JOURNAL

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EDITORIAL.

Special Areas.

In view of the expansion of the Commission's operations in South Wales and in the North of England under the Special Areas Scheme, attention is drawn to the small maps reproduced in this number of the Journal. These maps indicate the areas in England and Wales which are suffering from acute industrial depression and the effects of unemployment.

In 1934 the Government appointed two Commissioners, one for the depressed areas of Scotland and one for those of England and Wales. In 1935 the latter issued a report in which he referred to afforestation as a means of providing useful occupation in the Special Areas. It was consequently arranged that the Forestry Commission should make a preliminary survey of the possibilities of afforestation in and near the English and Welsh areas. This was completed in September last. As a result, it was estimated that in and within 15 miles of those areas there were some 200,000 acres of land suitable for afforestation.

The Forestry Commissioners then, with the support of the Commissioner for the Special Areas of England and Wales, prepared a scheme for the acquisition and planting of 200,000 acres, and for the establishment of 1,000 forest workers' holdings. The scheme contemplated that land acquisition and the establishment of the holdings should be proceeded with as rapidly as possible, while the planting operations would be spread over a period of about ten years. It was estimated that the scheme would provide employment for an average of 2,200 workers during the decade; of these 70 per cent. would be drawn from the industrial unemployed in the Special Areas.

The proposals were put forward in a Report of an Inter-Departmental Committee, and in February, 1936, the Government approved the scheme in principle, subject to review at the expiration of three years. In the first three years the Commission may acquire up to 100,000 plantable acres and establish 500 holdings.

The Commissioner for the Special Areas will, if necessary, assist the Forestry Commissioners by using his statutory powers for the compulsory acquisition of land.

The scheme is not to prejudice the Commission's normal operations and is to be financed by additional funds.

Commission Staff Changes.

A number of changes in the Divisions are likely to be brought about in the immediate future owing to the additional work devolving on the Commission in connection with the Special Areas Scheme. As arrangements regarding these have, however, not been completed at the time of going to Press, only those changes which occurred previous to March, 1936, can be notified here.

During the past year Mr. George Lowe (Division 4) was promoted as Higher Grade District Officer, Mr. R. G. Sanzen-Baker was transferred from Division 4 to a Research appointment at the Imperial Forestry Institute, Oxford, Mr. W. A. Muir succeeded Mr. Sanzen-Baker and Mr. J. M. Ross was transferred to Division 5 from Division 7. New appointments to District Officer posts consisted of:—Mr. G. W. Backhouse and Mr. W. D. Haldane (Division 3), Mr. G. D. Rouse (Division 4), Mr. J. S. R. Chard (25 Drumsheugh Gardens, Edinburgh), Mr. W. N. Gibson (Northern Division) and Mr. G. H. Good (Estate Officer, Division 1).

Empire Forestry Conference.

The fourth Empire Forestry Conference was held last year in South Africa. Sir Roy Robinson was Chairman, the other delegates from the Forestry Commission being Mr. A. P. Long and Mr. W. H. Guillebaud. There was a heavy agenda for discussion, the principal topics including forest policy, erosion and water supplies, silviculture, management, and utilisation. During the tours arranged for the Conference, delegates were much impressed by the extensive and very successful afforestation in progress in the Union. The principal trees being planted are various species of pine, *e.g.*, *Pinus patula* from Mexico, *P. taeda* and *P. carribaea* from the southern United States, *P. radiata*, and *P. pinaster*. Growth has been phenomenally rapid and it was an impressive sight to see ten-year-old plantations of such trees as *P. patula* and *P. radiata* with a mean height of anything from 30 to 40 feet. In the south of Cape Province there are some quite extensive blocks of indigenous forest which are of great beauty, but the species are mostly of the shade-bearing, evergreen type and are unsuitable for afforestation purposes.

International Congress of Soil Science.

The International Congress of Soil Science held its third Congress last year in Great Britain, the Chairman being Sir John Russell, Director of the Rothamsted Experimental Station. The Forestry Commission sent as delegates Mr. D. W. Young, Mr. J. Fraser, Mr. James Macdonald and Mr. J. A. B. Macdonald. The Congress held a week's session in Oxford at the end of July, followed by a fortnight's tour through England and Scotland. There was a good attendance on the part of delegates from foreign countries, including a number of specialists on forest soils, and the discussions during the excursions proved very fruitful. Visits to Thetford and Rosedale Forests were included in the tour.

Frost Enquiry.

The abnormally severe and widespread frosts which occurred in May, 1935, caused extensive damage. In order to have a record of the results, the Divisions were instructed to furnish reports on each of their areas. The reports were of two types, the one general, covering the main effects of the frost, influence of topography, shelter, etc., and the other detailed, in which actual counts and measurements were taken in specially badly frosted areas. By a fortunate chance the annual grant from the Schlich Memorial Trust was placed last year at the disposal of the Forestry Commissioners, who allotted the sum to Mr. W. R. Day with the request that he should undertake the compilation of the data and prepare a report as soon as possible for publication as a Bulletin. The report is nearing completion and it is hoped to publish it at an early date.

Civil Service Sport.

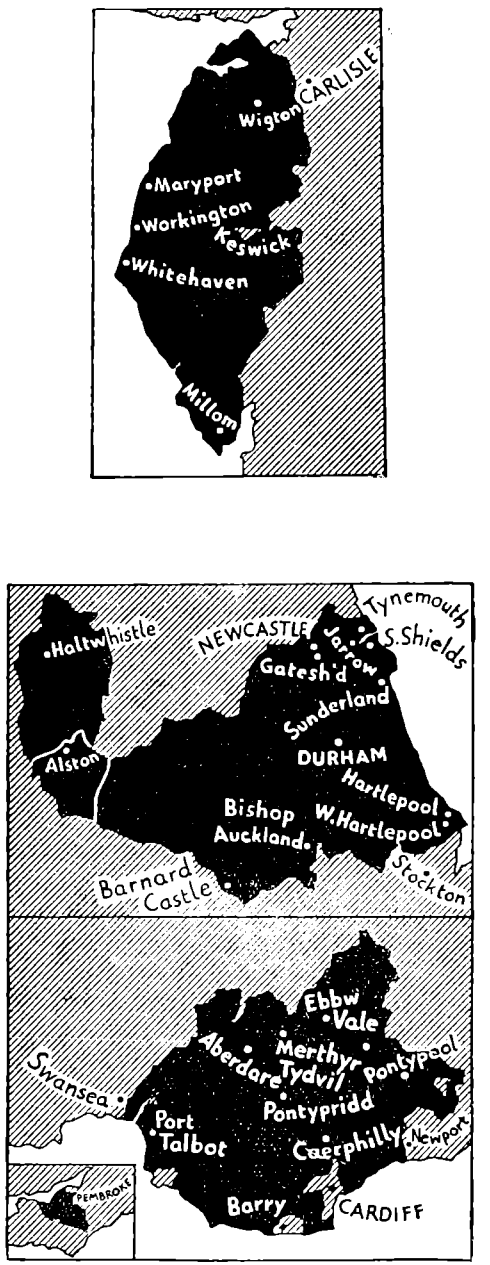
The Forestry Commission staff is too scattered to make feasible the formation of sport societies, but the Ministry of Agriculture Golfing Society admit our staff to membership, and the annual subscription is only 2*s*. 6*d*. Three meetings are held each year. The Ministry would probably also admit our staff to their other sports societies.

It may be of interest to report that Mr. C. E. L. Fairchild was fourth in the Civil Service Golfing Championship, 1935, while Mr. A. G. Herbert was runner-up for the Civil Service Ice Skating Championship, 1935. Mr. J. R. Thom has played in the Civil Service rugby matches against the Army, the Navy and the Air Force.

Contributors to the Journal.

The following Divisions have been selected as special contributors to next year's Journal: Divisions 2, 5, and Scotland, Northern.

The special contributors to the present number of the Journal are Division 4; the New Forest (Division 6); the Forest of Dean (Division 7), and Scotland, South-Western.



Maps showing the districts in England and Wales included in the Special Areas Scheme.

PROGRESS REPORT ON RESEARCH: JANUARY, 1936.

By W. H. GUILLEBAUD.

1. NURSERY EXPERIMENTAL WORK.

A feature of last season's work was the trial of Sorbex peat in a considerable number of Divisional nurseries. The special object of this experiment was to improve the size of one-year-old seedlings of Sitka and Norway spruce. In both England and Wales and Scotland the results were in the main negative, germination was as a rule better in the controls, and, except in one or two nurseries, there was no marked improvement in the size of the seedlings due to the peat treatments. It is now realised that a mistake was made in applying the Sorbex in a dry condition to the beds shortly before sowing. In future where Sorbex or other types of dried peat are to be applied to seedbeds the application should be made during the winter to allow the peat to become thoroughly saturated by the winter rains or snow.

