedure resulting in a saving of foresters' time.

Before concluding there are two things worth mentioning. The first is that uniformity in procedure in the different Divisions on some matters such as dealing with Advice Notes would save considerable time, and the second concerns the rather involved procedure in ordering stores and materials (especially fencing materials). If any appreciable saving in time would result, further to the saving in correspondence, it would appear desirable for Divisional Officers to place their orders direct with the manufacturers. A price list issued monthly by Headquarters, with addresses of manufacturers and arrangements made with them, would be a necessary adjunct.

To conclude I would emphasise that the organisation, to be successful, depends on the loyal co-operation of District Officers, Foresters and Foremen, and it is pleasing to record that the response in this Division has been extremely satisfactory. Not only are the mistakes rare but goodwill, which is apparent, assists in promoting harmony between all ranks and removes the atmosphere of "strafe" from the few queries and corrections that are necessary. There is little doubt that any time lost in the field as a result of increased office work is more than compensated by the interest and sense of responsibility with which a contented and loyal personnel are invariably imbued as a result of each step towards devolution, carrying, as it does, a more complete grasp, an enhanced sense of control and personal responsibility, even though the actual supervision of operations may, in itself, be closer and more rigorous.

NURSERY MANAGEMENT AND GENERAL PRACTICE.

By W. C. Squires.

In this article I propose to give in as concise terms as possible a system of nursery management and general practices as carried out on a large scale, such as in the Commission's nurseries at Bagshot.

Preparation.

It is assumed that the area selected for the nursery is in a rough state, with a quantity of coarse weeds and birch scrub. The weeds must be cut and the scrub grubbed and the whole of the rubbish burnt. The surface having been cleared of rubbish it will be necessary to proceed with this cultivation of the soil.

Steam ploughing has often been advocated but this process does not break the subsoil sufficiently deep, so trenching to a depth of at least 20 inches is recommended. The initial outlay is rather costly, say £20 per acre, but it will pay in the end. Before trenching, the nursery should be divided into divisions and plots to facilitate the collection and haulage of plants. For this purpose plots 35 yards square, approximately $\frac{1}{4}$ of an acre, are very convenient. A path 4 feet wide should surround each plot and 16 plots will form a division; this in turn should be surrounded by a ride 12 feet wide for cart traffic. This arrangement in practice has been found very satisfactory, as no part of the nursery is at an inconvenient distance from a path or ride, and the plots being of equal size, the number of plants per plot, or acre, can be quickly ascertained. The rides and paths should not be trenched but allowed to remain firm for haulage.

The nursery should now be in a condition for the different operations to be proceeded with.

Seed Beds and Sowing.

I will commence with the preparation of seed beds and seed sowing, as I consider this operation very important, if not the most imporant of nursery work, for without a successful crop of seedlings the whole of forestry work is impeded.

Seed beds should be formed 4 feet wide with an alley 2 feet wide between the beds. This will allow 17 beds to each $\frac{1}{4}$-ac replot with an area of 420 square feet to each bed. By having beds of uniform size the area required for the sowing of 1 lb. of seed can be easily and correctly regulated.

If possible the plots selected for the season's sowing should be dug deeply early in the year, so as to get the advantage of aeration. About three weeks before sowing, the beds should be marked out and the soil broken down to a fine tilth, then on light soil trod firmly, to retain moisture in summer and prevent frost lift in winter. After treading, the beds should be raked to a fine surface and allowed to remain so until two days before it is intended to sow the seed, when the beds should be lightly

hoed and raked; this and the action of the sun will have the effect of destroying the first, and generally the heaviest, crop of weeds.

The operation of seed sowing can now be carried out. Where several hundred pounds of seeds are to be sown, broadcast sowing is preferable, being quicker, and more economical in space. The seed after being sown should be lightly covered, especially in the case of European larch and Sitka spruce, with soil sifted from the dividing paths. Before sowing it will be found a great advantage to pregerminate the seed. For this purpose trays 3 feet long, 2 feet wide and 4 inches deep, inside measurement, made of 1-inch ploughed and tongued boards, and covered with an unhinged framed lid of perforated zinc for protection against mice, should be provided. A tray of this size is large enough to deal with 12 to 14 lbs. of seed.

Assuming that six beds of 420 sq. feet each are to be sown with Corsican pine seed at the rate of 1 lb. of seed to every 180 sq. feet, then $6 \times 440 = 2520 \div 180 = 14$ lbs. This quantity should be carefully weighed and placed in the germinating tray, and kept very damp but not soddened, and frequently disturbed to prevent fermentation. After some time, it all depends upon the temperature, probably in the case of Corsican pine 10 to 12 days, the seed will show signs of germination by the appearance of the minute radicle, and should at once be sown. To facilitate sowing, the damp seed should be mixed with a small quantity of dry fine sand, which will allow the seed to be sown with ease. If the weather is very dry and warm the seed beds should be saturated with water, by means of water cans, immediately before the seed is sown, so that the germination which has just started should not be checked.

By adopting this method of treatment and sowing, a crop of seedlings is generally assured, also the germination as seen in the tray is, as a rule, a true forecast of the yield value of the seed, and a guide as to what density the seed should be sown. All seeds should be sown if possible by the end of May.

The following tables gives the density at which seeds of the most common species of conifer should be sown to give the best results without overcrowding in the seed beds.

Species.	1 *lb. to sq. foot.*
Scots pine	250
Sitka spruce	250
Norway spruce	200
Corsican pine	180
European larch	150
Douglas fir	150

Protection of Seedlings.

Seedlings of the species, particularly larch and Sitka spruce, tender in their early stage to require protection against sun scorch and heavy rains. A lath protection formed of 5 feet lath 1 inch wide tacked on three bands of webbing, supported on and secured to a strained wire run through

iron rods 1 foot from the ground, will answer very well for this purpose. The rolls should not exceed 24 feet in length otherwise they become too cumbersome to handle. This class of protection is also very useful as a shelter for tender seedlings against early autumn and late spring frosts.

The protection shelter described above will with care last a few years, and is more or less of a permanent character. If a temporary shelter only is required the following will answer for the purpose. Drive stakes into the ground 6 feet apart alongside the beds, 1 foot out of ground; fix small poles on top as runners with cross stakes at intervals of 6 feet; on this stretch wire netting on which boughs or heather can be placed.

Lining-out.

No hard and fast rule can be laid down as to what age and season of the year seedlings should be lined out. Many seedlings are large and strong enough to line out at one year and the weather in our variable climate determines the time when the work can be carried out to the best advantage, but given fairly open weather seedlings lined out in the following months give fairly good results :—

Scots pine	November–February.
Corsican pine ..	January–March.
Larches	January–February.
Sitka spruce ..	February.
Norway spruce	November–February.
Douglas fir ..	February–March.

After the ground is prepared by digging, great care must be exercised when making the trench for lining-out to see that it is deep enough for the roots of the seedling to hang perfectly straight down, and the soil is placed by the hand against the seedling to keep it in position, after which it should be firmed by the foot, precaution being taken to see that the foot is not too near the seedling, otherwise damage might be caused by bruising the tender bark. Lines should be 12 inches apart and seedlings lined out five to the foot; this gives approximately 200,000 to the acre. A less distance between lines is not advocated as much damage is done by hoeing if too close together and the use of Planet Junior hoe restricted.

Weeding.

This work, particularly in transplants which have stood in the lines from the preceding season, should be commenced as early in the spring as possible providing the weather is favourable. The ground between the lines should be roughly disturbed by using a Planet Junior hoe, and this has the effect of loosening and aerating the soil to the great benefit of the transplants. The Planet Junior hoe should be followed after a brief interval with five-pronged cultivators; this operation destroys the weeds in their tender stage, thus saving considerable work and expense later. Weeds should never, if it can be avoided, be allowed to seed, as the old adage " One year's seeding makes seven years' weeding " still holds good.

Seed beds must be hand-weeded and the sooner the work is undertaken the better so that the weeds do not overpower the seedlings. If the seed beds are treated as described under the heading of "Sowing" much labour and time are saved. The weeds gathered from the seed beds should not be thrown on the path between the beds but collected in any suitable receptacle, an old pail will answer the purpose, and eventually carried away to the rubbish depot.

The dividing paths, when the beds are clear of weeds, should be dug, and after an interval of two or three weeks, raked to an even surface, the effect being to dispose of the weeds and give a clean and tidy appearance to the nursery. The grass rides and paths should be trimmed twice a year, first at end of May or early in June, before the seed ripens and blows on the adjoining plots, and the aftermath early in the autumn. The trimmings should be burnt.

Lifting Plants.

This is an important operation and one that should receive very careful attention, otherwise the transplant or seedling may be seriously damaged and its vitality impaired by injury to the fibrous roots through insufficient care being taken. Transplants, especially those which have stood two years in the lines, should be raised by having the soil loosened on both sides of the row and the spade, when lifting, inserted deeply and the transplant raised bodily and not torn out, so that the rootlets are not injured.

When lifting seedlings special precautions should be exercised so that the delicate rootlets are not skinned. A trench nine to twelve inches wide and slightly deeper than the roots should be made at the end of the seed beds. The trench having been opened, the seedlings should be undermined, preferably with a fork, the surface then slightly broken, and the seedlings can then be removed in small clumps and the soil shaken from the roots without any damage being done as is usually the case when the soil is insufficiently loosened and the seedlings drawn out. While care should be taken with all species, Corsican pine requires particular attention as the rootlets are very tender and liable to skin.

Transport.

When millions of plants are transferred annually as is the case from the Bagshot nurseries, much organisation and forethought are required to ensure accuracy of numbers being despatched, and arrangement with the railway authorities for prompt despatch and delivery.

Transplants should be tied in bundles of 25 or 50 according to size of plants, and seedlings in bundles of 100 or 200. As lifting is generally carried out by piece-work, the plants should be heeled in, pending despatch, in rows containing 1,000. This enables the employee's work to be calculated quickly and accurately, it is also a check when the plants are loaded into the haulier's cart in the nursery and again when loaded into the trucks at the railway station, or into lorries when transported by road. During lifting, bundles should be frequently taken from the rows and counted to

see that the men place in the correct number. The workmen should be instructed to include an additional 2 per cent. in transplants and 3 to 4 per cent. in seedlings. This should prevent a dispute with the consignee as to the accuracy of the number stated to have been sent and those received. The method of transport by rail is generally to consign transplants by goods train and seedlings by passenger train. If large numbers of seedlings are to be despatched, the most economical and expeditious method is to forward them in a ventilated passenger luggage van capable of holding 500,000. The railway station to which they are to be sent is usually reached the same day as they are despatched, thus assuring that the seedlings will not become heated by a prolonged journey. Crates should be used for sending small quantities of seedlings and transplants packed in strongly secured bundles.

In all cases it is essential that sufficient litter, bracken is very suitable, should be packed between each layer of plants to prevent heating and protection against frost.

Goods trucks should be covered with a tarpaulin sheet; if possible one with a bale should be procured so that the sheet should not press heavily on the plants. When a truck with a bale cannot be obtained it is not advisable to load the truck to its fullest extent.

Water.

Water is essential in a nursery. If it is not possible to have a supply laid on, water must be obtained from the nearest pond, or if there is a ditch in the neighbourhood with a constant flow of water, it can be dammed and a bay formed. To obtain a storage in different parts of the nursery it will be necessary to provide galvanised iron tanks with a capacity of 250 gallons each, which can be placed where required. Tanks of this size can easily be carted to any position, and filled from a 100-gallon water cart. The tanks should be let into the ground until the top is just below the level of the outflow valve of the cart, which can be emptied quickly without great waste of water.

In the foregoing I feel that inadequate justice has been paid to many of the subjects, some of which are worthy of much fuller details, but I trust that the information I have given will prove of some interest and assistance to those who read this article.

FORESTRY AND SPORTING RIGHTS.

By J. P. Mackie Whyte.

The combination of forestry and game preservation on the same area is a fairly common one and has often been managed successfully. Usually, however, game has come first and forestry second, plantations being formed to provide cover, to ensure that birds would be driven where they were wanted, and to improve the appearance of the estate, with a more or less vague hope of profit from timber at some future date. Such plantations are too often uneconomic, being of species which have little value at the best, and that little lost through neglect after the thicket stage is reached. But the combination is possible, though it is a little more difficult when the attempt is made by two independent parties with different outlooks, as the Forestry Commission and their shooting tenants.

The chief point on which there is likely to be dissension is the old one of rabbit suppression. The passing of the Ground Game Act was bewailed as the beginning of ruin for shoots; actually it improved them, for it removed the farmers' grievance, and also reduced the number of stoats, weasels, rats, etc., which are enemies of game birds as well as of rabbits, and its benefits are universally recognised now.

So far, then, the shooting tenant and forester can work together in limiting the numbers; but at that point they separate. The tenant kills all foxes, stoats, weasels and hawks, as enemies of his birds; the forester likes them, as enemies of rabbits. The tenant likes rabbits in moderate numbers for odd days' sport: the forester would give a good deal to see the last pair. The tenant wants the woods to be undisturbed from about August to January, or until the ground has been shot over at least once; the forester considers that his busiest time, and often has felling, underwood cutting, fencing, thinning, etc., going on simultaneously in many parts of the forest, and must make certain of rabbit extermination on planting areas, and on surrounding land if he can. Any sporting agreement should definitely reserve to him the right to enter any land and use any means of destruction against rabbits, without giving the tenant the option of destroying the rabbits first. This tends to lead to unpleasantness with the tenant and friction between the forester and keepers. This right would not be abused, in view of future lettings; but, if forestry is to be the chief consideration, the success or failure of a year's work should not be dependent on the order in which coverts are shot or on the spare-time rabbiting of gamekeepers.

The complete extermination of rabbits in the forest, and consequent dispensing with fencing, does not appear possible in pheasant shooting country, where the necessary co-operation of neighbours could not be got.

Grouse shooting and forestry on a large scale are not compatible, owing to the impossibility of burning heather on large areas. Grouse can also do much damage to buds of young larch and Scots pine, though probably this is only an emergency food. The Grouse Disease Inquiry Committee

found that heather shoots formed about 95 per cent. of the spring food and 60 per cent. of summer food, the balance being chiefly blaeberry, whortleberry, cranberry, etc., while in winter heather seed, bog myrtle buds and *Salix repens* leaves were a usual diet. But the tests may have been made on ground where there were no trees, and further information would be interesting.

The other members of the grouse family, capercailzie and black game, are definitely harmful. Although a game bird in everything but classification, the caper is protected only by the Wild Birds' Protection Acts, as it was extinct in Scotland and Ireland from 1770 to 1838, and its name has not been added to later Game Acts. It is now found wherever there are conifers. Its Gaelic name, Cabhar coille = cock of the woods, is a true description. Black game is rarely shot hard, "cocks only" being the usual rule, but there can be no question of sparing any on planted ground, where they do an astonishing amount of damage. It will be interesting to hear what success has been obtained by treating buds with an offensive mixture at Monaughty.

Without attempting to give a comprehensive list, the commoner birds and beasts met on forest and shooting land may be classed as follows:—

(1) Liked by forester, disliked by gamekeepers—
Blackheaded gull, carrion and hoodie crows, rook, jackdaw, buzzard, kestrel, peregrine, little owl, golden eagle, fox, hedgehog, stoat, weasel.

(2) Liked by both—
Owls, snipe, woodcock, curlew, pheasant.

(3) Disliked by forester, liked by gamekeeper—
Red grouse, black game, pigeons, doves, rabbits, hares, deer.

(4) Disliked by both—
Jay, magpie, capercailzie, sparrowhawk, merlin, badger, squirrel, rat and mouse.

No classification can be beyond dispute, for damage varies with numbers and opportunity. Owls and pigeons are often put in the first class, rooks, jackdaws, eagles and badgers in the second, and this is as it should be, for few would wish to kill according to a hard-and-fast list. There are not so many British species that we can risk exterminating some. Let local observation, not prejudice, decide what defensive measures are necessary.

NOTES ON FORESTRY IN CANADA.

By J. W. MACKAY.

The following notes are the result of a few days given up to forestry during a visit to a friend in Canada in the autumn of 1927. As my trip, which lasted 28 days from start to finish, only gave me thirteen days ashore, my time was very crowded. It would be a great advantage to junior officers if extra leave could be granted to them when combining forestry with holidays, more particularly when long and expensive journeys are involved, and in my opinion the service would benefit ultimately by any such encouragement being given.

On my railway journeys from Montreal to Ottawa, Kingston, Toronto and Chalk River, I was everywhere struck by the absence of close woods or forests. The tree growths seen from the train consist chiefly of scattered groups of self sown white spruce, white and red pine, *Thuya occidentalis*, oak, maple, lime, birch and alder, of various ages.

I took the first opportunity of calling at the Dominion Government Forestry Office in Ottawa, and was well received by Mr. E. H. Finlayson, Director of Forestry, and Mr. D. Roy Cameron, Assistant Director, both of whom are known personally to many foresters in this country. I also met Mr. W. M. Robertson and Mr. Morgan, Research Officers, and Mr. Robertson kindly arranged for my subsequent visit to Petawawa. The Dominion Government issue a well-illustrated book on native trees and leaflets on the most important conifers.

The first part of my holiday was spent in a bungalow camp in a mixed wood near Kingston belonging to the State of Ontario. Here the principal trees were oaks, maple, white (or Weymouth) pine, red pine (*Pinus resinosa*), white spruce and *Thuya occidentalis*.

At the time of my visit the black squirrels were busy on the oaks, cutting off the acorns and letting them fall to the ground. I collected a number of acorns, principally *Quercus rubra*, for sowing on my return to Scotland, but I found that a number of them were occupied by weevil grubs, some of which had eaten their way out on the journey. I was informed that the squirrels in this part of Canada have not adopted the habit of peeling conifers, which makes the red squirrel such a pest at home.

The larches have been nearly exterminated in this part of the country. One I saw in the grounds of the Mental Hospital at Kingston, though apparently sound, had been thoroughly gone over by the woodpeckers, and I was able to get a good photograph of a part of the trunk showing their perforations in horizontal lines.

There are still a number of the old zigzag or "snake" fences left, relics of the days when wood was of little or no value. My friend informed me that on one farm with which he had been connected the old fences had been sold at a later date to a cabinet maker for making furniture.

I paid a hurried visit to Toronto for the National Exhibition which is held there every autumn. Both the Dominion Government and Ontario

forest services had exhibitions. Prevention of forest fires was a prominent subject, and the exhibits included a watcher's hut and various fire-fighting appliances. An interesting exhibit was the making of a birch bark canoe. The Ontario Government had a collection of seedlings and transplants of various ages and sizes in boxes. They also had on sale a very beautifully-got-up and well-illustrated book on the forest trees of Ontario, including the more commonly planted foreign trees, with identification keys.

From Toronto I went to Chalk River on the Petawawa Reserve about 130 miles West-North-West of Ottawa. This Reserve extends to about 131 square miles and belongs to the Military Authorities, who use part of it for field training operations during the autumn months. Arrangements have been made by which 100 square miles of the Reserve have been brought under the control of the Dominion Forestry Service, and they have established an experimental station here.

Bungalows are provided for a Director and Assistant Director. A third bungalow is used as an office, and has sleeping accommodation in the upper storey, where I was given a bed. At the time of my visit a number of students were accommodated in tents, and I took my meals with them in a marquee. A number of the men were busy compiling and revising records of sample plots, etc., while another party was engaged in erecting telephones.

Mr. G. A. Mulloy, who was in charge of the station, kindly put himself at my disposal and tried to show me as much as possible during the short time of my visit. This was mostly spent in inspecting some of the sample plots, principally Weymouth and red pine, white spruce, yellow birch and poplar.

The species of pine now favoured at Petawawa is *Pinus resinosa*, althought the wood of the Weymouth pine is more in demand. The Weymouth pine grows quite well here, but the leading shoot is very liable to damage by the white pine weevil (*Pissodes strobi*), resulting in a side branch taking the lead. This may occur over and over again, which gives the trunk a crooked and rough appearance. The branches are thick and slow in dying off and a long rotation is required to form a good clean trunk. *Pinus resinosa* on the other hand is less liable to insect damage and disease, the side branches are usually small and die off early, more like the larch, giving a clean stem at an early age. A small plot of Scots pine about 10-years old had a fine glaucous colour, and the annual growths were similar to what they are in this country.

The trees in the sample plots are not numbered with paint as is customary here, but with aluminium tallies. The numbers are pressed into the tallies in a machine similar in action to the automatic name-plate machines one sees in railway stations here. The machine punches a small hole in one end of the tally and the tallies are secured by brass nails or escutcheon pins partially driven into the tree in a horizontal or slightly drooping position so that the tally always lies away from the tree. The nails are 16 gauge and 1½ inches long and are driven just below the breast height point, so that the calliper arm or tape will rest on the nail when the tree diameter is being measured.

In laying down sample plots the positions of the trees are plotted on squared paper, which forms a permanent record. In the event of any of the tallies being missing, the number of the tree can readily be found by reference to the plan and the tally replaced with a new one.

Mr. Mulloy showed me some new experimental plots of various spruces and pines planted at the bottom of furrows made with a plough. The soil is light and mostly well drained. The planting distance of pines has hitherto been 5 feet, but they are now trying a planting distance of 7 feet by 7 feet as they cannot afford to thin.

Observations on relative humidity of soil cover in regard to temperature as an indication of fire danger are being made by means of a special instrument which is pushed horizontally into the surface litter. These instruments are examined daily, and when the danger point is reached, the watch for fires is tightened up.

I was very sorry not to have had time for a longer stay at the station. Mr. Mulloy assured me that any forest officers who care to take a trip to Petawawa will be sure of a welcome, and will be given all possible assistance.

The time at my disposal did not admit of my visiting any of the provincial forests or nurseries.

STORM DAMAGE IN SAMPLE PLOTS.

By J. MACDONALD.

The gale which swept over the country on Friday, 28th January, 1927, will long be remembered alike for its violence and for the great destruction that it wrought. All parts of the country felt its force, but only Scotland and the north-west of England encountered its full strength. Blowing from the south-west, the wind reached velocities of 85 and 95 miles an hour, and one gust of 102 miles an hour was recorded at Renfrew. The loss of life was serious and the damage to property and communications so extensive as to be without parallel in recent times.

Naturally, woodlands and plantations suffered much. All over Scotland trees by highways and in hedgerows were thrown, young plantations and middle-aged woods were damaged and many of the older woods which had stood against other severe storms did not, on this occasion, escape.

When the first accounts of the storm appeared, some anxiety was felt and fears were expressed for the safety of many of the permanent sample plots in Scotland and, accordingly, a circular letter was put out to the various estates on which plots had been established, asking for particulars of any damage that had occurred. As the replies to this letter came in, it was found that the fears were in some instances fully justified, but, when all had been received, it was seen that the loss was not so heavy as at first had been expected.

Out of the 77 effective sample plots in Scotland, three were completely overthrown, not a tree being left standing, two were so badly damaged as to be of no further use as sample plots, and seven others were injured, more or less seriously.

The following plots were completely overthrown :—

Plot No. 11	.. ..	Douglas fir	.. Durris, Kincardine
,, ,, 42	.. ..	do.	.. Murthly, Perthshire
,, ,, 43	.. ..	do.	.. do. do.

The following plots were so badly damaged as to be rendered useless :—

Plot No. 14	.. Sitka spruce	.. Durris, Kincardine
,, ,, 53	.. Douglas fir	.. Dunach, Argyll

and the following were more or less seriously injured :—

Plot No. 10	.. Japanese larch	Drumlanrig, Dumfriesshire
,, ,, 34	.. Scots pine	.. Novar, Ross-shire
,, ,, 41	.. Douglas fir	.. Murthly, Perthshire
,, ,, 56	.. Weymouth pine	Dunach, Argyll
,, ,, 79	.. Douglas fir	.. Culloden, Inverness-shire
,, ,, 80	.. do.	.. do. do.

In addition, the demarcated areas surrounding the following plots were damaged slightly :—

Plot No. 23	Douglas fir	.. Glentress, Peeblesshire
,, ,, 58	Japanese larch	Ardgowan, Renfrewshire
,, ,, 60	Norway spruce	do. do.

From these lists it can be seen that the most serious damage to sample plots occurred on two estates—Murthly in the Tay valley and Durris on lower Deeside. Both are in areas where the full violence of the storm was felt and where damage in plantations was widespread.

The Douglas fir has suffered more than any other tree as a result of the gale, for out of the fourteen plots mentioned in the lists given above, no fewer than eight were of this species. If has also to be added that in previous years, two other plots of Douglas, No. 12 at Durris and No. 63 at Inverliever, have been wiped out in the same manner.

That Douglas is undoubtedly liable to extensive damage by wind has been recognised now for many years, and the recent accidents have only served to emphasise the warnings which have been put forward on many occasions against the indiscriminate use of this species in planting. It is difficult to estimate the position which it will finally occupy in our silviculture, but it is certain to be much lower than the one it holds to-day. And its liability to windblow will be one of the factors determining its final status.

It is all the more important to study the effects of a gale such as that of last January upon this, and other species which are still on their trial, because experience shows that such gales are to be expected from time to time, and that the damage they cause can be kept at a minimum only by paying due regard to the powers of the various species to withstand them. It is doubtful if, in the past, sufficient attention has been paid to this aspect of silviculture. Lack of attention has resulted in serious losses and further damage may be expected in time to come.

In studying the damage in the sample plots of Douglas fir, one can see that there are certain factors with a direct bearing on the liability of this species to wind-fall.

(1) There is the form of the tree. Douglas fir is remarkable among conifers for its rapid growth in youth, a rapid growth which leads to the formation of a large crown at an early age. It is almost certain that, especially in closely planted woods, the root development does not go on at a corresponding rate. Consequently, in a wind there is a great pressure on the large area of crown which is exposed and very poor anchorage owing to the indifferent root development with the result that wind-fall follows.

(2) The nature of the soil is of great importance. Experience has shown that young Douglas is most likely to go down on deep, open soils and on shallow soils where there is pan or rock near the surface. On soils of the first type, there is generally a luxuriant growth in the early stages, and though there may be at the same time a good root development, there is very little, so to speak, to hold on to, with the result that the root-hold is not firm enough to withstand the greater pressure on the crowns. On the second type the root development is poor and the hold uncertain.

The plots which were blown at Murthly and at Durris were on soils of the first type, deep sandy loams over old red sandstone and gneiss respectively, while damage on soils of the second type was found in the west of Scotland. For example, in Plot 53 in Glenlonan the patches

which were blown were situated where the rock came near the surface of the ground. The roots in this case were quite superficial.

(3) Adequate drainage is essential if windblow is to be avoided. Wet patches in plantations are generally the first to suffer, especially in plantations of Douglas fir and Norway spruce. The presence of excessive moisture results in the death of roots. It has also the effect of reducing the " holding " power of the soil. On the other hand, too many drains are sometimes a source of danger, as they undermine the stability of the trees along their edges.

(4) Root-rotting fungi also appear to play a part in weakening the power of a tree to withstand wind. The presence of *Fomes annosus* was a cause contributing to the fall of the Douglas at Durris, and it was, without doubt, responsible partly for the windfalls in many of the larch woods in central Scotland. In Douglas fir plantations formed on the site of crops of old larch and Scots pine, this fungus is, as a rule, abundant.

(5) The history of a plantation and its treatment have to be considered in connection with any wind damage that may have occurred. Though it is not proposed to say anything which would add to the ample literature on the subject, planting distance is of importance in so far as a wider spacing reduces root competition. But on soils such as those already described a wider spacing may not lessen the risk of wind damage. The more open planting would lead to a greater crown development with a larger and more rigid stem, and in wind, throw on the roots a strain they might not be able to bear.

As to thinning, it is clear that to delay it too long is to invite trouble, but it is not clear whether heavy thinnings or frequently repeated light thinnings are the more desirable. But other considerations arise here, for, at present, thinning is not a silvicultural, but an economic question.

The loss in the plots of the other coniferous species was not great, the only regrettable feature being the heavy damage in the Sitka spruce wood at Durris, one of the classical plantations. It is fortunate, however, that another Sitka plot on the same estate and of similar age escaped injury.

Norway spruce stood the storm in a very satisfactory manner. No plots of this species were damaged, although there are several at high elevations and in exposed sites. This agrees with the experience that in exposed situations and, indeed, generally, there is no conifer up to middle life which is more wind-firm than Norway spruce provided that it is reasonably thinned and kept free from excessive soil moisture either natural or the result of bad or neglected drains.

After the storm the opportunity was taken to make extensive measurements on blown trees in order to obtain information on the form of the various conifers. It is hoped that the investigation of this important subject will be commenced as soon as possible, so that improvements in the technique of mensuration may be considered and our research work brought into line with that of other countries.

EFFECTS OF THE SPRING FROSTS OF 1927.

Northern Division, Scotland.

If one judges by the reports of foresters and District Officers, every year since the commencement of operations by the Forestry Commission must be regarded as the " worst on record " as regards climatic conditions. The same, with more reason, was said of the Forest Year 1927.

In autumn and early winter the progress of work was continually held up by adverse weather conditions. To such an extent was this the case in the Northern Division that during this time (*i.e.* up to the end of December) only 136 acres were planted—the lowest return for this period except in the Commission's first year of operating. This was followed on January 28th by an extraordinarily severe south-west gale which left its mark in the shape of blown timber over the whole country. It was especially severe on a 21-year-old Douglas fir plantation at Culloden, a freshly thinned increment plot suffering very heavily. Younger plantations on exposed or semi-exposed districts were swayed badly by the gale and had the soil opened up at ground level, especially where plants were at all " leggy." This necessitated a good deal of work in firming up.

Early spring weather was extremely varied and there were frequent gales with wind and snow, so that nursery work and planting in the forest was still further delayed, and the latter operation had to be continued to a later date than would normally have been the case.

Then came the severe late frost on the night of May 10th. It was not an entire surprise, as cold winds with rain, snow and frost had occurred throughout the last week in April, but for intensity it was probably the worst since April of 1908. It was experienced practically over the whole Division, and was almost disastrous in some cases in its effects. The main frost was on May 10th, as already noted, when 8° of frost were registered at Beaufort Nursery. In the same nursery 5° of frost followed on June 15th, and these frosts were probably much more severe in higher and less sheltered districts.

The effect of these frosts on new plantations was most marked on the lower and sheltered ground and on south aspects. Growth in such locations was fairly well advanced ; buds had swelled or burst, in the case of larches and even Sitka spruce. These buds were killed outright, and in some cases the damage included the tips of the shoots. Douglas fir seemed to be particularly susceptible. On the higher ground and on northern aspects growth was not so far advanced, and damage to spruces was not so severe, but even in these situations the older needles were scorched and browned.

Nurseries, however, suffered most severely. The unfavourable spring weather had delayed lining out, but by the time the May frosts occurred young growth was in full swing. Recently lined-out plants, two-year ones or older plants lined out a second time, did not suffer quite so badly as seedlings and plants which had been two or more years in the same place, and consequently began growth at an earlier date. Seed beds of two-year-old Douglas fir and Sitka spruce were badly damaged, and

Douglas fir, which was just being handled at the time, showed an abnormal percentage of failures. Growth was well under way in the two-year European larch seedlings at Culloden and damage was correspondingly heavy. At this nursery 450,000 of these seedlings were intended to remain another year in the beds and had therefore been wrenched. Following the frost of May, 10th however, they were so extremely damaged that they were a total failure, and it was decided to plough them in.

Sowings were not exempt from damage, many newly formed beds being partial or total failures, as the newly germinated seedlings were killed outright. This was the case more particularly at Beaufort, which nursery also reports a rather peculiar effect arising out of the late season, in that small birds, being late in nesting, were exceptionally heavy in their depredations on seed beds.

A few words might be added on the subject of recovery in plantations. Favoured, where death did not actually occur, by the wet summer and absence of hot weather, Douglas fir in particular made a striking recovery in some cases. Leading shoots, of course, were checked or killed back, but a high percentage of new shoots were in evidence at the end of the season to replace the damaged ones, and in some cases, as late as August or September, plants apparently quite dead were showing strong green shoots from ground level. The result of the late frost, however, will be apparent for years in plantations in the form of bushy plants and lost leaders until a first thinning can be made.

F. Oliver.

Chiddingfold Forest.

Chiddingfold Forest is situated in the counties of Surrey and Sussex. It lies in a basin surrounded by the Sussex and Surrey hills. The altitude ranges from 140 to 220 feet. The soil in most places is stiff and clayey and is soggy wet in the winter months.

The low-lying portions from 140 to 170 feet are more or less affected by late frosts every year, but the frosts we had on the nights of the 26th and 27th of April last were the most severe and did the most damage. The part that suffered most was a young and promising plantation of Sitka spruce, P.24. The plants had got well established and were doing well, some of them having reached the height of 5 and 6 feet.

The leaves began to turn a rusty colour early in May and soon after began to fall; the stems of the plants when cut over were dead and black as if they had been laid on the ground for six months. About 90 per cent. are quite dead above ground, but still seem alive in the roots; 5 per cent. are alive and green in the leaves and look healthy, but have only made a short growth of about 5 inches; and the remaining 5 per cent. made a short growth early in the season, but the leaves are now yellow. The stems of the plants from about 2 to 14 inches above ground are quite dead, the return of the sap forming quite a bulb above the dead portion.

A few of the live plants have had their bark frozen in patches, as can be seen by the irregular return of the sap, the stem not being cylindrical in form.