The influence of season of sowing upon the size of one-year seedlings was further tested in a number of nurseries in Scotland, as well as at Kennington. The results as a whole were strikingly in favour of early sowing, especially for the larches and spruces, though there were one or two puzzling exceptions. In this particular season, with its hot and dry summer, the germination of the beds sown in March and the first half of April was below that of the later-sown beds, but the differences were not as a rule important. One general conclusion which seemed to emerge from the experiments was that the tilth difficulty, which is often urged against early sowing, can be very largely overcome by the use of coarse sand or grit for covering. Tilth is only of paramount importance where ordinary nursery soil has to be used for covering such species as Sitka spruce and the two larches.

Further work on stratification of seed of birch and alder confirmed previous results showing that stratification of birch seed in sand in December or January greatly increases germination. Alder germination, on the other hand, is not benefited at all by stratification.

2. PLANTATION EXPERIMENTS.

Peat Soils.—Most of the experiments escaped serious injury from the May frost, but shoot growth was generally below that of the previous year. At Beddgelert, a plot of Corsican pine, turf-planted on deep peat in P.27, is outstanding in vigour and uniformity of growth; so far there has been little or no damage from windthrow, though a number of *Pinus contorta* in an adjacent plot have been blown.

Some P.30 plots of S.S. and P.C. at Borgie Forest are growing remarkably well on scirpus peat. The entire surface was turned over by hand labour before planting (imitation ploughing) and basic slag was applied. Most of the Sitka spruce are putting on shoots of 10 inches and over and show no sign of checking. *Pinus contorta* are growing

even more vigorously. On present indications it would seem that in this area the surface conditions alone are the obstacle and that with mechanical cultivation by ploughing and the addition of a small quantity of basic slag it may be possible to bring a considerable area of the Forest under tree growth.

At Achnashellach the P.28 Japanese larch on the steep hillside in Glencarron now average 10 feet in height with leading shoots of 2 feet. A younger plot (P.33), planted about 300 feet higher up the hill, is suffering very badly from blast and it seems probable that only a comparatively narrow strip of land is sufficiently sheltered to be fit for planting with this species.

At Inchnacardoch *Pinus contorta* are still growing well in the Belgian-turfed P.28 experiment on the Lon Mor. This is a drainage experiment, the drains in the two contrasting treatments being 12 feet and 18 feet apart respectively. The closer-drained plot is now going ahead as the following data indicate. 12-ft. drain spacing : Av. height of plants 5 feet, leading shoot 10 inches. 18-ft. drain spacing : Av. height of plants 4 feet, leading shoot 7 inches. So far the trees appear to be windfirm, although root dissections show that the root system is very superficial.

The Oregon alder planted in P.30 on slope peat at Inchnacardoch are still a conspicuous feature in the landscape. Some of the largest plants have had to be pruned to prevent whipping of the Sitka spruce. The tallest alder on the area is now 13 feet in height and, although the average is much below this, the species appears distinctly promising for mixture with Sitka spruce on the poorer types of peat. It is probable that an application of slag is essential in order to get the tree started on this type of ground.

Upland Calluna Soils.—The principal experimental areas are at Teindland in Division N.E., Allerston, Harwood Dale and Hamsterley in Division 1, and Clocaenog in Division 2. During the last year or two there have been some interesting changes in the relative development of the species used. Except at Clocaenog, Sitka spruce has undergone a severe set-back. Plants which, aided by ploughing and often also by basic slag, made good growth during the first few years are now apparently going into check in almost all areas. In P. 35 the falling-off in rate of growth was particularly well-marked. The cause of the set-back is still uncertain ; it may be due to a change for the worse in the soil conditions, *e.g.*, reconsolidation of the soil after ploughing, invasion of heather, exhaustion of slag, etc., or, what appears more likely, it may be due to the last three dry growing seasons. The shallow root system of the spruce renders it specially sensitive to prolonged drought and it is possible that one or two wet seasons might bring about recovery.

Japanese larch has behaved somewhat similarly to Sitka spruce at Allerston, but at Teindland and Harwood Dale it remains vigorous, and is one of the most promising species, provided it is given a start with basic slag.

The pines generally are flourishing, especially *Pinus contorta* (in all areas) and Corsican pine at Allerston. Whether pines will ever make

big timber on these upland areas is a question, but so far there is no doubt that they are the most reliable of the conifers for purposes of establishing a first crop.

Perhaps the most striking feature in these experimental areas has been the rapid early growth of birch and alder, although, on the poorer soils, these trees are even more dependant than the conifers on the initial impetus to growth supplied by basic slag. Of the various species of alder, *A. oregona*, which has only been recently tried, is doing outstandingly well. The following provisional data from a P. 34 experiment at Allerston and a P. 32 experiment at Teindland illustrate the rapid progress of the plants provided basic slag is applied at the time of planting :—

	Average Height.		*Average leading Shoot.*	
	Manured.	*Unmanured.*	*Manured.*	*Unmanured.*
Allerston. P. 34	3 ft. 6 in.	2 ft. 0 in.	16 in.	2 in.
Teindland. P. 32	4 ft. 4 in.	8 in.	15 in.	1½ in.

Examination of the root systems of a few of the plants has shown that the main roots are deep going, and they have been traced well into the undisturbed lower layers of the soil. Except on the better ground at Allerston birch is decidedly slower growing than alder. Where it is doing well it also is developing a strong, deep-going root system.

The success of these broadleaved species on these poor acid soils is a matter of great interest; if they continue to thrive the effect on the soil should be very beneficial. On the one hand there is the action of the roots which should help to aerate the soil and increase its effective depth (except perhaps where there is a thick unbroken pan as at Teindland), and on the other hand the leaf-fall will tend to improve the humus conditions and promote a favourable type of decomposition.

Dorset Heaths.—One of the chief developments in this area has been a serious attack by pine shoot moth on Scots pine and *Pinus contorta* planted in P. 32 at Wareham ; the weaker plants of some of the Corsican also have been damaged. It is rather unusual for pine shoot moth to damage seriously plantations at such an early stage, and as a rule Corsican pine is virtually immune.

Dr. Rayner's direct sown plots of Corsican pine, Scots pine, and *Pinus contorta*, to which composts were added before sowing in P. 33, have made remarkably good growth and the plants show normal root development. This experiment is to be repeated in P. 36, on a larger scale and using selected composts.

Lawson cypress planted in P. 33 is healthy and growing vigorously ; it has survived both the 1935 May frost and three dry growing seasons and appears very promising.

Thetford Area.—The damage by frost was general and severe. Date of flushing was a crucial factor in this area, the only plants to escape being those which had not flushed when the frost came. A number of experiments were established with large and small plants of beech, larch and other species. In every case frost damage was much more serious

to the small plants and many deaths occurred. The large plants escaped with minor shoot frosting and there were few actual casualties. Grey alder planted as a nurse species is growing well, and though damaged by the late frost made an excellent recovery.

Owing to the untoward combination of late frosts and summer drought the last three seasons have proved extremely difficult for the more tender species tried at Thetford. Such a series of adverse years is probably exceptional, but the difficulties experienced present a warning against large-scale introductions of any species other than pine. Where tender species are to be planted some form of advance crop of either pine, birch, or grey alder appears to be indicated. As regards size of plant the evidence is strongly in favour of sturdy, well-developed transplants of the 2+2 or 2+1+1 type, for such species as beech, Douglas fir or larch.

Chalk Soils.—Almost all the plots at Buriton were damaged by the May frost, and the chief points of interest arise in this connection. On the high ground at the top of the Downs the frost zone extended to only about 15 inches above the ground, and the only plants injured were those below this height. Some of the beech introduced in P. 33 below tall alder plants escaped any damage, but where the alder stocking was thin the beech were frosted.

On the lower slopes and in the valleys the frost zone extended to several feet above ground and all beech plants were damaged.

There are several weeding experiments at Friston, and it is of interest to note that the beech in the unweeded plots were as badly frosted as those in the weeded plots. It is clear that in a frost of this nature, the natural grass herbage is not an adequate protection from damage.