The part that suffered most has a north-east aspect, growing in an 8 feet coppice of ash and birch. The coppice not being in leaf gave no protection to the plants.

Several of the plants have sent out a shoot from the bottom and may, if not interfered with by frost again, make a nice plant in a year or two. Some of the plants have died from the top downwards.

About 5 acres planted in P.26 with 2+1 plants did well at first and have not so many dead as in the older plantations, but they have a weakly appearance ; several are shooting from the bottom.

Six acres of Sitka on the 200-feet contour line, where the coppice is fairly dense, have escaped much damage, but have not made much growth. In the grassy patches, however, there are about 50 per cent. dead. The thermometer on a wall here, 6 feet from the ground, 180 feet altitude, registered 12° each night, but the frost in the forest must have been more severe.

Which night the most damage was done I am not able to say, but the frost that killed the Sitka must have been a pure ground frost.

The Douglas plantations, P.23, have also suffered severely, 50 per cent. of the plants being dead. Some of the plants, like the Sitka, made a growth of 6 inches, but soon began to turn yellow and droop. Many of the plants never developed their bud, a touch of a stick bringing down the leaves in a shower early in June. Others have put out a straggly shoot here and there and present a miserable appearance. Plants growing in clumps of broom are quite dead, although they had all the protection that nature could give them.

The oak plants cleared of bracken in August, 1926, were cut back to the ground, but have made a shoot from the bottom. A frost of 10° on the 12th of May blackened the leaves of all the oak, although sheltered by coppice.

Norway spruce planted in P.26 made a nice growth the same season, and looked healthy. They suffered severely in the open places, about 50 per cent. being dead and the remainder looking sickly. Those in the shade of the coppice have not been so badly damaged, but look sickly also. Norway spruce planted in P.27 have quite escaped damage, no doubt owing to being newly planted, the sap not having started to rise.

Spanish chestnut suffered severely ; 5-year-old plantations, although growing in thick coppice, were cut back, but have shot well from the bottom.

Six-year-old coppice had in places the last three seasons' shoots killed. The ash did not suffer by that frost, but were nipped back in May. Of the poplars, *trichocarpa* and *generosa* were the only plants that suffered in the low-lying parts.

R. BUTLER.

Dorset and Hants.

On two of the Forestry Commission estates in Dorset fairly considerable damage was caused to Douglas fir by late frosts in May, 1927. The areas in question are Puddletown, 4 miles N.E. of Dorchester, and Ringwood, near the Dorset-Hants boundary, and about 25 miles E.N.E. of Puddletown.

Both areas are on the Bagshots and sand clays with coverings of gravel here and there. The soils vary greatly from yard to yard, but, generally speaking, both the affected areas have a slight covering of peat with 12 to 20 inches of peaty sand over gravel on sandy clay. The vegetation is of the heath type, but with a consi lerable admixture of bracken. At Puddletown the frosted Douglas extends over about 20 acres, but at Ringwood the area is rather greater. In both cases the elevation is about 150 to 200 feet and the aspect chiefly southerly.

The planting details are as follows :—*Puddletown*—Planted P.26 with 2+1 stock 12 to 15 inches high during the early part of March, 1926. Prior to planting there was considerable rain, but the actual planting was carried out in dry cold weather. By the end of the growing season the plants seemed fairly satisfactory and in the following spring began to put on growth. This plantation was well established when the frost occurred.

Ringwood—Planted P.27 with 2+1 stock 12 to 18 inches high in January and early February, 1927. Planting was carried out in fairly dry weather with slight frosts in early mornings, and was followed by a period of heavy rains.

Over most of southern Dorset, March and early April were comparatively wet, but in early May there was a change to dry cold weather with severe frosts. Frost damage was inconsiderable until an exceptionally severe frost was experienced on 23rd–24th May. Then it was found that Douglas in both areas had been badly frosted. Damage was not uniform ; plants scarcely touched were found surrounded by plants killed off to the ground level. Others, again, had only the new shoots damaged. But on both areas the number of casualties was sufficient to make it necessary to consider them as failures.

Later in the summer many of the presumed-dead plants began to send out shoots from the ground level, and by the beginning of the present winter many of these shoots were from 3 to 6 inches long. But growth finished late and the early frosts caught many of them.

Observation plots have been laid out to include plants :—

(1) Unfrosted.
(2) Frosted and shooting from soil level.
(3) Frosted and shooting from stem.
(4) Frosted and not shooting.

It will be very interesting to find whether Douglas fir is capable of recovering from such severe damage, and if so, whether or not the re-established plants are capable of reaching maturity.

W. D. Russell.

Clipstone Forest.

Generally speaking, Corsican pine is considered to be frost hardy, but this in practice has proved to be a fallacy, to judge by the effect of three days, or rather nights, of rather severe frost on the 27th, 28th and 29th April, 1927, on an area planted in P.26. These plants, which on the whole were looking well and just beginning to show signs of seasonal growth, made rather a pitiable sight; after the frost quite 50 per cent. on some compts. were to all appearances dead. On close examination, however, it was observed that in a good many cases only the previous year's shoot was affected, and it is gratifying to note that a large percentage is now coming away; some recovered their leading shoot after a time, while others were springing away from the roots. It may be of interest to note that the area which suffered most was on the higher ground, and the percentage of frosted plants declined with the fall in altitude; this is contrary to the generally accepted theory on such matters.

T. E. Anderson.

Laughton Forest.

A plantation of Sitka spruce (36 acres) was planted in March, P.27. On 12 acres the soil is a fairly moist sand with the top layer of peat 3 inches thick, where bracken flourishes. Good healthy 2+2 plants were used. In June the frost killed off 90 per cent. of the young Sitka just when they were making their young shoots and looking promising. A week later this area gave the appearance of winter, with its bracken and young trees all browned off.

On another 16 acres the soil is a very wet sand with a heavy growth of molinia grass. This area was screefed and planted with 2+2 and 3-year wrenched plants. The latter stood the frost much better than the 2+2 owing to their being more backward in opening out their young shoots. Here the damage was only 18 per cent., while the 2+2, which were much more forward with their young shoots, suffered heavily, 35 per cent. being killed off. Quite a lot of the plants which had all their young shoots frosted have since sent out new growth from the ground level.

The remaining 8 acres consist of a very wet piece of land with a thick layer of black peat which had to be heavily drained. Mound planting was then done in two ways.

On 7½ acres small drains were cut into the main drains and the turves taken out were cut into small mounds 14 inches square by 5 inches thick. On these mounds the frost did very little damage, only 10 per cent. of failure being found; the plants are looking well and made quite a good growth for the first year.

On the remaining half-acre plot, mounds 2 feet square by 1 foot thick were made by digging around and stacking. The mounds were allowed time to drain off and 2+2 plants were then planted in the centre. The failures here were greater than in the case of the smaller mounds.

W. Tribe.

Parkhurst Forest.

Late frosts did considerable damage to young plants, although perhaps not quite so serious as it at first appeared. The young chestnut coppice seems to have suffered most severely, this no doubt being due to the fact that extensive new growth had taken place before the frost came. Little or no damage was done to the ash, which had scarcely shown any new growth. The species most affected were chestnut, Douglas fir and Sitka spruce. In the case of Douglas fir, it seems quite possible that the late frost is responsible for the large amount of deaths now taking place among this species. The plants were so weakened by the loss of foliage as to make them an easy prey to the disease *Phomopsis Pseudotsugae* so prevalent in this forest at present. One hoped that this disease would be confined to the frost-affected areas, but unfortunately some deaths have been found on the high ground in Compt. 33A and B, although at present not so serious as in Compt. 12 and other low-lying areas.

The effects of good and bad drainage are very noticeable this year, perhaps because of the very wet season, and the trees look far more healthy where they are well drained.

It is encouraging to notice that the late frosts had no ill effect on the mature oak in this forest. In past years it has been very noticeable that after late frosts the oak leaf roller moth, *Tortrix viridana*, has played greater havoc than when no frosts have come to injure the young buds. This year, however, there were only a few *Tortrix* to be found, and a good crop of acorns followed. One can yet feel hopeful that this pest has done its worst.

O. R. T. Aston.

New Forest.

Briefly speaking, the frosts in May and June, 1927, have resulted in the annual growth of plantations of Douglas fir and Sitka spruce being reduced to an almost negligible amount. The spring shoot was totally checked except in favoured areas. The secondary growth amounted to from 3 to 6 inches in the case of Douglas fir and from $\frac{1}{2}$ to 2 inches in Sitka spruce.

Generally speaking, the plantations formed in 1926–27 suffered less than those previously established, probably due to their having been planted late in the season, and growth being retarded. Douglas fir plantations of 1925–26 suffered most. Sitka spruce plantations of 1923 have suffered in parts, trees 5 to 6 feet high being totally defoliated, but growth started again in the summer. No common spruce in this district has yet got beyond the semi-moribund stage and does not appear to have been damaged.

B. Gale.

PLANTATION FIRES.

By O. J. SANGAR.

There is little doubt that as servants of the Commissioners we must all face a fire problem of much greater relative importance than that which obtains in most other forest services; the latter may administer greater total areas and face conditions, climatic and other, which tend to greater hazards, but almost invariably the acreage in the most dangerous state—that is the stage prior to first thinning—represents only a proportion of the whole. With us the situation is entirely different in that virtually our whole area is now in this most dangerous stage, and during the next ten or twenty years the risk will increase as the aggregate acreage of young plantations increases, whilst only an inconsiderable percentage of our total acreage passes on to the stage of decreasing hazard.

In view of the position and our comparative lack of experience it is surprising that Mr. Long's article in the 1926 Journal called forth no comments last year. In all text-books on forestry may be found chapters, or even a volume, on forest protection, and many pages, and many careful illustrations, are devoted to insects and fungi, whilst trespass, thefts, forest-law, and other matters are dealt with at length. Concerning such of the diseases, insect attacks, and other dangers as may be encountered by a forester he would almost invariably have time to consult his books of reference or secure expert advice, and in many cases he would find that it was impracticable to take any action. Such delay and inactivity in the case of fire can hardly be recommended and in this, the one contingency requiring immediate and bold decisions, with prompt action, we may frequently find the person in charge lacking in both guidance and (fortunately perhaps!) experience. If, as is probable, the forest apprentices are turned out to fight fires in the Dean, one could almost hope that fires will become a weekly occurrence in that forest—but the Deputy Surveyor will probably wish otherwise! As it is our business to reduce outbreaks of fire to the minimum, and in so doing necessarily to rob ourselves of almost all opportunity for gaining first-hand experience, it seems essential that we record all possible information as to such experience, and make it available to others in the Commissioners' service; this collation of information is doubtless already done at headquarters from the fire reports submitted, but there is much that could be done through the medium of this Journal—and this article, which expresses purely personal views, is written in the hope that it may evoke criticism and suggestions, and that definite and precise information may be also forthcoming to the benefit of all of us.

The last dangerous summer was at a time when risks were infinitely less than would be the case this year or in future; a much smaller area had been planted, and the plantations were younger, none had reached the thicket stage, nor even the maximum in that accumulation of inflammable material, which, starting with planting, increases steadily till after thicket is formed, both restricted views and difficulty in penetration are

added to our troubles even if the latter has not been encountered at an earlier stage owing to the growth of brambles, gorse and such-like. In every forest we have " fire-lines " and they cost a lot of money both in cleaning and waste of ground ; this cost can be regarded as an insurance premium, but are we paying too high a premium, or are we spending it wisely having regard to the purpose and the actual proved degree of effectiveness of the various measures adopted ? Do we not want to know, for example, what percentage of fires are actually overcome by back-firing from, or beating-out on, prepared fire-lines, and whether lines designed as automatic " stops " are worth their extra cost or whether actual beating is always required ? Is it not just possible, remembering the period from, say, four to twenty years of age, that we may find frequent narrow, access- or inspection-paths, merely kept free enough for easy and quick travel, could be substituted in hilly country or with rectangular ride-system for a percentage of the fire-lines as at present prepared, the money saved being possibly spent on extincteurs or lamps for counter-firing ?

It is difficult usefully to consider the position without a clear understanding as to terminology, and the term " fire-protection " itself includes, on the one hand, true preventative measures which aim at preventing the start of any fire, however small, and, on the other hand, control measures which involve actual fire-fighting in conjunction with any lines of defence previously prepared and maintained. Preventative measures are thus affected by many factors, either purely local or (often) nation-wide, and including the education and attitude of the general public and its admission to our areas, the cultivation of local goodwill, the number of rights-of-way across the forest, the risks of fires caused by broken glass or lightning, and the proximity of main roads or railways. Except as regards risk from lightning and bottles, etc., prevention is thus concerned with steps to secure that fire is not started by human agency within our boundaries or in such place that it will spread on to our area ; both are largely governed by considerations too wide to be discussed here, whilst the last may also resolve itself into a question of control closely comparable to the control of a fire already burning within the forest, and can be treated accordingly.

The following main types of fire are generally recognised :—

Ground-fires.—Rarely occur in this country except in peat, or in the form of gob-fires in coal mining areas.

Surface-fires.—The usual type of fire, burning in grass, bracken, heather or other surface vegetation.

Crown-fires.—Conflagrations in which the actual crowns of the trees catch. Recorded instances in this country are relatively scarce.

The following terminology for use in the description of aids to fire-control is suggested :—

Fire-line.—Any ride or track left unplanted specifically for fire-control purposes, but provided also the bulk of the dead and inflammable matter is cut, burnt or removed, as may be necessary. Tracks left to provide quick access in case of fire would not necessarily be classed as fire-lines.

Fire-trace.—Any ride or fire-line provided with a width of bared mineral soil such that (having regard to the vegetation) a surface fire is expected not to cross it and a counter-fire can be started from it in safety.

Fire-belt.—A belt of hardwoods with or without a ride or a fire-line designed to catch sparks, whether they be from a crown-fire, railway locomotive or traction engine.

Fire-break.—A combination of fire-belt and fire-trace.

Fire-zone.—A danger area, cut off from the forest by a fire-trace, wherein no serious effort at fire-prevention is made.

The risk of crown-fires does not seem sufficient to justify the establishment of fire-belts except along railways or where the hardwoods themselves can either be regarded as an economic crop or are required for a windbreak or other purpose, such as amenity, especially as the efficacy of such a belt for stopping a crown-fire is extremely doubtful whatever its width. In places where its employment is considered justified it will generally be well to incorporate a fire-trace, thus making a fire-break of it, for the reason that it is thus possible to counter-fire ; not only is this about the only remedy for crown-fires, owing to the reverse draught of the counter-fire, but the hardwoods will generally be by railways, where the trace is necessary, or down ridges, where it will be doubly useful for counter-firing, even against surface fires. The fire-belt proper will thus probably be little used except in places where it is really adopted for other purposes.

Fire-breaks and fire-traces are in a class quite distinct from fire-lines and fire-belts ; the two former are expected, under ordinary circumstances, to stop a surface-fire either because they are non-inflammable over their whole width or because the vegetation is kept cleared so that it will not burn fiercely enough to jump the bare strip provided. Fire-line and belts are solely lines of defence upon which a fire can be met and fought. The writer has the gravest doubt as to the efficacy of fire-traces as such, and as to the wisdom of placing any great reliance thereon. One blown blade of grass or wisp of heather and the fire is away again across the trace, whilst the staff, relying on it, are most likely engaged on a less important front. For counter-firing, however, they are invaluable, and will be mentioned later in this connection. Fire-lines and belts are not expected to stop a fire, but should be in every way suitable for active operations by the fire-fighters ; unless men can quickly reach the fire-lines and easily travel them they will lose half their value, and where the normal inspection paths are unsuitable, special paths for access to the fire-lines may usefully be left, especially in steep or rocky country or for use when the plantations are in the thicket-stage.

When a fire is burning in a planted area there are three main methods of dealing with it, namely :—

(i) Immediate attack of the burning edges, wherever these may be.

(ii) Conservation of effort and careful preparation until the fire reaches a line of defence where it is attacked with all possible energy.

(iii) Carefully considered counter-firing, generally from a prepared or natural line.

It is important to differentiate between the above, because it may often happen that the first method is used without due consideration, and that it is not till the men are thoroughly exhausted and perhaps overcome by smoke that the second method is (perforce) adopted, the fire-fighters being then perhaps only 50 per cent. efficient, and failure being almost certain, with the result that the fire goes on till it reaches some natural barrier, or till evening or a change of wind. It is suggested that there be some definition of responsibility and discretionary powers as between foresters, foremen, patrolmen and workers, and this might be as follows :—

Patrolmen should be selected men, experienced, if possible, and in common with all workers should be charged with the primary duty of calling help unless *certain* they can themselves extinguish the fire, but some at least should be differentiated from workers by being given discretionary powers—that is, to the extent of being allowed to guide a fire towards a line of defence rather than exhaust themselves (and any help which arrives) by direct attack, if it is obvious that the latter is futile.