Loam and Clay Soils.—The May frosts cut back and damaged practically every plot of oak or ash throughout the experimental areas in the South. One of the few exceptions occurred at High Glanau near Tintern, where a P. 35 experiment on the hoeing of ash completely escaped ; this was fortunate because the plants showed a definite response to the treatment, the shoots of the hoed plants being nearly double the length of the unhoed controls (7 · 9 as compared with 4 · 4 inches).

The experimental cost of hoeing (£5 per acre, including screefing before planting) was high, but the plants appear well established and if there is no subsequent check the procedure may not be uneconomic, especially if cheaper methods of hoeing can be devised.

Taking the experimental areas as a whole, the oak and ash plants have made a very satisfactory recovery from the frost damage, there has been some loss of height growth and a good deal of forking has resulted, especially with ash owing to the death of the leading shoots, but it is remarkable how little evidence of the damage was to be seen by the end of the growing season.

3. Sample Plot Work.

The Novar *Abies grandis* plots were remeasured in 1935 and form a well-contrasted pair. The plots are 35 years old and the trees a little

over 70 feet high. The lightly thinned B grade plot carries 1,020 stems per acre with a volume of 9,800 cu. ft. per acre (true volume under bark). The heavily thinned D grade plot has a stocking of only 345 stems per acre, and a volume of 5,000 cu. ft.

The proportion of the stem under live crown is very different in the two plots, namely 35 per cent. in B and 47 per cent. in D. Another point of interest is that the current annual volume production is much the same in the two plots (550 cu. ft. per acre in B and 500 cu. ft. per acre in D), indicating that in spite of the very heavy D thinning the growing space is still being efficiently used. The trees are still growing in height at the rate of 2 to 3 feet per annum.

4. Research Work at Aberdeen.

Dr. E. V. Laing's work on root and shoot development of larch plants has proceeded on the same lines as in the previous year. Dr. G. K. Fraser carried out a series of field experiments at Durris. Duplicate plots were sown with seed and planted with transplants and different manures applied. Similar experiments were carried out on the same soils in pots. Differential effects due to the manuring are expected to show up next growing season.

5. Mycorrhiza Research.

Dr. M. C. Rayner has continued her investigation of the complex soil conditions at Wareham and their relation to the normal development of mycorrhiza. In association with Professor Neilson Jones, of Bedford College, the interesting discovery has been made that the raw humus overlying the mineral soil produces a chemical substance of the nature of ethylene which has remarkable physiological properties. Very minute traces of ethylene, for example, produce characteristic curvature of the leaf stalks of the tomato plant and also inhibition of root growth. Professor Neilson Jones has extracted a gas from Wareham soil which produced both these phenomena on tomato plants, and the conclusion is drawn that this is probably the toxic factor which had been suspected in the past at Wareham. There are indications that the quantity of the toxic substance produced depends upon the season, being at a minimum in autumn and in greatest amount in the spring; consequently autumn rather than spring planting is indicated.

6. Soil Research (Macaulay Institute).

Dr. A. Muir has been engaged on a survey of the forest soils in the neighbourhood of the Bin Forest, Aberdeenshire. This area includes a number of well-contrasted geological strata, ranging for quartzite to basic igneous rocks, and it is hoped that the survey will throw new light on the relation between geological formation and soil profile on the one hand and topography and vegetation on the other.

The Institute has also been very helpful in assisting us with our problems of nursery manuring. Dr. Stewart has carried out a consider-

able number of chemical analyses of nursery soils, and has prescribed for their manurial treatment on the basis of the deficiencies found. In connection with the whole question of manuring of nurseries, it would be useful if, in nurseries where manures are applied, one typical section of the nursery could be left completely unmanured as a check on the efficacy of the manuring. Such sections would need to be elaborately labelled to avoid the risk of manure being inadvertently applied and thereby the whole investigation hopelessly confused and wrecked.

7. Research on Vole Disease.

The original grant made to Dr. Elton for the investigation of vole disease was increased in 1935 to enable the work to be extended to research on a group of bacteria of the genus *Salmonella* which have been largely used in France and Germany for the control of voles. Unfortunately, owing to ill health, the pathologist, Mr. P. H. Leslie, had to abandon the investigation after about three months' work. Study of the literature, however, showed that these bacteria also cause serious food poisoning in man and consequently should not be used for mass-control work on rodents. This fact, combined with Mr. Leslie's illness, has brought the investigation in its present form to an end. The question of another line of approach to the problem is under consideration.

8. Advisory Committee on Forest Research.

The research programme was discussed at a meeting held in Scarborough in July last, and the Committee inspected the experimental plots at Allerston and Harwood Dale.

9. Mycology.

Elm Disease.—The usual survey was carried out in the autumn by Mr. Peace, who also visited the elm disease research station at Wageningen in Holland, and other districts in France and Belgium. As far as this country is concerned a major outbreak appears to be developing in Worcestershire, but elsewhere there is nothing special to report. In Holland considerable progress has been made in the raising of immune forms of elm; one form, belonging to the *U. foliacea* group of elms, appears especially promising, and arrangements have been made for the introduction of a number of the plants into this country for purposes of propagation and further tests on their resistance.

Butt Rot of Conifers.—Specimens have come in well from the Divisions during the year. Mr. Peace has visited a number of forests in which thinning operations are in progress and has obtained further material. *Fomes* is still the commonest fungus isolated, but quite a number of other fungi have also been identified.

Frost Investigation.—A good deal of the time of both Mr. Day and Mr. Peace has been devoted to compiling records dealing with the effects of the May frosts.

10. Entomology.

Pine Beetle.—Work on this pest has proceeded in the New Forest where Mr. H. S. Hanson and Mr. J. M. B. Brown are conducting their investigations. A report will be prepared shortly.

Pine Weevil.—In view of the importance of this pest Mr. Brown's report on the experiments carried out last year in the New Forest is given in full. This reads as follows :—

Eight modifications of bark, billet and spray traps for weevils were tested at Puckpits in 1934. The four most successful of these methods were tested in 1935 on a 7-acre area in Pound Hill Enclosure, felled during the previous winter. These four methods were :—

(a) *Bark.*—Two pieces of fresh pine bark, about 12 in. × 10 in. laid bast downwards, with a sprig of Douglas fir foliage between, and weighted with a block of turf.

(b) *Pine Spray.*—A bundle of Scots pine spray, 12–18 in. long, as much as can be grasped in the hands, tied together and laid flat on the ground.

(c) *Surface Billet.*—A pine billet, 18 in. long and 3 in. in dia., is placed flat, half buried in a groove in the ground.

(d) *Covered Billet.*—A similar pine billet is placed flat in a pit measuring about 20 in. long × 9 in. wide × 4 in. deep, and covered by a turf of such a size that the ends of the billet are barely exposed.

The area was subdivided into six blocks, in each of which a row of 20 traps of each type was prepared at the end of March. In four of these blocks, the traps were examined and the weevils collected six times weekly ; in the other two, only thrice weekly. Renewals in three of the blocks were made regularly at intervals of three weeks ; whereas, in the other three blocks, the individual rows were renewed whenever the traps began to dry out and lose their attraction for weevils. Thus, in addition to the main test of the comparative efficacy of the four methods of trapping, useful information was given on the most economical system of examining and renewing the traps. Collections were made and recorded from the beginning of April until the end of October and the main results are here summarised.

From small beginnings, the daily collection rose to a first peak of 300 to 400 at the end of April and then slumped to about 60 in mid-June. Catches continued small until August, when they rose to a second peak of about 1,000 daily at the end of that month. By October, the numbers caught were again small and they dwindled to a negligible figure before the end of the month.

In the first period of abundance, the billets were more successful than the bark, which in turn was much better than the spray. If the total caught by (*c*) be represented by 100, the total catches of the other methods would be : (*d*) 76, (*a*) 60 and (*b*) 30. But during the second period of high catches the bark traps were much the most successful, while the spray was not so much less effective than the billets.

The billets lasted longer than the bark or spray ; to be effective, bark traps should be renewed at least every three weeks and in the height of summer preferably every fortnight. Billets, on the other hand, appear to remain effective for a period of from 5–6 weeks.

The blocks where the traps were examined only three times weekly yielded about 20 per cent. fewer weevils than those where daily collections were made.

A thorough examination of several stumps on and near the area proved the very large number of breeding weevils and accounted for the high catches of young weevils in August and September.