Foremen and foresters should understand that in very many cases (if not most) they can do as much good with their heads as with their hands, and that hard work in the densest smoke and hottest fire is no justification for ignorance as to how the fight is going, whether the men are being overpowered, or whether the fire is working round a flank. Only the forester or foreman in charge should be allowed to counter-fire, but he should not hesitate to take this step if, with a complete grasp of the position, he judges it necessary.

The method of direct attack and the various tools and beaters employed is too well known to need discussion. It almost always resolves itself into a flank-attack owing to the heat and smoke, and this differs little from the policy of controlling and guiding a fire till it reaches a predetermined line, but the main difference is that in the first method a narrowed-down fire may reach this line and, with exhausted fire-fighters, jump it or get round a flank and go away again, whereas the principle of the second method is that the fire is retained on a wider front, but the men watch the flanks, are comparatively fresh when it reaches the line, and thereon attack it with full vigour. Such an attack is infinitely more certain of success if the fire-line is not (as usually prescribed) at right angles to the prevailing (fire-period) wind, but diagonal thereto. A fire safely out, with an extra acre or two burned, is better than a sporting chance of beating it—and possibly another 100 acres gone.

If a fire is burning straight towards a fire-line, trace or belt, which is at right angles to its travel, the men cannot attack it at its weakest moment (*i.e.* just as it arrives) for they will be blinded and suffocated by smoke, and may even be in serious danger. In such cases it appears possible only to counter-fire if direct attack is not going to succeed before the fire-line is reached, the latter thus functions only in this way, unless it is of such type as to stop the bulk of the fire, thus permitting the staff to be used on the flanks, and to extinguish such places as get started on the

leeward side. It is not apparent that this is any better than counter firing, and has certainly in some respects more risk.

Counter-firing is generally avoided, as there is an impression current that it involves large sacrifices. If conditions are such that the counter-fire can only be started from a fire-line or trace, then probably the fire will burn to (or beyond) that limit anyway, and must be attacked thereon at full volume. If a counter-fire be started instead, we have only to extinguish the leeward edge of a very small fire, with but little heat and smoke, and the two fires meet some distance from the line, with also the benefit of the back-draught of the counter-fire. If the main fire can be extinguished without waiting for it to reach a prepared line the position is exactly similar, and in counter-firing the general tactics are exactly as in direct attack or control, with the same important difference as above, namely, that the counter-fire is started *only just far enough* from the main fire (and also utilising natural features, etc.) to avoid the worst of the heat and smoke. The men can undoubtedly beat the edge of such (counter) fire quicker than the main one, can cut across the line of approach more obliquely, and, *provided the counter-fire be laid quickly enough*, will ultimately confine the fire to a smaller area than if directly attacked, even despite the extra strip (apparently) sacrificed. The counter-fire is obviously doubly necessary in thicket areas or in dense brambles, etc., where movement and fire-fighting are virtually impossible except on rides. In such cases the fire, sweeping down on the ride, will be in such volume that it will almost be impossible to control, and it will be very difficult to attack each individual fresh fire started in the thicket across on the leeward side of the ride. A counter-fire can also be started from a narrow track or footpath which, in the conditions outlined, would be otherwise virually useless, except for access.

Unless means for the laying of counter-fires *quickly* are available, half the advantages are lost, and the ideal is some form of high-power torch with which fire can be laid as a man walks, thus leaving the whole of the rest of the staff to beat its leeward edge and watch flanks. The Hauck burner now on trial seems ideal, for not only does it lay fire quickly, but its powerful blast blows loose material towards the main fire, and, with a fire-line, road or beaten footpath to start from, little beating of the lee-side should be necessary. It seems possible that less expenditure on fire-lines and traces, etc., might be justified if the balance were devoted to burners for laying counter-fires and even extincteurs (if a suitable type can be found), so that even two or three men can start a counter-fire safely, the extincteurs being used only on the lee-edge of the counter-fire and not on the main fire at all.

Public roads and rights of way are a most difficult problem, and the expenditure justifiable thereon can only be assessed as information is gradually collected. The removal of inflammable material within easy throw of the track is an obvious precaution, in which the local authority will sometimes assist, but how far shall this measure be carried ? Such clearing or brashing often encourages pedestrians to stray from the beaten path and even into the plantations, so that the uncleared area is again in

danger. Is the risk, in extreme cases, sufficient to justify a fence delineating the track, and a cleared or screefed area on the planted side of the fence? A seemingly good idea adopted by the forester at Delamere is to brash young plantations, or even the edges thereof, and leave the branches in a tangle on the ground. It is found that this is one of the strongest possible deterrents to penetration by the silk-stocking trippers of to-day.

The following suggestions, and points upon which specific information is required, are noted :—

(i) To gain experience extensive prep. ground should be organised approximately on " fire " conditions.

(ii) Where practicable, some of the projected fire-lines should be prepared prior to such prep. ground. No great extra cost should be involved, and information as to their efficacy can be secured and counter-firing practised.

(iii) Some means of quickly laying and controlling a counter-fire should be provided.

(iv) Lines of defence should be diagonal to the prevailing (fire-period) wind and, where possible, should be just on the reverse slope of spurs or ridges, *i.e.* on the lee-side as to the danger wind, or on the side away from that direction from which a fire is likely to come. In either beating or counter-firing the benefit of the ground-eddy will then be secured.

(v) In thicket or brambles, gorse, etc., a width of plantation on either side of the ride, fire-line, etc., should be kept brashed and clear to permit penetration to extinguish sparks and blown embers.

(vi) District and Divisional Officers should be informed by telephone or telegram of every fire if there is the least chance of their reaching it before it is out.

(vii) Bracken-switching rather than cutting reduces the collection of inflammable material in bracken areas.

(viii) Definite information is desirable, under varying conditions, as to the number of fires :—

(*a*) Extinguished with, and without, the assistance of the various prepared lines of defence.

(*b*) Automatically stopped by fire-traces or breaks.

(*c*) Controlled by counter-firing and, if so, the nature of the line along which the counter-fire was started, also the tools and implements employed.

(*d*) Started from railways, roads and rights of way, and what distances they start from the line or actual beaten track.

(ix) Each regular worker, patrol man and, possibly, forester or foreman in charge should be provided with a card of instructions, in the briefest possible form, "What to do in Case of Fire." The exact phrasing of the cards would vary with almost every forest, but no room should be left for hesitation or uncertainty.

FROM AN OFFICE WINDOW AT 1, WHITEHALL.

By B. R. Davies.

Every man's outlook is limited ; some see farther than others.

There are seven men working behind this window, and for many hours each day their outlook is on paper. It may be a forester's report, a District Officer's, or a Divisional Officer's report, but it is on paper (I have seen a letter on a brown paper cover, but a member of the Public was guilty of this disrespect). Eighteen years ago I was working by the same window-sill.

Now you foresters and others actually see things, and I do think you might give us poor report readers a better idea in your reports of what you see and what you want us to do. Take, for example, the progress reports. Quite often there are items of cost which seem extravagant and may cause comment. You see the work going on and know that a particular bit of draining was difficult ; why not make a little note alongside to explain ? The forester has only his own progress report ; the Assistant Commissioner has dozens to digest and the digestion is not always easy, because you will not add the appetising notes which may explain. But take warning : notes will not excuse constant high costs.

Here we have been trained to put things down on paper ; the man who never forgets I have yet to meet. At each forest I would suggest that a decently-bound forester's daily log book be kept. Do you outdoor folks use the pencil and notebook enough ? Remember that others do not see what you see. The Divisional Officer cannot be everywhere, and your little report, in time, of a certain happening may save him a lot of worry in the future, as he may be able to apply the remedy. But, above all, write what you think and not what you think you ought to write. Simple language, stating the plain facts, is a good deal better than a lot of surplus irrelevance.

To keep in touch was one of the hardest problems of the War (some of us have been connecting files), and it is always difficult to link up the work. You do not know me ; I do not know you. I have often wished for an ordinary workaday photograph of each forester to fix him in mind. We are all on the same work, doing our best to help it along, and the more we understand each other the easier the machine will go. Here we endeavour to link up all the operations in England and Wales, but we must be provided with the information from all localities.

You have local knowledge ; we have not. You raise a question about a road or path from this place to that. Put it on a plan, please, as to us there may be two such roads. You know that the other road is used only by a certain farmer ; we do not, and we may make a (to you) foolish mistake.

We ask you for all the local information, but, unfortunately, we cannot always give the reasons for our instructions or requirements ; it is

not allowed. It may be a Parliamentary Question or a Government instruction. We have quite enough work to do without adding to it by asking needless questions. I can assure you we are not allowed to stagnate.

When you are out in the rain you envy us; when you are in the sunshine we envy you, so there is not a great deal between us. It we can realise the other's outlook the better for both.

REVIEWS AND ABSTRACTS.

THE AFFORESTATION OF SHIFTING DUNES IN THE FOREST OF GRÜNHAUS.

By Oberförster Müller.

(*Zeitschrift für Forst und Jagdwesen*, October, 1927.)

The article describes the results of the afforestation of over 2,000 acres of shifting dunes on the coast of the Baltic near Stettin. Rainfall data are not provided, but the climate is described as rainy and misty.

The land was originally under forest, but the destruction of the latter during the Thirty Years' War caused sand to invade the area and to threaten the fertile fields beyond with destruction. As a result of much outcry on the part of the peasants concerned the State undertook the stabilisation of the dunes, and between 1835 and 1842 a foredune was fixed by means of Marram grass planting. Behind the foredune stretched a great expanse of rolling main dunes in the form of ridges and rounded hills, the heights of many of which were over 100 feet above sea-level. The long axes of the dunes are parallel to the north-west, the direction of the prevailing sea wind, and slopes are gentle on the seaward side, but very steep and abrupt to the south-east. By the time that the foredune was fixed the main dunes consisted of loose sand without any trace of vegetative covering, and attention was then directed to the problem of fixing the surface sufficiently to enable trees to be planted. The use of *Elymus arenarius* was out of the question owing to the absence of fresh accumulations of sea sand; marram grass proved better, but even this failed and vanished in time, torn out by the strong gales. Eventually it was employed only where pine planting was to follow immediately, and then the casualties in the young plantations were very heavy, and they were finally compelled to use branches of alder, Scots pine, elder and broom stuck with their thick ends buried 8 in. in the sand.

The writer recognises five distinct localities in the sand dune areas :—

(1) The spring hollows (flowing water).
(2) The land surrounding the spring hollows.
(3) The flat interdune land.
(4) The gentle slopes, the upper parts of the steep slopes and the dune tops.
(5) The lower part of the steep slopes.

Nurseries were established in the flat interdune area, and the latter were drained by an extensive network of ditches. Three to four-year-old Scots pine seedlings were lifted as ball plants from the nurseries and planted in a hole prepared with a circular spade; these plants were watered immediately afterwards. Triangular planting with 4 ft. spacing was adopted.

After the first 10–15 years the use of pine and broom branches for covering was given up as a general measure, with the result that by 1848 more than 500 acres on the dune tops were destroyed by the driving sand. Experience showed that shelter against driving sand was indispensable for all pine plantations on the dunes. The destruction of the needles was the actual cause of death in many cases.

The interesting observation was made that, where heather plants were accidentally raised with the pine from the nursery and these came to be placed on the north-west side of the pine in the dune sand, they provided shelter against the sand, the pine kept a good colour and made vigorous shoots. Such solitary pine often succumbed after 20–30 years' growth, probably because they outgrew the shelter of the heather. The latter is the only plant which was invariably successful when planted on the dunes.

The position in 1848 was roughly as follows. The dune tops and sea-facing slopes were stocked with yellow-foliaged pine up to 20 years of age and 3 ft. to 4 ft. high, the roots of the trees spreading 10 ft. to 12 ft. over the sand. On the lower steep south-east slopes the trees were flourishing and gave promise of excellent growth. In the interdune flats the trees grew well for the first 10–15 years, but then died in groups in the hollows when the roots reached the water table. Great trouble was experienced in the following years with *Lophyrus pini*, *Tortrix resinana*, and *Pissodes* beetles, which had to be constantly picked or trapped. Damage from storms and drought also was unceasing, while pine leafcast caused huge losses in some years. In 1866 Scots pine was declared to be the least suitable species for dune planting—largely on account of the casualties due to pine leastcast, and attention was paid to other species, notably erect mountain pine from Danish seed and maritime pine. The latter species was very promising at first and far superior to Scots pine as regards rate of growth, but sooner or later winter frosts brought about the wholesale death of the trees. Reference is made to investigations by Müller, which showed that maritime pine increased the microflora and nitrogen content of the dune sands, and but for its inability to withstand severe winter cold it is regarded as a most valuable species for dune culture. Mountain pine gave a far greater measure of initial success than Scots pine, and gradually the method was evolved—in particular for planting the dune tops—of planting alternate rows of Mountain pine and of Scots pine, with the addition of loam or peat to the plant roots. The sand between the plants was covered with heather bushes.

The work of afforestation came finally to an end in 1905, and the following may serve as a summary of the methods employed. Use of three to four-year-old ball plants lifted with the circular spade and planted in holes prepared by the same implement. Deep planting. Immediate covering of the sand with bushes. Species—Danish mountain pine, maritime pine, with Scots pine and *Calluna vulgaris* the predominating species. Addition of a handful of compost to each plant. Spacing usually 3 ft. 3 in. × 3 ft. 3 in., with two-year Scots pine seedings, 18 in. to 3 ft. 3 in., with heather planting, 13 in. to 19 in. (square planting). The

fixed half way up the stem and the tree pulled over bringing the roots up out of the ground. Dominant stems were usually selected with an occasional subdominant or dominated tree for purposes of comparison. The ages ranged from 10 years up to 45 years, the latter being the oldest trees available.

The soil naturally takes premier place among the factors which may influence root development, and Herr Groth is to be congratulated on the thoroughness which he has devoted to this side of the investigation. The Douglas fir stands selected were growing on the following formations: upper and middle Bunsandstein (Triassic Strata), Granit, Basalt, Quartzite and, exceptionally Löss, thus giving a very wide range of soils. In every case soil samples were taken at depths of 6 inches, 12 inches, 2 feet and 3 feet 4 inches in the immediate vicinity of the grubbed tree and subjected, in the first place, to mechanical analysis using Kopecky's apparatus for the determination of the finer particles. Two analyses were made of each soil and the mean taken; according to the writer, differences were usually inconsiderable. The soils are classified into three groups, according to the proportion of fine sand, silt and clay (particles below 0·1 mm.):

(1) Coarse grained soils 20–40 per cent. fine sand, etc.
(2) Medium grained soils 41–60 per cent. ,, ,,
(3) Fine grained soils 61–70 per cent. ,, ,,

In addition to the mechanical analysis, the acidity of the soil was also determined, using Daikuhara's Titration Method.

The other factors besides soil which were considered were (1) Planting distance, (2) Mixtures and (3) Thinning. The results are given in tabular statements, which comprise the following information for each tree: Number of Area, Situation, Area of plantation, Whether pure or mixed, Locality description, Geological Formation, Nature of Soil (depth, moisture, texture), Planting Distance, Stem Class of grubbed tree, Height, Diameter at breast height, Root system, Depth, Diameter of root spread, Diameter of the roots at half their length, and finally whether the stand had suffered damage from either wind or snow.

Before discussing the relation of root development to soil and other factors there are a few general points of interest arising out of the article. For example, there is the general rate of growth of Douglas fir, the elevations at which it has been planted in the part of South Germany concerned, the planting distance, etc. The rate of growth can only be arrived approximately, as the height measurements given refer to the trees actually felled and beyond the fact that dominant trees were selected in most cases, there is no means of determining the relation of the height of these trees to the mean height of the stands. In all probability the tabulated heights are above the true means, but, accepting them as such, the majority of the stands are between the 80 feet and the 90 feet Quality Classes.

The stands were mostly planted on South, East and North slopes, *i.e.*, on the more sheltered aspects, and at elevations ranging from 700 to 1,900 feet, averaging 1,250 feet. The slopes range from flat or gentle to steep and, in a very few cases, very steep. The planting distance was close, in the majority of the stands the spacing was 1 meter (3 feet 3 inches), some

are 4 feet apart and only in a very few cases does the spacing approach 5 or 6 feet.

The root system of Douglas fir is of two distinct types, namely (1) a "heart-root" system and (2) a "shallow-root" system. The tree does not form a tap root comparable with that of oak or Scots pine. By "heart-root" is understood a fanged type of structure consisting of a considerable number of large vertical roots which strike off vertically downwards from the bulbous mass of woody tissue formed below the stem collar. The depth penetrated by the fangs depends largely on the age of the tree, depths of over 4 feet are recorded for some of the trees over 35 years of age. A characteristic feature of the heart-root system of Douglas fir is the profusion of small fibrous roots produced from the main roots. The shallow-root system is somewhat similar to that of spruce but less wholly superficial and the roots are much more fibrous.

The individual factors :—

(1) *The soil.*

Douglas fir forms a well marked "heart-root" system on coarse grained granitic and Triassic soils and on fine grained basaltic soils except those of a clayey nature. The heart roots were found to be formed even in 12- and 13-year-old stands spaced 4 feet apart.

The depth and root spread on these soils will appear from the following typical examples.

Age.	Planting Distance.	Depth.	Diameter of root spread.	Diameter of roots at half their length.
	ft. in.	ft. in.	ft.	ins.
12	4 0	1 8	7	0·8
24	3 3	2 4	5	0·8 to 1·6
38	3 3	3 3	10	2·4 to 3·2
45	4 0 (with spruce)	Over 4 0	10	3·2 to 3·9

The only instances of wind or snow damage occurred in certain stands planted at 1-metre spacing and insufficiently thinned, otherwise all the plantations on coarse-grained soils were storm-fast.

On fine-grained Triassic soil and stiff basaltic clays Douglas fir forms only a shallow root system, as will be observed from the following data :—

Age.	Planting Distance.	Depth.	Diameter of root spread.	Diameter of roots at half their length.
	ft. in.	ft. in.	ft.	ins.
23	4 0	1 4	3	0·8
31	4 0 (mixed)	2 3	11	0·8 to 1·2
39	3 3 (mixed)	2 3	10	0·8 to 1·2

It should be noted that these soils were deep and offered no obstacles to root penetration. A feature of the rooting on these fine-textured soils is the excessive amount of branching which takes place, causing the roots to form a dense matted layer near the soil surface. Douglas stands on such soils are very prone to windfall and snow damage, and many of the stands examined had suffered from this cause. The writer attributes the flat rooting of Douglas on the fine-grained soils chiefly to lack of aeration.

Douglas fir grown on medium-grained soils, *i.e.*, on soils with about equal proportion of fine and coarse particles, develops a root system which is a combination of heart-root and shallow-root. Some of the main roots are surface rooting and others go vertically downwards, but remain of small size in the younger plantations, developing later into stout fangs. Wind and snow are dangerous on these soils in youth, but as the trees get older and the stocking is reduced by thinning the stands become quite wind-firm.

(2) *Influence of soil acidity.*

The exchange acidity only was measured by titration with caustic soda, and P.H. values are not given. The results indicate that all the soils were very acid, but that there was a general tendency for the acidity to increase from the coarse to the fine-grained soils. There was no evidence to show that root structure was in any way closely related to soil acidity.

(3) *Influence of planting distance.*

The writer ascribes great importance to this question. He states that close planting prevents the normal development of the roots and so makes the trees very liable to wind-throw and snow-break. Unfortunately the data he provides are not very convincing. He was able apparently to investigate only a very small number of widely-planted stands, and these, for the most part, were of abnormally slow growth, which may have affected root development. Groth claims to have found that in close-planted stands the root spread is very much smaller than in wide-planted stands and the size of the roots also markedly less. He quotes, moreover, examples of wide-planted stands which have stood untouched, while close-planted Douglas on similar soil and at similar elevation was badly snow-broken. He recommends a planting distance of not less than 5 ft. for Douglas on coarse-grained soils, 6 ft. on the intermediate soils, and $6\frac{1}{2}$ ft. on fine-grained soils. The problem of branch suppression is dealt with by the proposal to prune 25 per cent. of the crop at the time of the first thinning. Alternatively, Groth suggests inter-planting with spruce or Scots pine; the former should be removed later as Christmas trees.

The use of Douglas for planting in small numbers as single trees among Norway spruce and also among beech is recommended; the Douglas develops a particularly strong root system in mixtures of this type and tends to safeguard the main stand against wind-fall.

(4) *Influence of thinning.*

Thinning greatly encourages the root development of Douglas fir, and in early and frequent thinning lies the only hope of rendering close-planted stands wind-firm.

(5) *Comparison of root systems of Douglas and Spruce and relation of the two species to wind and snow damage.*

Norway spruce differs from Douglas in developing a shallow-root system on both coarse and fine-grained soils. Two adjoining trees were examined in a 45-year-old plantation and the following data obtained :—

——	Root depth.	Root spread.	Diameter of roots at half length.
	ft. in.	ft.	
Douglas fir	Over 4 0	10	3 ft. 1 in. to 3 ft. 9 in.
Norway spruce ...	3 3	20	2 ft. 4 in. to 3 ft. 9 in.

The Douglas had developed a typical heart-root system, while the spruce was shallow-rooted with a few vertical "sinkers." The much greater root spread of the spruce will be noted. Groth considers it difficult to say which species is the more wind-firm; but suggests that on coarse-grained soils Douglas should have the advantage.

CORSICAN PINE.

In a recent number of the *Revue des Eaux et Forêts* (October, 1927) Mons. J. Salvador contributes an interesting article on the Austro-Corsican group of pines. He refers to the numerous informative contributions, in the French language, which appeared in 1926, concerning *Pinus Laricio* and its varieties, and goes on to show that the black pine of the Cévennes ("pin de Salzmann") is identical with that of the Pyrénées, quoting authorities who dispose of the latter as a separate species. A full description of the local habitat of this tree in the Spanish Pyrénées, and its occurrence on the French side of the frontier is given, from which it appears that its maximum elevation near to Saint-Laurent-de-Cerdans is 2,625 ft., and, in Spain, the altitude varies from 1,969 ft. in the wet valley of Llobregat to 4,757 ft. in the Vansa valley, which is drier. By way of comparison it is mentioned that the evergreen oak occurs up to 4,921 ft. There are several hundred acres of this pine, almost pure, in the neighbourhood of Sen d'Urgell, between Sègre and Noguera Pallaresca, where individuals attain a height of 49 ft., with diameter measurements of from 16 in. to 20 in. at breast height, and regular exploitation is actively pursued. The formation is limestone and the soil dry and poor. The station would seem to be a good one from which to investigate this tree in the Pyrénées.

This *pin Laricio* is described as being a truly Mediterranean tree, and more or less indifferent to the nature of the soil. In comparison with *Quercus Ilex* it does not approach so near the sea, neither does it rise to such high elevations in the mountains, and apparently it is not so tolerant

of humidity. The writer offers the opinion that conditions suited to the "pin de Salzmann" closely approximate to those demanded by *Ostrya carpinifolia*, the introduction of which into the district of Saint-Guilhem-le-Désert was attempted with success in 1913, but not persevered with, and he urges the planting of these two species, one coniferous and one broad-leaved, on the limestone soils of the foothills of the Mediterranean mountain chains.

Reference is made to the excellent results with Calabrian pine at Barres, and with regard to this species in its native habitat quotation is made from the *Bulletin de la Société Dendrologique de France* (November, 1926). The point from which the Calabrian pine has developed is the Sila, a mountain massif which is separated from the Southern Appennines in Calabria by the valley of the Crati. The culminating point rises to 6,329 feet but generally the terrain is in the form of a plateau having a mean elevation of 3,937 to 4,265 feet. The formation is of chrystalline schists and granites which decompose readily into coarse sands. The climate is maritime with four very dry months in summer; winters are not severe, snowfall is never heavy nor does snow lie long on the ground. The Sila is crowned with magnificent forests of Calabrian pine including a crown forest of 21,250 acres. The stocking throughout is pure or almost pure, for here and there occur beeches, oaks (chênes chevulus) and sycamores, and the forest floor is carpeted with a fairly dense herbage which the sunny climate renders possible, which characteristic as well as the appearance of the trunks of the trees gives the appearance of a larch forest.

No regular coupes are taken owing to transport difficulties. Stocking is very irregular as under the group system a method of treatment which seems to suit the species. Regeneration is extremely easy and the smallest gap is restocked at once. When animals are excluded from the meadows and clearings these are quickly invaded by the pines and are soon covered by regular thickets; like many of its congeners the Calabrian pine has a marked tendency to occupy vacant spaces and, more resistant of damage by stock than other species of trees, it slowly establishes itself when they are displaced. This ecological peculiarity no doubt accounts for the present stocking of the Sila.

The Calabrian pines (in the Sila) attain large dimensions: 98 to 115 feet is not a rare height—and diameters of from 31 to 39 inches are fairly often to be observed. As in the case of the Corsican pine there is much sapwood until an advanced age, but individual trees exhibit marked differences in this respect. Botanical characteristics are said to show great variation, and individuals are to be found in these forests which bear needles identical with those of the Austrian pine; while others with their long, fine and straight needles are more like the *pin de Salzmann* (Laricio of the Cévennes). Young Calabrian pines have their needles straight which differentiates them from young Corsicans which have their leaves curved in all directions. The white buds, considered a characteristic of the *pin Laricio* are not constant in the Sila where numerous instances of reddish buds occur. The cones also are very variable. As

regards form the Calabrian pines of the Sila show the straightness of the Corsican pines and usually they are remarkably slender, but more stumpy specimens are met with approaching the Austrian pine in appearance. The crown is pointed and often very straight, but again there are many variations; by the side of trees having regular whorls are to be found trees the whorls of which approximate more to those of the Austrian, etc., pines. Generally the branches are short but not in all cases and some take almost the form of the cedars.

The bark is usually a darker grey than is the case with the older trees planted in France, and at times there is a singular resemblance to the bark of the larch; but in numerous cases, especially with old and isolated trees, it is of an extraordinary whiteness, sometimes approaching in appearance that of the Stone pine.

Although so very variable in its characteristics, the Calabrian pine is nevertheless a distinct species, considered a particularly interesting tree for the mountains of Southern France in silicious soils and at middle elevations.

Information is needed concerning the black pines of Spain, which form two large forest areas of over 250,000 acres each, in the Serranias of Cuenca and Albarracin on the borders of New Castile and Aragon and the Serranias of Cazorla and Segura in Andalusia. Here, according to the authority quoted, the *pin Laricio* attains dimensions equal to those of Corsica and Calabria and possess a markedly calcicole habit, the stands occurring exclusively in the Jurassir and Cretacious marls at elevations of from 2,625 to 5,578 feet. The writer traverses the suggestion that all the varieties of *pin Laricio* in Spain can be grouped under the name of "Laricio Hispanica." He quotes M. Gaussent, of Toulouse, who has, it is claimed, established beyond dispute that the black pine of the Spanish Pyrénées is identical with that of the Cévennes and Pyrénées—Orientales of France. It remains to be discovered if the species occurring in the great forests of Eastern and Southern Spain are the same or distinct. M. Salvador states that he has been able to find no essential difference.

Information is lacking concerning the species occurring in the massif of Edough in Algeria, that of the island of Panteliaria and that of the mountains of Greece, and as for the most Eastern of all (*pin Laricio Pallasiana*) this tree is said to form vast forests in the Taurus in Asia Minor at between 3,281 and 5,905 feet on calcareous soils and to attain magnificent dimensions. There are some fine groups of the last mentioned, which is an intermediary between the Austrian and Corsican pines and seems tolerant enough from the soil point of view, at Barres, and a large specimen at Petit-Trianon, at Versailles, planted in 1790. The tree has frequently been introduced into France but results have not been co-ordinated.

W. L. TAYLOR.

This periodical is devoted mainly to systematic entomology and to "collectors'" records, thus it is comparatively seldom that articles appear which are of interest to foresters or forest entomologists.

1919.—H. G. Champion, of the I.F.S., described the life-history of a Longicorn, *Chlorophorus strobilicola* (Champion) which breeds in the cones of *Pinus longifolia* in the Himalayas. The extent of damage done is normally of small importance, but in a poor seed year when the cones are scarce the proportion of infestation may rise to 40 per cent. or more. The only natural check to the increase of the species noticed was a fungus which killed the larvae. In non-fire protected areas many of the fallen cones containing larvae are burned on the ground.

G. W. Nicholson and G. C. Champion gave notes on the Buprestid beetle, *Melanophila acuminata*. This insect breeds in the bark and sapwood of Scots pine which have been scorched by fire. Forest fires in the heathlands of Berkshire, Hampshire, Surrey and probably other places attract the beetles in large numbers and the females may be seen running over the smoking trees searching for suitable egg-laying crevices. The beetle appears to be of no economic importance in this country since it only breeds in charred trees, but Burke ("Journ. Econ. Ent., Concord, N.H.", February, 1919) recommends burning of the infested trees before the insects have quitted, so presumably it may assume the status of a timber pest.

T. A. Chapman described the life-histories of the pine sawflies *Pteronus pini* and *P. sertifer*.

1920.—D. Sharp and J. W. Munro contributed notes on the occurrence in Britain of *Hylastes attennatus* on Scots pine stumps.

1921.—E. G. R. Waters described the occurrence of various conifer-feeding moths of the genus *Argyresthia* in the Oxford district.

Hylurgus ligniperda, *Ips* (*Tomicus*) *sexdentatus* and *Ips erosus* are imported bark beetles which appear to be becoming established in the country. (C. Bartlett and J. R. le B. Tomlin.)

1922.—Hugh Scott described some Hymenopterus and other enemies of *Tortrix viridana* : *Pteromalus deplanatus*, *Phaeogenes stimulator*, *Pimpla brassicariae* and *Labrorhynchus nigrocornis* have been bred from the pupae of the roller moth.

1923.—The author gave further notes on the life-history and habits of *Melanophila acuminata* (see above) from Bramshill and various of the Berkshire pine areas.

Phloesinus thujae was noted as a new Scolytid found attacking *Thuja orientalis* and *Cupressus pisifera* in Kew Gardens. (T. Hudson Beare.)

H. G. Stewart found *Pityogenes bidentatus* infested by a Chalcid parasite, *Etroxys dimidiatus*.

1925.—J. W. Munro, in correspondence relating to the mobility of *Hylobius abietis*, gave some interesting observations. Beetles have been found attracted by light, having flown long distances from their native pine woods, but normally they are slow to disperse from the breeding centre, and it is probable that the active flyers are usually males. In an actual experiment with marked males the maximum distance travelled from the point

where 1,000 specimens were liberated was 780 yards. Other observations tend to show that under normal conditions where the main woods are Scots pine, *Hylobius* will not travel far. The success of trapping methods certainly bears this out.

G. L. R. Hancock gave a further list of parasites and hyper-parasites of *Tortrix viridana*. No fewer than ten different species are enumerated from the larvae and pupae of the moth.

1926–7.—No articles of special interest to foresters have appeared during the last two years.

G. B. Ryle.

The Indian Forester.

January to December, 1927.

During the past year this monthly journal has maintained its usual high standard. The contributions cover a diversity of subjects, silvicultural problems are very much to the fore, utilisation and protection also come into prominence. The articles, which naturally are of greater interest to Indian and Colonial foresters than to us at home, are often provocative of spirited correspondence in succeeding issues, which tends to clear up doubtful issues. The sections devoted to extracts and reviews cover all phases of forestry and enable the isolated officer to keep abreast of the times.

Among matters which might interest foresters in this country is an article by R. S. Hole in the August and September issues, dealing with the mortality of the Himalayan spruce. In this article Mr. Hole reports the finding of *Fomes annosus* on *Abies Pindrow* and *Picea Morinda*, records which it is believed are new for India; it differs somewhat from the European form and has been named *F. annosus* var. *indica* Wakef, its mode of attack and effects, however, are apparently similar to our own fungus. *Armellaria mellea* is also reported on *Picea Morinda*, another first discovery in India.

Another interesting article is found in the issue of October on "Aviation as a Means of Forest Protection" (based on a translation from *L'Illustration*, dated 18th December, 1926), written by Mr. E. A. Sitzler. It describes how aeroplanes were used in Alsace-Lorraine to dust the crowns of 130 acres of pine forest with an insecticide powder in order to kill the Fidonia caterpillar. The results are reported to have been very successful in killing the caterpillars, and the cost of the operation exceedingly moderate, viz., £1 4*s*. per acre. As so many ideas have been regarded as fantastic in the past, and are now in common use, the day may not be far off when such control methods may be brought to bear upon our Tortrix and Chermes, although the Editor of *The Indian Forester* does not appear to be very enthusiastic over its employment in India.

R. G. Broadwood.

Tharandter Forstliches Jahrbuch, 1927.

A number of articles of unusual interest appear in Volume 78 of this Journal.

Perhaps the most noteworthy is that by Professor Jentsch, of Tharandt, on Forest Administration in Soviet Russia, in which he traces from pre-war conditions the changes which have taken place up to the present time.

The condition of Russian Forestry before the war is fairly well known, but as to what happened after war was declared but little information has been forthcoming, and it is this lack of information which makes the article under review of peculiar interest.