Before the results can be fully appraised, the records must be studied in greater detail and some supplementary observations and experiments made. Can we, for instance, ascertain the approximate absolute efficiency of our trapping

methods? In one respect the result is regrettable, for it appears that at seasons when bark is easily procured it is less effective than billets and that later, when it is hard to obtain, it is very attractive to the weevils. Provisionally, we may suggest: (i) that the simple, cheap and effective method (*c*) might be generally adopted, but replaced or supplemented by method (*a*) where bark is available; (ii) that the billets should be renewed every five weeks and that if the bark cannot conveniently be renewed more frequently than this, at least the Douglas fir sprig should be replaced fortnightly; and (iii) that the most economical system of examination would probably be a somewhat dense series of traps examined three times weekly. In conjunction with the main experiment, useful information was obtained about the sex ratio of the weevils caught, the dates of egg-laying, food preferences and methods of enhancing the efficacy of bark traps.

A second experiment dealing with the pine weevil was laid out in the south-eastern quarter of the Forest. Four belts of Scots pine were chosen, each extending to three acres and remote one from another. In one of these (*d*), breeding traps were prepared by Mr. H. S. Hanson and in a second (*c*), 80 bark traps were put down in April and the weevils collected 2–3 times weekly until the end of September. The total yield was 4,885, distributed thus through the months: April, 625; May, 1,851; June, 1,101; July, 306; August, 647; September, 351.

All four areas are now being clear-felled and in the coming season will be thus dealt with:—

(*i*) No operations.
(*ii*) Trapping as in (*c*).
(*iii*) Trapping as in 1935.
(*iv*) Renewal of the breeding places.

Next winter, all four areas will be replanted and the results of the experiment obtained after the assessment in 1937 and 1938 of the damage caused to the young crop in each.

Pine Shoot Moth.—A first attempt was made in 1935 to introduce from Austria an egg parasite of this pest. The parasite in question, *Copidosoma geniculatum*, does not occur in this country, but is considered to be of considerable importance on the Continent. Unfortunately the arrangements for collection in Austria broke down and only a small amount of material was received. The parasites were bred out at the Farnham House Laboratory and liberated at Puddletown in Dorset, where a serious outbreak is in progress; owing to the small number of parasites available the prospects of success are not very great. In the current year it is hoped to obtain a much larger supply of material from Austria, and the parasites bred out will be liberated at either Thetford or Rendlesham.

Oak Tortrix.—Last year Mr. Brown reported that there were indications that the severe outbreak of 1932–34 was subsiding in the Forest of Dean, and in particular that the high percentage of parasitised pupae collected from several areas in 1934 gave promise of control by the parasites. The severe May frosts in 1935, which destroyed much of the foliage on trees in the valleys and on the lower slopes, also caused heavy mortality to the caterpillars, the percentage parasitism, however, also declined, and it seems probable that the severe weather in May either killed many of the parasites, or at least affected their breeding. In general the indications are against any considerable defoliation in 1936.

Chafer Larvae.—With the co-operation of Imperial Chemical Industries experiments on the chemical control of chafers were conducted in Old

Pale Nursery, Delamere Forest, and Nagshead Nursery, Forest of Dean. The substances tested were :—

(1) Seekay Soil Fumigant, a solid mixture of ortho—and para—dichlorbenzenes, and

(2) A benzene derivative, known provisionally as M G 15, which has proved effective for the control of leatherjackets.

The experiment at Nagshead was inconclusive ; it may have been marred by a heavy thunderstorm immediately following the application.

At Delamere a certain measure of success was obtained, *e.g.*, in Scots pine seedbeds a reduction of 50 per cent. in the number of seedlings attacked by chafer. The treatment in this case was with Seekay.

One of the chief problems in the use of Seekay is to find a satisfactory method of incorporating it with the soil ; if this difficulty can be overcome it appears the more promising of the two chemicals, as there are reasons to believe that it may act as a deterrent to egg-laying in addition to its toxic action on the grubs. Further trials will be carried out in the coming season.

11. Utilisation.

The examination by the Forest Products Research Laboratory of pruned material has been continued. The primary factor governing the rate of occlusion of flush pruned wounds is clearly the rate of growth. This fact points to the advisability of combining pruning with thinning, and also to the adoption of an " elite stem " type of thinning, favouring more particularly the pruned trees.

CHERMES COOLEYI.

By R. N. Chrystal.

The discovery by Dr. A. E. Cameron, of the galls of *Adelges* (*Chermes*) *cooleyi* in Scotland last summer, is one of the most interesting of recent records. So far, Dr. Cameron has not published any account of the find and his paper is awaited with interest. A keen watch should now be kept for these galls in all parts of the country, as there is already a suspicion that they have been found on Sitka spruce in the north of England. The galls are not difficult to recognise. They are definitely elongate in form, extend the whole length of the shoot, and usually completely surround it. Large specimens may measure several inches in length.

The natural enemies of *Adelges* (*Chermes*) *cooleyi* on Douglas fir have not been studied in very great detail and there is virtually no information as to their abundance in Douglas fir plantations in different parts of the country. Foresters should be on the look-out for (i) larvae of the ladybird beetles, (ii) larvae of the " hover flies " of the Dipterous family *Syrphidae*, and (iii) Lacewing flies.

Ladybird beetles (Family *Coccinellidae*) are sufficiently well known to render their description superfluous. The same may not, however, apply to the larvae, which are, if anything, more active as predators than the adult beetles. They usually measure about half an inch in length, with the body elongate-oval, tapering at both ends. The colour varies from almost black to a slaty blue, with sometimes a few yellowish spots or markings on the segments. The three segments (thoracic) immediately following the head each carries a well-developed pair of legs. One further characteristic will assist the beginner in recognising these larvae. The dorsal surface of all the body segments carries clearly marked darker patches of chitin on which occur prominent spines. On the abdominal segments, these are usually circular and vary in number from 2 to 4 per segment.

Some species of hover flies (Family *Syrphidae*) may be easily recognised in the adult state, by their habit of hovering over flowers and foliage in bright sunlight and by the yellow banding on the abdominal region of the body, which gives them some slight resemblance to wasps. The larvae are not, however, at all well known to many people. They will be found hanging on by their tails to branches or twigs on which there are colonies of *Chermes*. In many cases, they are almost covered by the white wool of the latter. The larvae measure about $\frac{1}{4}$ of an inch in length, and have the tail end truncate and the head end pointed. In general form, they are somewhat reminiscent of slugs, the colour varying from black or brownish black, to greyish white, yellowish, or greenish with a touch of red. The skin is usually much wrinkled. When full-grown, the larvae pupate under cover of a bag-shaped puparium which is often fixed on to a twig or leaf but is also found in the soil.

Lacewing flies belong to the *Chrysopidae* of the order Neuroptera. There are two kinds known, the green and the brown, and of these, the

green species are larger and better known. The common green lacewing measures about $\frac{3}{4}$ of an inch in length and has a bright green body and large iridescent wings which, when at rest, lie roofwise over the back. The eggs, which are laid on leaf surfaces, are carried on long stalks, a device to prevent their destruction by other insects. The larvae are oval-shaped and may be white, yellowish, or greenish in colour. The body tapers somewhat at the head end being broadest in the centre, and tapering again towards the hind end. The jaws or mandibles are very prominent. One curious habit of these larvae is their custom of carrying on their backs the empty skins of the prey which they have destroyed. They are inveterate enemies of all aphids and other sucking insects.

The brown lacewings, which belong to the genus *Hemerobius*, are smaller insects and usually have the wings covered with brownish hairs. The eggs are not carried on long stalks. The larvae are of the same shape as those of Chrysopa but rather more slender. They are usually cream-coloured with brown markings. They are often very difficult to find, not only on account of their smaller size but also because they get mixed up with and covered by the thick white wool of the *Chermes*. Their value as destroyers of the *Chermes*' broods is considerable.

RECENT FOREST FIRES.

By Sir Alexander Rodger.

The early part of 1936 has been an unusually unfortunate season for the Forestry Commission in respect of fires.

Since the 8th of February 30 fires have been reported to Headquarters. Of these 24 occurred in England and Wales and 6 in Scotland. The estimated value of the plantations burned is £9,745 (843 acres) in England and Wales, and £2,497 (315 acres) in Scotland, making a total of 1,158 acres, value £12,242. Thirteen of these are reported to have been caused by railway engines, three by exterior fires which crossed the outer traces, four by members of the public, one by the Commission's employees, and in nine cases the cause is unknown though incendiarism is suspected in two cases, including one serious fire in South Wales. The damage done was assessed at nil in nine cases, no plantations being involved. Wales suffered severely, 817 acres of plantations being destroyed in the four principal fires, the damage being estimated at £9,285.