It would appear that, shortly after hostilities commenced, Russia was faced with a grave shortage of coal, partly on account of the cessation of imports and partly on account of reduced home production in the Don region and to difficulties of transport. For railways, factories and household use wood became the principal fuel, and it is characteristic of the old empire government that no organisation was built up to deal with the emergency. The authorities were unable to take charge of the situation. Panic and chaos reigned. Vast quantities of State timber were given away, still greater quantities sold at extremely low prices, and probably more still stolen. The ports became choked with sawn timber which could not be exported, while inland districts could not obtain it at any price. It is clear, in fact, that the disintegration of the Russian Forest Service commenced very early in the war. Eastern districts were denuded of their forest officers, who were employed in the production of timber and firewood for the army areas. How different it was, say, in France, with a well-organised forest service, where every cubic foot of timber and every cord of firewood was carefully measured and sold at good prices. Even during the great crises of the war the French Forest Service never lost a grip of their organisation and no " panic " fellings were permitted.

Needless to say, then, long before the revolution commenced, enormous damage was done to the Russian forests by great and unregulated clearances and general devastation for the production of firewood and timber. To this must be added later the vast areas damaged by military operations and the great quantities of timber felled by the invading Central Powers and taken away for use in their countries.

The revolution commenced in 1917, and by January, 1918, all private ownership, including that of forests, was abolished. All private forests of any value were declared to be the property of the State, and small areas of woodland were handed over to the local Soviet authorities, but, owing to the chaotic condition of the country and the absence of any forest service, great quantities of timber were stolen, and even during the early part of the Soviet Administration no effort was made to control fellings. Timber was felled and handed over without payment for a number of years. Silviculture was entirely disregarded and the remnants of the forest service were compelled to work as ordinary labourers and paid accordingly.

It is estimated that over 100 million acres of forest were either completely destroyed by felling or by fire.

By 1922 the importance of a forest organisation made itself felt and the forest officers were then returned to their normal duties. It was then found, however, that the number of educated foresters available was only 14 per cent. of the number required, so the remainder of the posts had to be filled with persons having no knowledge of the subject, and this with what appears to us an extremely extensive system of organisation.

To turn to the question of export, it would appear that Russia is at present exporting between 300,000 and 400,000 standards per annum, as compared with about 2,700,000 in 1913. In other words, the country has failed to regain about 85 per cent. of its export trade in timber. It would appear that the theories of Communism are not well adapted to commerce.

According to Dr. Busse, the way to make beech forests pay is to produce artificially on beech stumps two varieties of fungus—*Agaricus ostreatus* and *Pholiota mutabilis*—for human food. It would appear easy and inexpensive to cultivate these species, but as far as this country is concerned marketing might prove a difficulty.

Dr. Vater writes a long and detailed article on the root system of the pine, spruce and beech, the essence of which appears to be that the root growth of these species does not by any means always conform to the description given in text-books. It seems that these species show great adaptability as regards their roots and develop them in accordance with the soil upon which they are growing. The tree requires food in solution, air and water, and develops its root system partly to obtain these and partly to obtain stability.

Where the necessary moisture is far down the tree must send roots to find it, as well as forming a more superficial system in the more nourishing but drier surface soil. It is noteworthy, however, that this investigation discloses cases on fresh gravelly soils where spruce persistently developed roots half as deep again as pine or beech.

A good picture of the life and work of a German Forest Officer is given in obituary notice of Oberlandsforstmeister Winter. Born in 1843, the son of a Saxon Forstmeister, he commenced his studies at Tharandt i 1862 and here had to do private teaching to maintain himself. In 1866, after he left the Forest Academy, he became an assistant in a Saxon State Forest and later went to the Central Working Plans Office. In 1877 he became Oberforstmeister of the Schmiedeberg Forest and remained there for twenty years, loving the outdoor life and taking a great and kindly interest in the workpeople under him, riding daily through his 5,000 acre charge. After further promotion he finally came in 1903, at the age of

over sixty years, to Dresden as the Chief of the entire Saxon Forest Service —a post which he held till the revolution in November, 1918. His main work in this office was to regulate the expenditure of the funds available in the service, and here he showed that he was first and foremost a true forester in that he always managed to provide sufficient for the proper formation and management of the plantations in spite of, rather than with the help of, the Finance Minister. A hard man, a hard worker, and a terror to idlers, he was above all a forester.

The article by Forstmeister Fritsche deals with the size of experimental plots, and his conclusion, based upon the quick changes of soil and other factors, is that small areas where conditions are constant throughout will give more accurate results than larger ones. He therefore advocates a greater number of small plots rather than fewer large ones.

Dr. Raab writes on the results of the Treaty of Versailles upon Forestry in Germany. He shows that, while the former German Empire lost 13 per cent. of its area, only 10·7 per cent. of the former forest land had to be given up. This is accounted for by the fact that reduction took place in lands which had under the average percentage of woodland. The actual percentage of woodland now in Germany is given as being 27 per cent., as compared with 26·3 per cent. in the pre-war empire.

Germany lost a total forest area of 3,707,000 acres, of which 2,450,000 went to Poland and 1,080,000 to France. The former consists largely of pine forests and the latter of hardwood forests.

A. D. HOPKINSON.

NOTES AND QUERIES.

Nursery Practice.

In the spring of 1926 about 5,000 2-year silver fir (*A. pectinata*) were lined-out at Delamere in alternate rows with 2-year Douglas fir. The spacing adopted was 10 inches by 2 inches. This winter as 2 × 2's it is noticeable that the silver fir are much above the average, and that the Douglas fir have also benefited and are appreciably better than the adjacent lines where the Douglas were lined-out in the usual way.

There are strong indications that day-work weeding of 1 year seed-beds greatly increases the survival percentage, especially with species such as Sitka, and also that if properly supervised and controlled, and extended over the whole of the first season, it is actually more economical than piece-work.

The application of Kainit to nurseries has resulted in a remarkable improvement in the transplants produced, particularly as regards Douglas fir, and, it would appear, Scots and Corsican pines. Measurements have been taken at Nannau Nursery (Vaughan Forest), where Kainit was applied at the rate of 2½ cwts. per acre in the spring of 1926 by sprinkling between the lines of 2×0 Douglas after lining-out. The percentage failure as 2×2's in the treated plants is 6 per cent. as compared with 24 per cent. in those which were not treated, and the tallest plant amongst the former is 44 inches as compared with 22 inches in the latter. The trees on the area treated are also noticeably better in general appearance.

Damage to 2-year European larch seedlings by *Meria laricis* is serious in some nurseries and extensive spraying with Burgundy or Bordeaux mixture seems necessary for control; one or even two sprayings do not seem to suffice. In cases where the disease has been spread by the transfer of infected plants it has even been necessary to spray in the transplant lines, whilst transplants which had apparently recovered from the attack have gone back after planting out in the woods, the immediate cause of the actual death being apparently a fungus called *Cytospora pinastri*, which also attacks Douglas fir weakened by *Phomopsis Pseudotsugae*, *vide* Bulletin No. 6.

O. J. Sangar.

Effects of Wet Season on Young Plantations at Rothbury.

In the above mentioned forest Corsican pine has been the worst sufferer and by the end of the growing season the plants had turned a very unhealthy yellow colour. The growth of the plants has not been much less than under normal conditions, but the needles of the leading shoots were a good deal shorter than those of plants that had been planted on exceptionally dry ground and had therefore not felt the ill effects so much.

A great number of the plants (especially those on very exposed ground) died off during September and November, as during these two months we had some very strong south-easterly and south-westerly winds.

Corsican pine in the nursery also suffered in a like manner and a great many of these died off after the growing season was over.

No other species seemed to suffer from the abnormally wet summer, but on June 21st, 1927, Scots pine and Sitka spruce suffered somewhat from a north-westerly gale that at one time reached 70 miles an hour. The young side-shoots and leaders were, in this case, twisted clean off. Sitka spruce appeared afterwards as if they had had an attack of aphis. The damage done by this wind was not very extensive.

W. J. Bewick.

Rendlesham Forest.

The year 1927 has gone far in establishing records of weather conditions—17 degrees of frost on 1st May and 10 degrees on 29th marked many hardy plants besides Scots pine, Corsican pine, larch, Douglas, beech and Spanish chestnut. Corsican pine 3 to 4 feet in height were badly frozen on many areas and young Scots pine were in many cases killed off, whilst Douglas fir were cut down to ground level.

The rainfall amounted to nearly 12 inches above the average, although no excessive downpours occurred to cause washings. The forest crop generally benefited by continual rainy periods and growth was good. In the nurseries, however, the cold during July badly affected seedling growth and for several weeks no movement was apparent.

For the second year in succession saw-fly attacked nearly 3,000 acres of young pine; the first attack appeared in May and continued until July; hundreds of this insect attacked every tree over the oldest planted areas leaving the pine defoliated, even eating the current year's leaves. Extermination was carried on, but no sooner were the trees cleared one day than in a day or two were infested again, and this continued until an epidemic appeared and killed the insects on the trees, where they adhered, covering the stem and branches until dried up.

About seven or eight species of birds fed on the larvae, but as the pest was so very numerous little headway was made in this direction, but it was noticed however that birds continued to feed on the dead caterpillars for a time. The autumn attack which occurred in August and September was very slight and little harm was done. On this occasion the yellow insect only appeared in clusters, whilst the summer attack was made by the dark green caterpillar.

Although defoliation of the pines was very extensive the wet summer so assisted the autumn growth that by the end of the growing season the trees had so much improved that the summer damage was scarcely noticeable.

The saw-fly attack greatly reduced the Tortrix and less harm occurred during 1927 from this insect, which however died off in the same manner as the saw-fly and at about the same time.

C. Hankins.

Reducing Cost of Preparation of Ground.

Wooded estates acquired by the Commission are frequently handed over by parts in successive years, the former owner selling off all produce of any value just before relinquishing the land. The result is that expenditure on preparation of ground is very heavy, acres of useless scrub having to be cleared, with no income from sales to set against it. For such forests, could not an extra heading be inserted in the estimate of expenditure and a sum reserved for purchase of profitable underwood at the auction sales ? The purchase of timber is not suggested in most cases, owing to the difficulty of clearing and marketing it in the short time usually available.

A few recent cases may illustrate the point :—

(1) Two acres of mixed coppice with tellars were offered for sale, with one year to clear. They were bought for £1, the tellars and poles cut and sold at a profit of £40, and lop and scrub handed over to the Commission the succeeding year. It cost £2 an acre to clear.

(2) Six acres of similar coppice, with five months to clear, were sold for 5*s*. per acre. There are 1,000 tellars on the ground, which can be sold at a profit of 9*d*. each, besides chestnut and birch poles which find a ready market. The lop and scrub are again being left on the ground.

(3) Fifteen acres of chestnut coppice, with five months to clear, were sold for £3 per acre (maximum). The coppice was six to seven years old, too young to be of much value, but in seven years' time it would have made at least £20 per acre.

Such cases are not isolated, for underwood rarely fetches its true value at these forced sales. A larger area than normal is in the market, the stock is immature, and the time allowed for clearing is often short, If a few of the best cants were bought, they could either be resold with an extended clearing time, on condition that the ground was thoroughly cleared, or the produce worked up for market during frost or wet weather, when it is always difficult to provide work.

Young chestnut areas, of course, would simply be maintained as safe investments.

J. P. Mackie Whyte.

Improved Celluloid Computer.

Mr. J. W. Mackay, District Officer, sends the following note on the use of the improved celluloid computer devised by him and adopted by the Forestry Commission :—

"The numbers in the squares represent the total areas enclosed, counted from the left-hand bottom corner. By placing the computer with the left-hand bottom corner fitting as near as possible one corner of the boundary of the area to be measured, the enclosed acreage up to 320

acres can be read direct from the right-hand top corner of the area. For irregular boundaries any surplus acres can easily be counted and deducted.

"The oblong acre divisions were adopted in place of squares, as they make it easier to fit different shapes of areas, and the computer can be read either upwards or to the right-hand.

"Incidentally, the squares also form a multiplication table."

Sheep Fences.

The following suggestions apply to areas where only sheep are to be fenced against.

Undoubtedly the least expensive, yet effective, fence to erect is sheep-netting, 4-in. mesh, strengthened by No. 8 gauge plain galvanized wire top and bottom, with a strand of barbed wire 4 in. to 6 in. above the top of the netting, attached to wooden posts. This type is the most effective fence where sheep are concerned, but for areas near the sea the life of No. 15 gauge netting is only three years, and even this period may be shortened should a fire be allowed to burn through the fence during its first year.

Where areas of molinia grass are enclosed wire-netting fences cause considerable trouble by retaining the leaf blades, which when dead break and are picked up and borne by strong winds for considerable distances. Quite frequently in gales the meshes of the netting become choked, and the fence then being almost a solid block, offers such resistance to the wind that either the whole length of fence collapses or, if the netting is the weaker, it becomes torn through the centre. Should the fence be strong enough to resist the gale, it remains choked with grass. To clean the meshes by hand is slow and expensive; to fire the grass is much quicker, but by doing so the netting is thinned. If, again, it is left, it provides a great temptation to passers-by to light it, and if lighted by them further damage would very probably be done in the plantation. Where permanent boundary fences are to be erected on areas similar to the conditions mentioned, I am in favour of more initial expense in erecting a seven-wire fence, either all plain galvanized wire or the uppermost strand of barbed. These to be attached to extra good posts and strained by ratchet or Whiting's patent, to enable a simple means of re-straining when necessary. This class of fence should last at least ten years near the sea, as plain galvanized wires are not affected by the salt air so quickly as the smaller gauge in netting. Also single wires would not hold the blown molinia grass and very little damage would be done by a fire burning through the fence when tracing fire-lines.

The disadvantages are: Trespassers and workmen will climb through between the wires, with the result that they stretch, and once the tautness is lost, sheep, when pressed, will force their way through.

G. W. Hollis.

Damage by Moles.

After a spring and summer such as have been experienced on the Elveden District of Thetford Chase, where the treading of mole runs in the newly-planted plough furrows has kept a considerable staff of workmen busy for weeks, a forester feels that all his planting has gone for nothing. I would not like to exaggerate the damage that the moles have done on this area, but certainly, if it had been impossible to follow on the treading and firming of plants where the moles had thrown up the transplants, there would have been on some parts of the area 70 per cent. of deaths.

I have seen a batch of trees carefully cleaned and re-firmed at 10 a.m. and at 12 noon the moles had thrown the plants up as bad as ever. It is not the raising of the plants alone where all the damage occurs; it is the undermining and leaving an open channel immediately under the plants which drains all the moisture so much needed on this poor sandy soil. Were it not for these open channels, when rain falls there would be a general watering, but the sandy nature of the soil allows the water to pass quickly from the surface into these mole runs and from there to some lower level where greater supply would occur in any case.

I have this season followed a furrow with 18 plants either quite dead from drought or completely covered in to a depth of several inches, and in the next row to this, where the mole had not worked, the plants showed 2 in. to 4 in. growth and were looking well. All these plants were planted by the same men under the same conditions and came from the same nursery. We are now trapping the moles on all boundary fences, and the warreners are obliged to inspect the traps twice daily in conjunction with rabbit protection. These two men have in 21 days secured some 13 dozen moleskins, which were stretched and dried and then despatched to the skin factory, the proceeds being credited to the Forestry Commission. This means a considerable reduction in the loss of transplants and also a much reduced labour bill.

T. Hendrie.

Attack on Corsican Pine by *Strophosomus lateralis*.

Last year a bad attack on Corsican pine by the heather weevil (*Strophosomus lateralis*) occurred at Clipstone. This covered an area of about 200 acres and considerable damage was done to the young plants, although, thanks to the wet summer and to the fact that measures were promptly taken to combat this pest, a considerable proportion of the affected plants show signs of recovery. A point which is worthy of notice is that on areas where Grade I plants were used the mortality is 50 per cent. less than where Grade II plants were employed, these latter apparently not having sufficient vitality to withstand the attack.

Of combative measures three methods presented themselves:—(1) spraying; (2) trapping, and (3) hand-picking. The first was discarded as being impracticable; the second was tried with poor results, about 200 traps being used. The latter consisted of Corsican pine twigs about 6 in. to 9 in. long inserted in the ground so as to resemble as near as possible

growing plants. These were closely watched, and, although a few insects were found feeding on the foliage, far larger numbers could always be picked off the young plants in the near vicinity.

The conclusion was therefore arrived at that hand-picking should be resorted to. This was thoroughly done on the worst places, and over 40,000 weevils were collected and destroyed, although the weather was not on the whole favourable, the insects being most active on sunny days.

As something has been written in a previous number of the Journal that heather areas where *Strophosomus* is suspected should be burnt over the season previous to planting so as to allow the young heather to come up again, which would provide normal food for this insect, it should be pointed out that this area was burnt over the year previous to planting, and, in the writer's opinion, this is not sufficient; at least two or even three years should intervene between burning and planting, if this is practicable.

T. E. Anderson.

Protection against Rabbits.

When fencing 200 acres of planting last season our boundary fence joined up with an existing wire-netting fence which had been erected by the tenant farmers to keep rabbits coming off the common land and eating their crops. Agreements were made with the tenant that we take advantage of the existing fences and thus save expense of new fencing.