It appears that February was a most unfortunate month in weather. Owing to the heavy rain the lines could not be burnt. Then came strong drying winds, followed by a hard, dry frost. In molinia areas, such as were seen by the writer in South Wales, and probably also at Newcastleton, the conditions were as bad as they could be, so that it was no wonder that on a windy day fires should cross the exterior lines or be started easily by careless or malicious trespassers. Papery masses of dry molinia blowing about and lodging against banks and in holes gave facilities for forest fires which could hardly be surpassed.

It was certainly bad luck too that an Indian pedlar should throw down a match when passing along a little used path near the Border.

The measures taken to guard against fires and to extinguish them appear generally to have been sufficient, but there is a considerable body of opinion among senior officers of the Commission that local officers should be encouraged to take more responsibility as regards the appointment of patrols in time of extreme danger. The Code says : " The Forester is responsible that properly-equipped patrols are posted as may be required from day to day in accordance with the provisions of the approved plans." If the fire plans have been prepared and duly sanctioned by the Assistant Commissioner, as prescribed in the Code, there can be no reason why sufficient freedom should not be given to the Forester, District Officer and Divisional Officer to take special measures at any moment when special danger is apprehended. This can surely be done without involving the Commission in large expenditure of money which could be better used for other purposes.

It is hoped to revise the Code in the near future so as to make the provisions of Section IX (as well as other parts) simpler and more easily followed.

ROYAL SCOTTISH FORESTRY SOCIETY.

Excursion to Deeside, 1935.

By R. Butter.

Deeside is one of the few districts in Scotland where extensive masses of woods occur comparable on a small scale with Continental forests.

Balmoral.—The woods extend to 6,000 acres, mostly of a good type. In the Ballochbuie forest we visited one of the best known examples of natural Scots pine, the trees being about 250 years old. They are fine well-grown trees of great height and dimensions. Owing to the presence of deer in large numbers there is very little natural regeneration. A Douglas fir plantation in which the Forestry Commission have a sample plot 52 years old and recently thinned, containing about 9,500 cu. ft. per acre, true measure, was inspected. There are 337 trees per acre, average height 86 ft., average girth 39 ins. at breast height. The trees had been pruned up to 50 ft. The original crop was a mixture of Douglas fir and birch, and the birch had done good work in the suppression of strong side branches and reduced the cost of pruning. The pruning had only been done about 7 years ago. To warrant the expenditure it would seem that pruning should have been carried out earlier.

Abergeldie Estate.—Scots pine and larch, 117 years old, rising to an elevation of 1,500 ft., showed good quality timber but, like many other plantations in the district, this was over-ripe, especially in the case of the larch, but the amenities of the district have to be preserved. In Genechal wood some fine examples of old Scots pine were seen; these were said to have been planted after the battle of Culloden. At Graig-na-ban were Norway spruce 90 years old, well-grown and clean.

Birkhall Estate.—A visit was paid to the sawmill which is under the management of the Forestry Commission. The mill which is planned on up-to-date lines, has three circular saws for slabbing, thicknessing, and cross-cutting respectively, also a pendulum saw and log-splitting machine; the last two being used for firewood production. The 30 H.P. steam engine burns waste wood and sawdust. A new style creosoting tank, heated with steam from the sawmill boiler has recently been installed to treat fence posts made from Scots pine thinnings.

Glentanner Estate.—At Snakes Well an interesting young Douglas fir plantation, dating from 1926, was seen. The trees were grown from seed distributed in 1922 by the American Tree Association. They have remained comparatively free from Chermes when all other Douglas fir on the estate were infested. From a Scots pine wood 80 years of age 90,000 trees had been removed during the war.

At Glentanner House a fine recreation hall, with reading, concert and billiard rooms, has been erected mostly from timber grown on the estate and in this the employees and their families meet. Much interest was also taken in the estate workers' cottages which, like the hall, were built of wood.

Ballogie Estate.—Here the woodlands extend to some 2,500 acres, of which some 600 acres have been planted since 1910. The oldest woods are about 75 years of age.

Squirrels were formerly very numerous, as many as 7,000 having been killed in 16 years. Now they and rabbits are well kept down. On Antilly Hill 260 acres of Scots pine were inspected. These had been planted but there was so much natural regeneration of European larch that a crop of the latter could have been obtained. At Berrystock there were about 20 acres of pure Corsican pine aged 52 years ; planted to replace Scots pine killed by rabbits. These were of better quality than the Scots pine of the same age and had proved more suited to wide spacing than the latter. The wood contains some 4,000 cu. ft. per acre. t.u.b. Of great interest were the Scots pine trees known as the Laird's Walking Sticks on the Fingean estate. They are tall, clean trees, 150 to the acre, 90 to 100 ft. in height, 17½ in. quarter-girth at 4 ft. 3 in., and contain some 7,000 to 8,000 cu. ft. per acre. These are the best Scots pine I have ever seen.

Mar Estate.—Tree growth on this estate reaches up to nearly 2,000 ft. above sea level. The remnant of the old Forest of Mar was most interesting, consisting of natural Scots pine up to 200 years old. The trees have produced exceptionally fine timber. There was a complete absence of all other tree species, and no recent natural regeneration. Near Derry Lodge a Scots pine plantation, formed about 1885, was visited. It has never been thinned and the trees which will form the final crop have suffered in no way from lack of thinning, the dominant trees having their crowns well out, with the dominated, forming shelter for the soil and cleaning the stems of the taller trees. The dominated trees are in just the position in which one would like to have an undercrop of beech. If left alone I think that this plantation would produce as good a quality of timber as the ancient Forest of Mar. It would of course be beneficial if the dead trees were removed.

Invercauld Estate.—Here the woodlands are principally maintained for sport, but much planting has been done. Many interesting specimen trees were seen, including a notable larch planted in the eighteenth century; the young larch plantations, however, are suffering severely from canker, owing to lack of early thinning.

Glen Dye Estate.—The woods extend to 2,700 acres. At Bridge Wood, with an elevation of about 500 ft., are Scots pine, 130 years old, of good diameter and having clean stems of over 50 ft. without branches. These were underplanted with Douglas fir 41 years ago; the Douglas firs are very fine trees and are now beginning to top the Scots pine where they have been able to get their heads through the canopy. A sample plot of Douglas fir where the Scots pine were sparse, gave 192 trees and 6,068 cu. ft. quarter-girth measure to the acre. As some members of the Scottish Society seemed to regard the Douglas fir with disfavour it was refreshing to have the opinion of a large timber merchant who gave it a good name. He said that the attitude of the Scottish builder

towards Douglas was mere prejudice, and that as the supply of the timber became more abundant this would be overcome.

Conclusions.—It is unfortunate that no one seems to know exactly how the fine old Scots pine on Deeside were treated when young. It looks as though the 80-year-old plantations will never produce the tall, straight and clean timber of the older crop. It may be that the 200–250-year-old pines were a mixture of Scots pine and birch, both naturally regenerated. The dead and dying trees were perhaps removed from time to time and used as firewood, until in the end the birch had disappeared altogether, leaving the fine old pines as the final crop.

There was much discussion on pruning and thinning. I came to the conclusion that where Scots pine have been established by planting, the spacing has been much too wide. On Deeside the tree is slow-growing, as it must be to produce the best quality timber. If spacing is wide, before the pine gets to the thicket stage the side branches become strong and difficult to kill off, the struggle for existence is delayed, resulting in loss of height and want of cleanness of stem.

The price obtainable for Scots pine does not warrant the cost of underplanting or extensive pruning. Thus, to get the economic crop we must resort to methods as near as possible to natural conditions. To obtain this the woods are best produced by natural means or, if planted, by close spacing. I would rely on the survival of the fittest to avoid the cost of pruning and reduce thinning to the minimum. As to thinning, of course, each plantation from time to time would have to be inspected and a decision reached as to the necessity for action. What I consider doubtful is any attempt to produce Scots pine by thinning and pruning, using wide spacing as an economy in the first stages of establishment.

I am very grateful to the Commissioners for the opportunity afforded me to visit Scottish woodlands for the first time.

BIRD LIFE AT THETFORD.

By W. A. CADMAN

Any widespread change in the vegetation of an area brings about changes affecting either directly or indirectly the fauna of that area. Some species increase, some decrease; others tend to adapt themselves to the changing conditions. These changes are of particular interest where bird life is concerned. The Breckland area of the Thetford district has long been known to ornithologists and naturalists, and now that a large part of it has been afforested some very interesting changes are taking place; changes which will be deplored by many, especially those who were familiar with the area before the change began; but changes which are nevertheless of great interest and which, since they are inevitable, are at least well worth studying.