The rabbits were then exterminated and the common land planted with young trees. A month after planting, trees were found to have been nibbled by rabbits in patches close by the fences which had been taken over. The fences were carefully examined to find out where the rabbits entered. None could be found for some time until a rabbit was seen to climb up one of the stays to the straining post over the top and into the enclosure. This gave us the clue to the way the rabbits were getting into our enclosure. On examining the stays and posts along the fences which were on the outside of our fence scratches could be seen on nearly all of these stays. This has now been remedied by a piece of wire netting 1 foot square being stapled down to the stay and tied by small strand wire to main straining wire of fence.

W. Tribe.

Are Ants Injurious?

The sudden withering and ultimately the death of occasional healthy growing conifers, ranging from 20 to 30 inches high, has led me to make investigations as to the reason, and I am convinced that the small red field ant is responsible. The deaths referred to usually occur in the summer months when the shoots are still tender. This makes an attacked plant easily noticed and the young shoots wilt very quickly. I have taken up several plants thus attacked and in every case I found an ant-hill

nearby and from the root-collar down numerous ants and hundreds of minute punctures were readily seen with the naked eye. It would appear that the ants were feeding on the juices from the tree and thereby in the majority of cases causing its death.

I have had it suggested that the ants were possibly attacking some aphis ; this is quite possible, but personally I am inclined to blame the ants entirely for the damage. Quite a number of good plants succumb to this kind of attack every year at Margam, and I imagine similar losses occur elsewhere. The species attacked appear to be chiefly Japanese larch with a small percentage of Douglas and Sitka. Occasionally Japanese larch attacked in this way will appear quite lifeless for several weeks and towards the end of the growing season will throw out some rather feeble shoots from adventitious buds on the main stem.

If there is knowledge on this subject which exonerates the ant by proving it to be in pursuit of aphis, I should be interested to know, as I think generally the ant is looked upon as a friend rather than an enemy to the gardener.

G. W. Hollis.

About the Growth of the Common Spruce in the Shade.

(English as she is wrote in Hungary.)

The oppression of the spruce in the forests of the Hungary of this day is partly the consequence from to late executed cleaning of the stability, partly the consequence from not well arranged plantings, for purpose of change of the original inferior stability, Such cases principally happen at the change of inferior hornbeam (*Carpinus betulus*) stabilities ; where the late executed deliverance of the replanted common spruces causes the partly oppression.

LIST OF TECHNICAL OFFICERS.

Headquarters.

At 22, Grosvenor Gardens, London.
Story, Fraser, Education and Publications Officer.
Guillebaud, W. H., Chief Research Officer.

At Imperial Forestry Institute, Oxford.
Steven, H. M., Research Officer, England and Wales.
Mills, D. F. L., Probationer District Officer.

Travelling Officers.
Macdonald, James, District Officer (Sample Plots).
Ryle, G. B., District Officer (Working Plans).

England and Wales.

Assistant Commissioner's Office (1, *Whitehall, London*).
Taylor, W. L., Acquisition Officer (acting).
Jones, E. W., Assistant Acquisition Officer.
Fletcher, W. S., Utilisation Officer (temporary).
Maurice, E. C., Estate Management Officer (temporary).

New Forest (*The King's House, Lyndhurst, Hants*).
Osmaston, L. S., Deputy Surveyor.
MacIver, L. E., District Officer.
Roberts, J. F. A., Assistant to Deputy Surveyor.
Yarr, W. J., Assistant to Deputy Surveyor.

Dean Forest (*Whitemead Park, Parkend, Lydney, Glos.*).
Young, D. W., Deputy Surveyor.
Forster Brown, W., Deputy Gaveller (Mines).
Popert, A. H., District Officer (Part-time Dean School).
Roper, J., Survey Clerk.

Division 1 (*Chopwellwood House, Victoria Garesfield, Rowlands Gill, Co. Durham*).
Hopkinson, A. D., Divisional Officer.
Ross, A. H. H., District Officer.

Division 2 (*Castle Chambers, Shrewsbury*).
Sangar, O. J., Divisional Officer.
Lowe, G., District Officer.
Fairchild, C. E. L., District Officer.
De Uphaugh, F. E. B., District Officer.

Division 3 (51, *Queen Street, Exeter*).
Hanson, C. O., Divisional Officer.
Forbes, R. G., District Officer.
Russell, W. D., Probationer District Officer.

Division 4 (64, *Goldsworth Road, Woking, Surrey*).
Felton, A. L., Divisional Officer (acting).
Whyte, J. P. M., District Officer.
Brown, J. D., Probationer District Officer.

Division 5 (*Bridge House, Santon Downham, Brandon, Suffolk*).
Long, A. P., Divisional Officer.
Ryder, D. C. D., District Officer.

Schools for Forest Apprentices.
Broadwood, R. G., District Officer (Instructor).—Parkend, Lydney, Glos.
Watson, H., District Officer (Instructor).—Beaufort, Inverness.

SCOTLAND.

Assistant Commissioner's Office (25, *Drumsheugh Gardens, Edinburgh*).
Cameron, J., Acquisition Officer.
Newton, L. A., District Officer (Survey, etc.).

Northern Division (35, *Queensgate, Inverness*).
Scott, F., Divisional Officer.
Home, G., District Officer.
Meldrum, J. A. K., District Officer.
Oliver, F. W. A., Probationer District Officer.

North-Eastern Division (156, *Union Street, Aberdeen*).
Annand, J. F., Divisional Officer.
Bird, D. H., District Officer.
Cowell-Smith, R., Probationer District Officer.
Mackay, J. W., District Officer.

South-Eastern and Western Division (25, *Drumsheugh Gardens, Edinburgh*).
Murray, J. M., Divisional Officer.
Fraser, J., District Officer.
Whellens, W. H., District Officer.
Blair, J. H., District Officer.

FORESTERS.

Name and Address.	*Grade.*	*Forest.*
England and Wales.		
Division 1.		
Price, A.; Low Dalby, Pickering, Yorks.	II	Allerston.
Bewick, W. J.; Thrunton, Whittingham, Northumberland.	II	Rothbury.
Laney, H.; Foresters' Lodge, Beck Wythop, Thornthwaite, Keswick, Cumberland.	II	Thornthwaite.

Name and Address.	*Grade.*	*Forest.*
England and Wales.		
Anderson, J. T.; Craig Villa, Falstone, Northumberland.	II ..	North Tyne.
Reid, D.; The Haven, Coldyhill Road, Newby, Scarborough.	II ..	Allerston.
Phelps, S. E.; Gillerthwaite, Ennerdale, Frizington, Cumberland.	II ..	Ennerdale.
McNab, C.; c/o Bedburn Farm, Hamsterley, Witton-le-Wear, Co. Durham.	II ..	Hamsterley.
Division 2.		
Harrison, P. M.; Castle View, Wigmore, Kingsland, Leominster.	I ..	Mortimer.
Williams, Jack; Pandy Glasdir, Llanfachreth, Dolgelley, Merioneth.	I ..	Vaughan.
Clark, J. S.; Pottal Pool House, Penkridge, Stafford.	II ..	Cannock Chase.
Jones, H. W.; Linmere, Delamere, Northwich, Cheshire.	II ..	Delamere.
Squires, C. V.; Brookbatch, Acton, Bishops Castle, Shropshire.	II ..	Walcot.
Shaw, J. L.; Diosgydd Isaf, Bettws-y-Coed, Carnarvonshire.	II ..	Gwydyr.
Anderson, J. W.; Alwyn Cottage, Tynycefn, Corwen, Merioneth.	II ..	Cynwyd.
Harris, W. A.; Chamberlayne Lodge, Arley, Bewdley, Worcestershire.	II ..	Wyre.
Fraser, R.; Esgairangell, Aberangell, Cemmaes Road, Mont.	II ..	Dovey.
Harrison, Percy; Cwm Mawr, near Cascob, Presteigne, Radnorshire.	II ..	Radnor.
Brown, G. H.; Hafod Ruffyd Garrol, Beddgelert, Carnarvonshire.	II ..	Beddgelert.
Division 3.		
Brown, T.; New Lodge, Chulmleigh, Devon.	I ..	Eggesford and Halwill.
Edwards, J.; Crown Office, Tintern, Chepstow, Mon.	I ..	Tintern and Chepstow.
Butter, R.; Underdown, Haldon, Exeter.	I ..	Haldon.
Wallington, A. W.; Parish's Lodge, Overstowey, Bridgwater, Somerset	II ..	Quantocks.
Williams, D. N.; Broadwood Farm, Dunster, Taunton, Somerset	II ..	Exmoor.
Dyer, H. C.; Botany Bay, Tintern, Chepstow, Mon.	II ..	Tintern.

Name and Address.	*Grade.*	*Forest.*
	England and Wales.	
Hollis, G.; 29, West Street, Maestag, Bridgend, Glam.	II ..	Margam.
Wallington, H. J.; Harefield Lodge, Plumley, Ringwood, Hants.	II ..	Ringwood.
Colwill, S. W.; Foresters' Lodge, Cold Harbour, Wareham, Dorset.	II ..	Wareham.
Gosling, A. H.; (Employed on relief at various forests), 51, Queen Street, Exeter.	II ..	—
Division 4.		
Simpson, A.; Forest Lodge, Alice Holt, Farnham, Surrey.	— ..	Alice Holt and Woolmer.
Richards, G. H.; Clapper Oak Cottage, Minley, Farnborough, Hants.	II ..	Bramshill.
Butler, R.; Jewsley Cottage, High Street Green, Chiddingfold, Godalming, Surrey.	II ..	Chiddingfold.
Jones, T.; Piddington Lodge, Northampton.	II ..	Salcey.
Nelmes, F.; Whitelimes, Cranbrook, Kent.	II ..	Bedgebury.
Johnson, A. E.; Park Villa, Stelling, Canterbury, Kent.	II ..	Lyminge.
Cottenden, W.; c/o Mrs. Fox, Woodnewton, Peterborough, Northants.	II ..	Rockingham and Westhay.
Gulliver, G. H.; Forest Lodge, Syresham, Brackley, Northants.	II ..	Hazelborough and Brackley.
Division 5.		
Hankins, C.; Tangham Farm, Capel St. Andrew, Woodbridge, Suffolk	Head	Rendlesham.
Anderson, T. E.; Preston Lodge, Edwinstone, Mansfield, Notts.	I ..	Clipstone.
Argent, C. D.; Forest Lodge, Brandon Road, Swaffham, Norfolk.	II ..	Swaffham.
McGlashan, J.; The Nursery, Lynford, Brandon, Suffolk.	II ..	Thetford.
Tribe, W.; Laughton Lodge, Laughton, Gainsborough, Lincs.	II	Laughton.
Hendrie, T.; Broom House, Brandon, Suffolk.	II ..	Thetford.
Slaughter, E. C.; Santon Downham, Brandon, Suffolk.	II ..	Thetford.

Name and Address.	*Grade.*	*Forest.*
	England and Wales.	
New Forest Division.		
Forgan, W.; Denny Lodge, Beaulieu, Brockenhurst, Hants.	I ..	New Forest.
Aston, O. R. T.; Signal House, Parkhurst Forest, Newport, I. of W.	II ..	Parkhurst.
Aston, S.; Wood End Cottage, near Wickham, Hants.	— ..	Bere.
Dean Forest Division.		
Smith, Frank; Worcester Lodge, Coleford, Glos.	Head	Dean.
Walker, A. E.; Crown Lodge, Oxenhall, Newent, Glos.	—	Dymock.
	Scotland.	
S.E. and W. Division.		
Cameron, Hugh; Inverliever, Ford, Argyleshire.	II ..	Inverliever.
Macintyre, J.; 1, Langholm Street, Newcastleton, Roxburghshire.	II ..	Newcastleton.
Spraggan, D.; Guithas Cottage, Ardgarten, Arrochar, Glasgow.	II ..	Ardgarten.
Reid, J. M.; Auchindarroch, Duror, Oban, Argyll.	II	Glenduror.
Paterson, S. H.; Red Lodge, Barcaldine, Ledaig, Oban, Argyll.	II ..	Barcaldine.
Simpson, A. N.; Tulliallan Nursery, Kincardine, Fife.	I ..	Tulliallan Nursery.
Anderson, R. T.; Glenbranter, Strachur, Argyll.	II ..	Glenbranter.
Fraser, A. M.; Glencorse, Parkgate, Dumfries.	II ..	Closeburn.
Graham, A.; Eshiels Cottage, Peebles.	II ..	Glentress.
Kennedy, J. A. M.; 38, Maxwell Street, Dalbeattie, Kirkcudbrightshire.	II ..	Dalbrattie and Bennar.
Cameron, Alistair; Dura, Lorne Street, Ladybank.	II ..	Edensmuir.
Macmillan, H.; Drynairn Cottage, Ardentinny.	II ..	Glenfinart.
Ross, W. L.; Comrie Farm, Fortingal, by Aberfeldy.	II ..	Drummond Hill.
N.E. Division.		
McEwen, J; Teindland Cottage, Orton, Morayshire.	Head	Teindland, Altonside and Ordiequish.

Name and Address.	*Grade.*	*Forest.*
Scotland.		
Sinclair, W.; Craibstone Nursery, Bucksburn, Aberdeenshire.	I ..	Craibstone Nursery.
Shaw, R.; Fetterdale, Tayport, Fife.	I ..	Tentsmuir.
Lamb, J. A.; Seaton Nursery, Hayton Road, Woodside, Aberdeen.	I ..	Seaton Nursery.
Mitchell, F. M.; c/o Kennedy, Kintessack by Forres, Morayshire.	II ..	Culbin.
Robbie, J. D.; c/o Davidson, The Crook, Alves, Forres, Morayshire.	II ..	Monaughty.
McConnell, J.; Brechin Road, Friockheim, By Arbroath, Forfarshire.	II ..	Montreathmont.
Donald, R. R.; "Finella View," Drumtochty, Auchenblae, Fordoun, Kincardineshire.	II	Drumtochty.
N. Division.		
Cameron, J.; Auchterawe, Fort Augustus, Inverness-shire.	Head ..	Inchnacardoch and Portclair.
Anderson, W.; Polloch House, Glenfinnan, Inverness-shire.	I ..	Glenhurich.
Warren, A.; Beaufort School, Kiltarlity, Beauly, Inverness-shire.	I ..	Beaufort.
Mason, W.; Nevis, Fort William, Inverness-shire.	II	Nevis.
McEwan, J.; Portclair, Invermoriston, Inverness.	II	Portclair.
McClymont, W.; Aultsigh Cottage, Invermoriston, Inverness-shire.	II ..	Creagnaneun.
Mackay, K.; Slattadale, Achnasheen, Ross-shire.	II ..	Slattadale.
MacAlpine, J. A.; Ratagan, Glenshiel, Kyle, Ross-shire.	II ..	Ratagan, Glenshiel, Inverinate and Eilenreach.
Murray, W.; Lechanashie, Lochcarron, Ross-shire.	II ..	North Strome and South Strome.
Macintosh, W.; c/o Macdonell, Bearnock, Glenurquhart, Inverness-shire.	II ..	Glenurquhart.
Gunn, J.; Auchterawe, Fort Augustus, Inverness-shire.	II ..	Inchnacardoch.

Name and Address.	*Grade.*	*Forest.*
	Scotland.	
Rose, A.; Smithton, Culloden, Inverness.	II ..	Culloden.
Kennedy, J.; Inchree Onich, Inververness-shire.	II ..	Glenrigh.
Cameron, R.; South Laggan, Invergarry, Inverness-shire.	II ..	South Laggan, Glengarry.
	Research and Experiment.	
Macdonald, J. A. B.; Strathoich, Fort Augustus, Inverness-shire.	I ..	—
Gray, W. G.; c/o Godfrey, New Cottages, Kennington Lane, Oxford.	II ..	—
Grant, A.; 1, Lovat Terrace, Fort Augustus, Inverness-shire.	II ..	—

REGISTER OF IDENTIFICATION NUMBERS.

Forest Year, 1927.

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 ; purity per cent. ; germination and fresh seed per cent.

27/1 80 lbs. ; *Juglans regia* ; 1926 ; England ; C. D. McKay & Co.

27/2 1 oz. ; *Pinus contorta* ; 1926 ; Canada (Alberni Summit, Vancouver Island, British Columbia, altitude 1,300 feet) ; gift from Canadian Government.

27/3 1 oz. ; *Pinus concorta* ; 1926 ; Canada (Nanaimo, Vancouver Island, British Columbia, altitude 200 feet) ; gift from Canadian Government.

27/4 2 ozs. ; *Pinus contorta* ; 1926 ; Canada (Merville, Vancouver Island, British Columbia, altitude 300 feet) ; gift from Canadian Government.

27/5 669 lbs. ; *Pseudotsuga Douglasii* ; 1926 ; U.S.A. ; gift from Mr. C. L. Pack ; 92·9 ; 63 + 7.