Breckland is a wide open expanse of country characterised by its barren appearance and by the almost complete lack of any of the more luscious types of vegetation. Broadly the vegetation may be divided into four main types:—calluna, pteridium, grass heath and carex associations. Many acres are covered by grey lichens, stonecrop and tufts of *Festuca ovina* cropped close by rabbits. In fact the barren appearance of much of Breckland is largely due to the excessive numbers of rabbits. Every herb which is palatable is cropped close by them. For this same reason tree life is for the most part non-existent; an occasional birch, hawthorn or Scots pine occurs, however. The soil is a poor type of sand normally overlying chalk at varying depths and in most places containing flints.

The principal breeding birds typically associated with this area are:—stone curlew ("Norfolk plover"), ringed plover, lapwing, French partridge, nightjar, stock dove, skylark, meadow pipit, wheatear, stonechat, whinchat. Other species are found, but either they are very rare or strictly local (*viz*, Montague harrier, shorteared owl, Canada goose, wood lark), or else they are not typically associated with the area (*viz.* pheasant, common partridge, kestrel hawk, red-backed shrike, etc.). Those birds associated with the meres and pools of Breckland (species of duck) have not been included since the recent drought years have introduced other factors.

Once an area is fenced and cleared of rabbits the ground vegetation soon becomes more dense; plants which previously were stunted grow freely and produce seed; others appear which before were not apparent. The chief plants to which these two remarks apply are:—*Galium verum*, *Crepis capillaris*, *Sedum acre*, *Festuca ovina*, *Agrostis vulgaris*, *Holcus lanatus*, *Rumex acetosella* and others.

Ploughing also has an effect on the vegetation as the disturbed soil promotes the growth or incidence of a number of species; many of these flower and seed profusely in the second season.

Thus it will be seen that the immediate effect of afforestation on bird life is one of conferred benefit, for there is a marked increase both in the insect life and in the seed production of many small plants. But

available food supply is not the only factor which governs the increase or decrease ; an equally or in some cases more important factor is the density of the vegetation. Hence it is found that whilst such species as game birds, the stonechat and the whinchat and to a lesser extent the nightjar are increasing (as a result of the increased food supply) the lapwing, although an insect feeder, is decreasing. In fact this species is so sensitive to the density of its surroundings that it is rare to find it breeding in the second year after planting. A few, however, breed annually in the nurseries.

The stone curlew, too, is directly influenced by the density of the vegetation, but this species, in contrast to the lapwing, does definitely tend to adapt itself to the changing conditions. The species has been found nesting in Scots pine plantations of four years' standing and on rides and fire traces between plantations of seven and eight years, but with each additional year the frequency drops. These attempts at adaptation to abnormal conditions are interesting, for the natural habitat of the species is the barren open land. There was a case of a pair of stone curlews which were nesting on a piece of unplanted ground heavily infested with rabbits ; warreners were continually working on this area to clear the rabbits off, with the result that the stone curlew came to regard the open ground with suspicion and on the approach of danger the old bird would run straight to an adjoining belt of some 30 years of age and there wait until the danger was passed. It was to this belt that the young were taken when they hatched.

The stock dove and the wheatear are dependant on rabbit burrows for their nesting sites and therefore these birds tend to disappear as breeding species from afforested areas once the rabbits have been cleared off and their holes blocked up. It is almost certain that wheatears do occasionally nest in the crevices formed in newly ploughed fire traces, but no actual nest has come to notice yet. Skylarks and meadow pipits decrease as crop density increases; they are usually only present sporadically after the seventh or eighth years.

Whinchat, stonechat, common partridge, after the initial increase consequent on the clearing of the rabbits, decrease towards the fifth year and disappear as breeding species about the same time as the skylark and pipits. The French or red-legged partridge decreases as density increases, but the species still persists on the wide fire traces of the oldest plantations (P. 22). Pheasants, too, are still present, though in reduced numbers. The golden pheasant, an exotic species introduced some years ago and now established as a wild-breeding species over quite a large range, seems to be quite at home in these oldest plantations.

So far mention has only been made of species which, as a result of afforestation, have decreased. This decrease is set off by an influx of species not normally associated with Breckland. The first species to invade the newly formed plantation are those usually associated with the former broadleaved areas of the district. Of these the willow wren, chiffchaff and the wren are the first to appear, usually about the fourth year. Hedge-sparrow, robin, whitethroat are soon in evidence. From

the sixth year onwards blackbird, song thrush, chaffinch, goldcrest garden warbler, and nightingale occur ; these species do not appear in large numbers and the last two species are local. Willow wrens and chiffchaffs outnumber any of the other species ; their numbers seem to reach a maximum after the sixth to ninth years. It is interesting to note that this corresponds with the period during which aphid (*Lachnus pini*) attacks on Scots pine are also usually at a maximum, and willow wrens and chiffchaffs may be seen to be feeding almost exclusively on these insects.

After nine years mistle thrush and turtle dove begin to breed in the plantations. In the oldest plantations now fourteen years old, wood pigeon have already nested. Jays too have frequently been seen during the breeding season but no nest has as yet been found. In the case of these last four species, and indeed in many of the others, the primary factor for the frequency of occurrence seems to be suitability of nesting site.

There is no reason why this gradual influx of breeding species new to the area should not continue as the plantations grow up. It will not be long before the tawny and long-eared owls breed within the plantations ; it is even possible that this has already occurred. Taking a much longer viewpoint, it is possible that such fine species as the buzzard and even perhaps the honey buzzard may return to breed. The hobby too, at present a rare Norfolk breeding species, is likely to increase. The crossbill, a species now of fairly widespread occurrence throughout Norfolk, is certain to increase considerably as soon as the plantations get up to a cone-bearing age.

From the foregoing observations it is clear that although several species may be lost from the afforested areas, other species will without doubt be gained. It is unlikely that any species will even approach extinction, for there is sufficient ground available outside the planted areas to ensure the safety of all the present breeding species (It is worth noting here that the ringed plover still breeds in the nurseries) and it it is very probable that some species, not at present known as breeding species, will return to their one-time haunts. Thus in the long run, the fauna of Breckland will be increased and further opportunities for very interesting field observations will be available for all those who are sufficiently interested to study the sequence of changes now taking place.

The above notes are the outcome of but one season's observations in plantations of different ages and for this reason they are not as full as they might be after a somewhat longer period. An article entitled " Habitat Selection in Birds " by David Lack (Journal of Animal Ecology Vol. 2, No. 2) has been of great assistance in drawing conclusions in such a short time.

TRANSPORT BY MULES.

By H. C. Young.

The acquired land of Mynydd Ddu Forest consists of the one slope of a more or less straight range of mountain with elevation in the valley between 800 to 1,000 ft., rising to 2,000–2,300 ft., and the boundary on the west side is the mountain ridge. With no road leading to the top and a gradient varying from 1 in 10 to as steep as 1 in 2 the possibility of getting our fencing materials to the top boundary seemed at first a difficult proposition, until I was informed of the existence of a pack mule outfit which was then engaged in extracting pitwood out of an inaccessible wood in a valley about 15 miles away. After consultation with the owner he agreed to transport our materials out of the valley to the top site on a daywork basis of 6*s*. per mule with attendance, and while at first it appeared an expensive item, the cost compared favourably with horse and cart transport on flat ground over the corresponding distance. For a total chainage of 88 the cost this season was £15 6*s*. 0*d*.—*i.e.*, 3*s*. 6*d*. per chain or thereabouts—which included a portion of a temporary fence down the slope to the valley. It may be of interest here to state that the permanent fence consists of oak stakes and posts, 3 plain 8 gauge wire, 1 barb jumping wire and, because of the presence of ponies, a strong 16 gauge rabbit netting, while the temporary fence is of hardwood (birch, etc.) stakes and posts 1 plain, 1 barb, and 16 gauge netting.

The equipment of the mules consists of a saddle similar to an ordinary cart saddle, which is attached to the mule by two belts, one just behind the foreleg and one just in front of the hindleg, while the irons are blacksmith made in the shape of a modified letter W.

The irons are secured to the saddle while as nearly as possible the same weight is loaded on each side. The animals are generally worked in fours by one attendant and follow a leader which zigzags its way to the top. Loading of the mules is judged by gradient, but a normal load is 2 cwt.

The employment of the mule, although primitive, was our only means, and whereas the conditions here may not concern foresters generally, in Wales and Scotland the same conditions are likely to arise occasionally, and ponies, I understand, are as suitable as mules.

This means of transport has further definite advantages ; for example, the transport of materials over good meadow land does not interfere with the surface as does tushing or damage by cartwheels. I understand from the owner that he has transported thousands of tons of fencing materials, pitwood, coal, lime, etc., to and from otherwise inaccessible places, and he is quite willing to furnish particulars of his outfit and photographs are available.

FOREST PROTECTION IN 1601.

By G. H. Clark.

At a time when there is much discussion about soil erosion and the influence of afforestation on water supplies, it is interesting to find that the subject was dealt with in Italy in an illustrated document so early as 1601. I refer to a curious volume which has just reached the Forestry Commission's Library, entitled " Un Codice Veneziano."

In the foreword it is explained that a landowner named Paulini wrote the paper as an appeal " to the wise and foreseeing statesmen of Venice," and to show exactly what he meant he attached a series of coloured diagrammatic representations of afforested and denuded land. The original pictures are reproduced in facsimile in the book. As the text is in the Italian of the Middle Ages, translation is somewhat difficult, but a summary is given below. I understand that the book itself is obtainable on application to Headquarters.

Signor Paulini's project was based on the principle that extensive reafforestation carried out in the devastated mountain regions and other derelict areas would have the twofold effect of restoring the amenities of the countryside and preventing serious flooding, and the depositing of silt in the flat districts around Venice and Belluno.

Thus he states : " One must first consider the fundamental causes of the present derelict state of the land. Formerly, when mountains and valleys alike were covered with forests, flooding was comparatively rare, because the rain as it fell was to a great extent retained in the foliage, and snow instead of melting very rapidly was gradually absorbed by the soil. Cloud formation tended to concentrate in the valleys.

" Whereas now, since there is little vegetation to retain surplus water, and in consequence of the rapid melting of snow exposed to the sun, the mountain streams become torrential and flooding is common. One of the major causes of the denuded state of the mountain forest districts is the damage from fires which have occurred at frequent intervals during the past century.

" The derelict areas can be readily restored to their former state by extensive replanting ; but precautions must be taken to combat the risk of fire damage and possible trespass, by the general public. The suggestion is made, therefore, that watchers be employed—particularly during the months of October, November, March and April. Heavy penalties should be imposed for the careless lighting of fires in danger spots.

" Refuse which is at present allowed to accumulate in public highways should be deposited in ditches specially constructed for the purpose by the roadside, the contents subsequently being used for fertilizing agricultural land.

" Beneficial results would follow in a very short time, namely, the mountains once again covered with trees, cessation of floods and greatly increased areas of arable land."

Paulini, as a sign of good faith, offered to the Government his entire resources to support the scheme, but nevertheless the proposals were rejected as revolutionary and impracticable ; still the scheme was not drawn up in vain, for from this seed germinated, some 100 years afterwards, the general agricultural programme of the eighteenth century.

H.Q.

By N. W. Perry.

In view of the Commission's staff being so widely scattered throughout the country, it is not unlikely that many members have but a hazy idea of the office from which emanate so many trying and seemingly unnecessary instructions.

If your imagination has pictured a palatial mansion reached by a stately avenue with liveried attendants in green at the door waiting to show you to rooms richly panelled and with exquisitely carved furniture, you are mistaken. The West End—that magical place in London, centre of luxury, expensive shops, mysterious night clubs, scene of plays, films and novels—this is the home of British Forestry.

If you are fortunate enough to locate Savile Row, you should have little difficulty in arriving at Number 9. But it is here that your troubles will begin. Faced with an array of tailors' signs it is only the very brave who dare to enter the hall to enquire for the apparently impossible, *i.e.* whether a Government Department can be found within. However, the brave have their reward, for usually, but by no means invariably, the lift is working, and sooner or later, he who has risked all is transported to that hive of industry, the Forestry Commission Headquarters.

In years to come, a guide-book may give full details of this office, but since this is as yet unwritten I must anticipate the event by endeavouring to forecast the contents of that book. Starting from the "*Messengers*" or "*Enquiries*" room, which is the officially recognised "arrival" and "departure" point, we have among others :—

The Waiting Room.—Typical of its kind and without a fire. (In fact all the rooms are heated by unresponsive radiators.)

The Registry.—Here are housed the full records, good and bad, of the Commission's work. Thousands of files dealing with hundreds of different subjects are stacked in a small space and any one can be produced in a few seconds—more or less. The one cry in this section is "room, room and still more room" as the Commission's activities increase.

The Stores Department.—Merely a corner of a room is given over to this branch but the tools which issue therefrom are used in the furthermost parts of the Commission's fields.

On this floor there are also :—

The Secretary's Room.—Reminiscent of a headmaster's study.

The Board Room.—This is the only part of the building really worthy of being called Forestry Commission property. The largest room of the offices, it is furnished almost entirely with British oak. It contains a fine oak table (12 ft. × 4 ft. 6 in.), around which the Commissioners meet, and others of smaller size, one serving as a writing table for the Chairman. There are sixteen oak chairs upholstered in brown hide, and a comparatively recent acquisition is a large glass show case in which are exhibited

antique articles of interest found on the Commission's estates. The parquetry floor of the room is of oak from the Forest of Dean.

The floor above contains that mystical place :—

The Finance Branch.—None of us can do without this section. Detailed examination reveals the smallest errors in the accounts submitted. Complicated juggling with figures results in our receiving smaller salaries than we consider we deserve.

At the other end of the corridor so hidden away as to be almost overlooked are :—

The Research Branch.—Even this is somewhat of a disappointment, lacking as it does that array of tubes and cases marked " dangerous," usually associated with the idea of " research."

The Editorial—of this Journal and of all the Forestry Commission publications. This tiny branch receives, moulds and distributes the entire literature of the Department.

The Library—is also to be found here ; it consists of nearly a thousand bound volumes and innumerable periodicals and publications from almost every country in the world. As a side-line the Publications Section catalogues and manages this not inconsiderable collection.

Last but by no means least on this floor is :—

The Typing Branch.—Fresh flowers and other signs of feminine occupation reveal that here is a sanctum in which the men do not hold sway.

Through all these rooms, at intervals, stalk the messengers. When one of them has finished his round he returns to the little room from which our tour commenced and now ends.

Way out straight down the stairs, please !

PLANTING OF SCREE.

By W. T. SMITH.

In the 1934 number of this Journal an article was published describing the planting of scree areas in Ennerdale Forest in the spring of 1933. The notes were made after one season's growth, and it was remarked that the real test of the work done would become apparent in the following two or three years.

For the benefit of readers who may not have the Journal referred to or may be unacquainted with scree, I would say that scree is an accumulation of rubble, stones and boulders which, in the course of centuries, have broken away from the craggy hilltops and rolled down the slopes, finally coming to rest in irregular, widespread heaps in the valley below.

Ennerdale scree is composed of igneous rocks, therefore there is practically no disintegration, and the subsequent lack of soil renders ordinary methods of planting impossible. The areas have an elevation of 700 ft., with a southern aspect, and are exposed to east and west winds.

The method employed, was that of planting each tree in a cardboard pot, and placing these in likely crevices in the scree.

The plants used were 3-year S.S. seedlings, and three types of pots were utilised, *viz.*, Plot A, waxed milk containers; Plot B, unwaxed milk containers (both these were of pint size and were tapered in shape); Plot C, home-made cylindrical bottomless containers of stout cardboard (larger than those used in Plots A and B). The soil used in the pots was obtained near the site of the experiment and was rather poor in quality. Plots A and B consisted of 500 plants each, and Plot C 120 plants.

Annual assessments made are tabulated below :—

Plot.	No. of Plants.	December, 1933.				Average Death Per cent. of all three Plots.
		Death Per-centage.	Height Growth (inches).			
			Maximum.	Minimum.	Average.	
A	500	5·5	3·4	0·75	1·8	7·9
B	500	6·5	3·0	0·5	1·6	
C	120	24·0	2·5	0·5	1·9	

Plot.	No. of Plants.	August, 1934.				Average Death Per cent. of all three Plots.
		Death Per-centage.	Height Growth (inches).			
			Maximum.	Minimum.	Average.	
A	500	18·0	4·0	0·2	0·5	16·6
B	500	10·0	3·0	0·2	0·4	
C	120	39·0	7·0	0·2	1·5	

Plot.	No. of Plants.	August, 1935.				Average Death Per cent. of all three Plots.
		Death Per-centage.	Height Growth (inches).			
			Maximum.	Minimum.	Average.	
A	500	18·0	8·2	0·1	0·75	19·0
B	500	12·9	4·1	0·1	0·4	
C	120	49·0	7·5	0·4	2·5	

From the above figures it will be observed that the average height growth dropped in the second year, but has increased again in the third year, while the average death percentage has only slightly increased in the third year.