27/6 555 lbs. ; *Pinus Laricio* ; 1926 ; France (Corsica) ; P. F. Pantalacci ; 98·8 ; 61 + 7.

27/7 1,344 lbs. ; *Pseudotsuga Douglasii* ; 1926 ; Canada (British Columbia) ; Canadian Government ; 92·8 ; 45 + 10.

27/8 1,524 lbs. ; *Picea sitchensis* ; 1926 ; Canada (Queen Charlotte Islands, British Columbia) ; Canadian Government ; 90·8 ; 81 + 1.

27/9 16 lbs. ; *Abies grandis* ; 1926 ; Canada (British Columbia) ; Canadian Government ; 92·5 ; 4 + 3.

27/10 49½ lbs. ; *Tsuga Albertiana* ; 1926 ; Canada (British Columbia) ; Canadian Government ; 93·7 ; 52.

27/11 5 lbs. ; *Pinus sylvestris* ; 1926 ; France (Haguenau) ; A. Gambs ; 96·9 ; 29 + 23.

27/12 1 lb. 2 ozs. ; *Picea Engelmanni* ; 1926 ; Canada (Mount Ida, British Columbia, altitude 3,300 feet) ; gift from Canadian Government.

27/13 2 ozs. ; *Picea Engelmanni* ; 1926 ; Canada (Salmon River, British Columbia, altitude 2,300 feet) ; gift from Canadian Government.

27/14 1 lb. ; *Pseudotsuga Douglasii* ; 1926 ; Canada (Turtle Valley, British Columbia, altitude 3,000 feet).

27/15 1¼ lbs. ; *Pseudotsuga Douglasii* ; 1926 ; Canada (Larch Hills, British Columbia, altitude 3,000 feet) ; gift from Canadian Government.

27/16 1¼ lbs. ; *Pseudotsuga Douglasii* ; 1925 ; Canada (Salmon Arm and Canoe, British Columbia, altitude 1,500 feet) ; gift from Canadian Government.

27/17 1 lb. 5 ozs. ; *Alnus tenuifolia* ; 1926 ; Canada (Annis, British Columbia, altitude 1,200 feet) ; gift from Canadian Government.

27/18 1½ lbs.; *Pinus ponderosa*; 1926; Canada (Tappen, British Columbia, altitude 1,300 feet); gift from Canadian Government.

27/19 1½ lbs.; *Pinus ponderosa*; 1926; Canada (Seton Lake, British Columbia, altitude 800 feet); gift from Canadian Government.

27/20 2 lbs.; *Pinus ponderosa*; 1926; Canada (Enderby, British Columbia, altitude 1,200 feet); gift from Canadian Government.

27/21 2 lbs.; *Pinus ponderosa*; 1926; Canada (Salmon River, British Columbia, altitude 2,200 feet); gift from Canadian Government.

27/22 1 lb.; *Pinus ponderosa*; 1926; Canada (Lytton, British Columbia, altitude 700 feet); gift from Canadian Government.

27/23 1 lb.; *Pinus ponderosa*; 1926; Canada (Lillooet, British Columbia, altitude 800 feet); gift from Canadian Government.

27/24 1 lb.; *Thuya plicata*; 1926; Canada (Salmon Arm, British Columbia, altitude 1,500 feet); gift from Canadian Government.

27/25 1 oz.; *Thuya plicata*; 1926; Canada (Larch Hills, British Columbia, altitude 3,300 feet); gift from Canadian Government.

27/26 1 lb.; *Larix leptolepis*; 1926; Scotland (East); E. S. Grant Altyre; 89·8; 35 + 2.

27/27 1 lb.; *Cupressus nootkatensis*; 1926; Scotland (East); E. S. Grant, Altyre; 90·3; 0 + 19.

27/28 1,210 lbs.; *Larix europaea*; 1926; Switzerland (Vintschgau); J. Roner; 89·7; 46 + 11.

27/29 22 lbs.; *Pinus montana* var. *uncinata*; 1926; France (Pyrenees-Mont Louis); gift from French Forestry Service; 96·9; 79 + 8.

27/30 2,360 lbs.; *Quercus sessiliflora*; 1926; Bavaria; H. Keller Sohn.

27/31 3,762 lbs.; *Pinus Laricio*; 1926; France (Corsica); G. Ursuline; 98·9; 73 + 3.

27/32 635 lbs.; *Pinus Laricio*; 1926; France (Corsica); O. J. Rossi; 99·1; 55 + 4.

27/33 532 lbs.; *Pinus Laricio*; 1926; France (Corsica); P. Spinosi; 97·7; 58 + 5.

27/34 1,150 lbs.; *Pinus Laricio*; 1926; France (Corsica); J. Grimaldi; 99; 60 + 5.

27/35 112 lbs.; *Larix europaea*; 1926; Silesia (Sudeten); K. Gebauer; 86·3; 46 + 5.

27/36 103 lbs.; *Pinus insignis*; 1926; U.S.A. (West); J. Rafn; 98·8; 58 + 17.

27/37 5½ lbs.; *Pinus ponderosa*; 1926; U.S.A. (Washington State); J. Rafn.

27/38 2½ lbs.; *Cupressus macrocarpa*; 1926; U.S.A. (California); J. Rafn.

27/39 8 lbs.; *Pinus Laricio*; 1925; Cyprus (Troodos); Cyprus Government; 93·9; 78.

27/40 279 lbs.; *Pinus maritima*; 1926; France (Landes); Vilmorin-Andrieux; 99·9; 88 + 3.

27/41 3 lbs.; *Cupressus macrocarpa*; 1926; France; Vilmorin-Andrieux.

27/42 1 oz.; *Pinus contorta*; 1926; Canada (Chum Lake, Turtle Valley, British Columbia, altitude 3,000 feet); gift from Canadian Government.

27/43 2 ozs.; *Pinus contorta*; 1926; Canada (altitude 2,000 feet); gift from Canadian Government.

27/44 2 ozs.; *Pinus contorta*; 1926; Canada (Coast Lowlands, altitude 75 feet); gift from Canadian Government.

27/45 6 ozs.; *Tsuga Albertiana*; 1926; Canada (Larch Hills, British Columbia, altitude 3,000 feet); gift from Canadian Government.

27/46 31 lbs.; *Quercus sessiliflora*; 1926; France; gift from French Forestry Service.

27/47 134 lbs.; *Quercus sessiliflora*; 1926; France; gift from French Forestry Service.

27/48 497 lbs.; *Larix europaea*; 1926; Italy (Tyrol); A. Grunwald; 86·1; 24 + 15.

27/49 45 lbs.; *Pinus canariensis*; 1926; Canary Islands; J. Rafn; 98·7; 88.

27/50 766 lbs.; *Picea excelsa*; 1926; Germany (Black Forest and Harz Mountains, altitude 1,640–3,280 feet); A. Grunwald; 99·4; 60 + 9.

27/51 8 lbs.; *Alnus incana*; 1926; Austria; A. Grunwald.

27/52 213 lbs.; *Pinus pinaster*; 1926; Portugal (Leiria); Portuguese Government; 94·4; 60 + 18.

27/53 2,236 lbs.; *Pinus sylvestris*; 1926; England (East); own collection; 97·8; 84 + 5.

27/54 2 lbs.; *Nothofagus procera*; 1926; Argentina; gift from the Hon. Henry D. McLaren.

27/55 6 lbs.; *Pinus Laricio*; 1926; Cyprus (Troodos); Cyprus Government.

27/56 525 lbs.; *Pinus sylvestris*; 1926; Scotland (East); own collection, extracted at Seaton.

27/57 284 lbs.; *Pinus sylvestris*; 1926; Scotland (East); own collection, extracted at Tulliallan.

27/58 25 lbs.; *Pinus sylvestris*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/59 94 lbs.; *Larix europaea*; 1926; Scotland (East); own collection, extracted at Seaton.

27/60 391 lbs.; *Larix europaea*; 1926; Scotland (East); own collection, extracted at Tulliallan.

27/61 124 lbs.; *Larix europaea*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/62 2 ozs.; *Larix europaea* (red flowered); 1926; Scotland (West); own collection, extracted at Tulliallan.

27/63 3 ozs.; *Larix europaea*; (green flowered) 1926; Scotland (West); own collection, extracted at Tulliallan.

27/64 1 oz.; *Larix europaea* (white flowered); 1926; Scotland (West); own collection, extracted at Tulliallan.

27/65 10 lbs.; *Pseudotsuga Douglasii*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/66 1½ lbs.; *Larix leptolepis*; 1926; Scotland (East); own collection, extracted at Tulliallan.

27/67 2 lbs.; *Larix leptolepis*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/68 12 ozs.; *Picea sitchensis*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/69 12 ozs.; *Picea excelsa*; 1926; Scotland (East); own collection, extracted at Tulliallan.

27/70 8 ozs.; *Picea hondoensis*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/71 1 lb.; *Abies nobilis*; 1926; Scotland (East); own collection, extracted at Tulliallan.

27/72 176 lbs.; *Abies nobilis*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/73 12½ lbs.; *Thuya plicata*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/74 9 lbs.; *Chamaecyparis Lawsoniana*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/75 1½ lbs.; *Sequoia sempervirens*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/76 3 lbs.; *Abies Pindrow*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/77 1½ lbs.; *Tsuga Albertiana*; 1926; Scotland (West); own collection, extracted at Tulliallan.

27/78 50 lbs.; *Quercus pedunculata*; 1926; Scotland (East); own collection.

27/79 4 lbs.; *Fraxinus excelsior*; 1926; Scotland (East); own collection.

27/80 35 lbs.; *Acer Pseudoplatanus*; 1926; Scotland (East); own collection.

27/81 1,679 lbs.; *Fagus sylvatica*; 1926; Scotland (East); own collection.

27/82 45 lbs.; *Fagus sylvatica*; 1926; Scotland (West); own collection.

27/83 1,000 lbs.; *Fagus sylvatica*; 1926; England (North); own collection.

27/84 1,485 lbs.; *Fagus sylvatica*; 1926; England (West); own collection.

27/85 4,478 lbs.; *Fagus sylvatica*; 1926; England (East); own collection.

27/86 155 lbs.; *Fagus sylvatica*; 1926; England (East); Hengrave Estate.

27/87 328 lbs.; *Fraxinus excelsior*; 1926; England (West); own collection.

27/88 464 lbs.; *Fraxinus excelsior*; 1926; England (East); own collection.

27/89 819 lbs.; *Acer Pseudoplatanus*; 1926; England (West); own collection.

27/90 198 lbs.; *Acer Pseudoplanatus*; 1926; England (East); own collection.

27/91 14 bushels; *Acer Pseudoplanatus*; 1926; England (North); own collection.

27/92 56 bushels; *Quercus sessiliflora*; 1926; England (North); own collection.

27/93 16 lbs.; *Quercus sessiliflora*; 1926; England (West); own collection.

27/94 4,366 lbs.; *Quercus sessiliflora*; 1926; England (East); own collection.

27/95 343 lbs.; *Quercus pedunculata*; 1926; England (North); own collection.

27/96 34 lbs; *Quercus pedunculata*; 1926; England (West); own collection.

27/97 12,047 lbs.; *Quercus pedunculata*; 1926; England (East); own collection.

27/98 18 lbs.; *Quercus Robur*; 1926; England (North); own collection.

27/99 23,800 lbs.; *Quercus Robur*; 1926; England (East); own collection.

27/100 4,130 lbs.; *Quercus Robur*; 1926; England (West); own collection.

27/101 10 lbs.; *Quercus Cerris*; 1926; England (West); own collection.

27/102 23 bushels; *Quercus rubra*; 1926; England (East); Hengrave Estate.

27/103 4 bushels; *Quercus rubra*; 1926; England (East); own collection.

27/104 7,616 lbs.; *Castanea vesca*; 1926; England (North); own collection.

27/105 1,036 lbs.; *Castanea vesca*; 1926; England (West); own collection.

27/106 2,133 lbs.; *Castanea vesca*; 1926; England (East); own collection.

27/107 9 lbs.; *Carpinus Betulus*; 1926; England (East); own collection.

27/108 123 lbs.; *Carpinus Betulus*; 1926; England (West); own collection.

27/109 20 lbs.; *Abies nobilis*; 1926; England (West); own collection.

27/110 1 lb.; *Abies nobilis*; 1926; England (East); own collection.

27/111 13 lbs.; *Abies Nordmanniana*; 1926; England (West); own collection.

27/112 17 lbs.; *Chamaecyparis Lawsoniana*; 1926; England (West); own collection.

27/113 1 lb.; *Cupressus macrocarpa*; 1926; origin unknown; gift from Mr. Andrew.

27/114 1 lb.; *Larix europaea*; 1926; origin unknown; gift from B. Reid & Co., Aberdeen.

27/115 1 lb.; *Pinus Laricio*; 1926; origin unknown; gift from B. Reid & Co., Aberdeen.

27/116 1 lb.; *Pinus insignis*; 1926; origin unknown; gift from Mr. Simmons.

27/117 2 lbs.; *Larix leptolepis*; 1926; England (West); own collection.

27/118 6 lbs.; *Larix eurolepis*; 1926; England (West); own collection.

27/119 30 lbs.; *Pseudotsuga Douglasii*; 1926; England (West); own collection.

27/120 1 lb.; *Thuya plicata*; 1926; England (West); own collection.

27/121 1 lb.; *Tsuga Albertiana*; 1926; England (West); gift from Sir Henry Hoare.

27/122 9 lbs.; *Juglans regia*; 1926; England (East); own collection.

27/123 441 lbs.; *Juglans regia*; 1926; England (West); own collection.

27/124 36,000 seedlings (2 years); *Pinus sylvestris*; crop year unknown; origin unknown; Arran Estates.

27/125 517,000 seedlings (2 years); *Pinus sylvestris*; crop year unknown; origin unknown; Dickson & Co.

27/126 20,000 seedlings (2 years); *Pinus sylvestris*; crop year unknown; origin unknown; War Office.

27/127 8,200 transplants (2 + 2); *Larix leptolepis*; crop year unknown; origin unknown; Howden & Co., Inverness.

27/128 21,000 transplants (2 + 2); *Larix leptolepis*; crop year unknown; origin unknown; B. Reid & Co., Aberdeen.

27/129 1,000 transplants (2 + 2); *Carpinus Betulus*; crop year unknown; origin unknown; Douglas Castle Estate.

27/130 40,000 transplants (2 + 2); *Larix leptolepis*; crop year unknown; origin unknown; English Forestry Association.

27/131 35,000 transplants (2 + 1 & 2 + 2); *Larix leptolepis*; crop year unknown; origin unknown; Manchester Corporation Waterworks, Thirlmere.

27/132 20,000 transplants (2 + 2); *Picea sitchensis*; crop year unknown; origin unknown; Sir Francis Acland.

27/133 60,000 transplants (2 + 1 & 2 + 2); *Pinus sylvestris*; crop year unknown; origin unknown; Lord Clinton.

27/134 22,000 transplants (12–24 inches); *Fagus sylvatica*; crop year unknown; origin unknown; English Forestry Association.

27/135 13,000 transplants (2 + 1); *Fagus sylvatica*; crop year unknown; origin unknown; W. Treseder, Ltd., Cardiff.

27/136 69,000 transplants (3 + 1); *Fagus sylvatica*; crop year unknown; origin unknown; Shaftesbury Estate.

27/137 50,000 transplants (2 + 1); *Fagus sylvatica*; crop year unknown; origin unknown; J. O. Boving, Tring.

27/138 2,800 transplants (2 + 1); *Fraxinus excelsior*; crop year unknown; origin unknown; W. Power & Co., Waterford.

27/139 22,000 transplants (1 + 1 + 1 & 1 + 2 + 1); *Fraxinus excelsior*; crop year unknown; origin unknown; Holkham Estate.

27/140 203,000 seedlings (1 year); *Acer Pseudoplatanus*; crop year unknown; origin unknown; Warren Wood, Elveden.

27/141 1,000 transplants (2 + 1); *Betula verrucosa*; crop year unknown; origin unknown; W. Treseder, Ltd., Cardiff.

27/142 500 transplants (1 + 1 + 1); *Cupressus macrocarpa*; crop year unknown; origin unknown; Galvin, Ireland.

27/143 6,000 seedlings (1 year); *Cupressus macrocarpa*; crop year unknown; origin unknown; Galvin, Ireland.

27/144 1,500 seedlings (1 yr. & 2 yr.); *Cupressus macrocarpa*; crop year unknown; origin unknown; J. O. Boving, Tring.

27/145 4,500 plants (9–18 inches); *Castanea vesca*; crop year unknown; origin unknown; W. Treseder, Ltd., Cardiff.

27/146 45,000 plants (6–10 inches); *Pinus Laricio*; crop year unknown; origin unknown; J. O. Boving, Tring.

(D 12/136)Q Wt. P 92-441 300 4/28 H & S, Ltd. Gp. 12.