This experiment suffered from the severe drought of the first summer after planting, and there were also some very dry periods in the second summer, so no doubt these are largely responsible for the much higher death percentage in Plot C, as by the pots being bottomless they would not retain any rain-water which fell previous to the dry spells ; surviving plants, however, are very good in this plot. There is no noticeable difference now between the waxed and unwaxed milk pots, so the variations in Plots A and B are mainly due to exposure.

Plants which are in sheltered situations—*e.g.*, those deep down in the scree—are very healthy and their establishment appears to be certain, but those on exposed sites are paler in colour, with poorer growth and shorter needles ; it is also on such sites where the deaths have mainly occurred, and generally in pots which have some of the exterior uncovered, and therefore more exposed to drought ; the drier atmosphere of such a situation also greatly retards the decomposition of the pots, with the result that the roots get pot-bound. The most healthy plants are mainly to be found in pots which are well covered over with moss, etc., the roots of such plants have broken through the walls of the pots and extended into the surrounding scree. One instance was found where the pot remained intact, but some of the roots have grown out over the edge of it and got hold in the scanty nearby turf; such a thing could not have happened in this case if the pot had not been covered over with moss. Moss grows in abundance amongst the scree, so there is a convenient supply ; all pots have now been covered and an improvement on the exposed patches is expected.

The packing around the sides and over the pots serves three very useful purposes :—

(1) It affords protection against drought.
(2) By retaining the moisture it accelerates the disintegration of the pots and liberates the roots.
(3) It bridges the gap between the pot and the surrounding scree, and also keeps the lower crevices dark, which encourages the growth and development of roots.

The development of this experiment after three seasons' growth gives us good reason to believe that certain types of scree which could not be planted by ordinary methods can be afforested by the use of pots. Considering that these plants suffered droughty summers in the first two years, it is surprising that the average death percentage is so low, and on the whole results are very encouraging. Further experiments of this nature are to be carried out this season (P. 36), when the pots will be put as deep as possible into the scree, and I hope to use molinia for some packing. It will be interesting to note the effects upon the plants from different types of covering.

SEASON OF PEELING CONIFER POLES.

An investigation carried out in 1934 on the relation of the season of the year to the ease of ringing coppice (report issued as Research Circular No. 1) was extended in 1935 to conifer poles to be barked for pitprops.

The investigation was carried out in the Forest of Dean under the direct supervision of the Head Forester, Mr. F. Smith, by Messrs. J. Adams and G. Taylor in the East and Centre Beats respectively. Two objects were kept in view : firstly, there was the question whether it was substantially quicker to cut and peel pitprops in the spring and early summer when the sap was running ; and, secondly, if poles were cut in the winter and left lying on the ground, would the sap start to run in the spring and the bark then be more easily removed. The following report on the investigation was prepared by Mr. D. M. D. Davies, Research Foreman in the Forest of Dean, who summarised the data collected.

The investigation was divided into two sections :—

(*a*) Spring peeling of winter-felled poles.

(*b*) Season of easy peeling when poles are peeled directly after felling.

For method (*a*) the poles were felled from the beginning of January to the end of February. Before peeling, the poles were cut into the required lengths of props—that is 3 ft., 5 ft. and 6 ft. In the case of those felled in winter, after cutting they were laid on the ground in the damp grass, etc. The tool used was a specially constructed peeling spade.

It was found that in all species handled—namely, Norway spruce, Scots pine, Corsican pine, Douglas fir, European larch and Japanese larch—the bark could be removed with the peeling spade irrespective of whether peeling was easy or hard. If the sap was not running particularly well, the spade would cut it off just as well as it would lift it off when the sap was running freely. Therefore, differences in time taken to peel a given length of pole on any particular day were due more to the pole being rather rough and knotty than to any difference in the ease of peeling due to the sap running or not running. Thus, for the production of peeled pitprops the peeling spade has proved that it is effective irrespective of whether the props were felled in the winter and left to lie on the ground and peeled in the following spring, or peeled immediately after felling either in the winter or spring. This, of course, does not apply to the production of peeled telegraph poles, as in this case it is necessary to remove all the bark and not leave small strands of the inner bark as the spade did in this experiment.

When the summarised data were examined, it was found that there was no relation between the time taken and the weather conditions or season of the year for any of the species. For example, it took 50 mins. to peel 100 ft. of props of Norway spruce on 5th March. It also took 50 mins. to peel 100 ft. of N.S. on 3rd June, when the weather was certainly warmer than in March. Neither is there any uniform difference in time

for the two treatments. I have summarised the data in order that a comparison of the ease of peeling of the various species may be obtained.

Time taken to peel 100 ft. of props of each species :—

Species.	(*a*) *Winter felled, spring peeled.*	(*b*) *Felled at time of peeling.*
N.S.	57·0 mins.	61·8 mins.
S.P.	63·1 ,,	69·9 ,,
C.P.	56·0 ,,	65·8 ,,
D.F.	56·7 ,,	47·9 ,,
E.L.	58.5 ,,	51·8 ,,
J.L.	45·1 ,,	43·5 ,,

It is curious that in N.S., S.P. and C.P. the props felled and peeled immediately should have taken longer to peel than those felled in winter and peeled in the spring, but it seems probable that the deciding factor was not the ease of peeling due to a good run of sap, but rather the good, clean growth or otherwise of the pole.

Below are given the phenological observations required by the working plan and collected by Mr. Smith :—

Whitethorn ..	Buds showing green 18.3.35 ..	About to flush	8.4.35
Blackthorn ..	Buds showing green 18.3.35 ..	In flower	27.3.35
Primrose ..	.. ..	In flower	15.1.35
Scilla	Showing above ground 17.1.35 ..	Flower buds developed	1.4.35
	Some in flower, but not general ..	.. .. ..	8.4.35
Ash trees	Under observation showing flower buds. These never developed owing to frost.	.. .. ..	13.5.35
Wood anemone	.. ..	In flower	27.3.35
E. Larch ..	Buds showing green 27.3.35. Not visible from the ground before. Needles on short shoots fully developed 4.4.35.		
Birch	Buds showing green 27.3.35.	Leaves expanded	4.4.35

One or two additional remarks to this summary may be of interest. In the first place there was no evidence of sap running in the winter-felled poles left lying on the ground until the spring. This may be due to the short lengths into which the poles were cut and the consequent drying out of the cambium. On the other hand, in the light of Professor Priestley's work it would appear impossible for the cambium to become active in felled poles which are devoid of any living branches or buds, because cambial activity appears always to initiate in a living bud. It is conceivable that in the case of large poles dormant buds, developing after the pole had been felled and trimmed out, might start the cambium into activity.

Secondly, although the experiment as a whole must be classed among those giving a negative result, this result is none the less of considerable practical interest. The fact that it is not appreciably cheaper to peel pitprops when the sap is running means that the work can be spread over the whole year instead of having to be concentrated in one short period. The great importance of clean trimming is also shown.

W. H. G.

FOREST APPRENTICES' SCHOOLS: REVISED SYLLABUS.

First Year's Course.

Botany.

General morphology. Characters of root, stem, leaf, flower, fruit and seed.

Physiology. Nutrition, growth and reproduction.

Botanical features and identification of British forest trees.

Geology and Soil.

Principal geological formations.

Soils: their composition and how they are formed.

Silviculture.

Tree-growth in relation to climate and soil. Growth in height, diameter and volume.

Duration of life. Reproductive power.

Character and composition of woods. Pure woods and mixed woods. Formation and regeneration of woods.

Silvicultural characteristics of the more important species.

Choice of species.

Preparatory work. (1) Preparation of ground. (2) Fencing. (3) Draining.

Formation of plantations. (1) Direct sowing. (2) Planting. (3) Beating-up. (4) Weeding. (5) Natural regeneration.

Making of a nursery and its management. Selection of site. Size and lay-out. Draining and fencing. Cultivation and manuring. Weeding.

Seed collection and sowing. Production of seedlings and transplants.

Protection.

Description and life-history of the more destructive insects. Classification based on structure with notes on principal orders.

Mensuration.

Elementary mensuration. Measurement of felled trees.

Surveying.

Use of the commoner surveying instruments. Calculation of areas. Plan drawing and map work.

Management and Accounts.

Forestry Commission costing and accounts system.

Second Year's Course.

Botany.

Classification of plants.

Plant associations.

The commoner timbers: their structure and identification.

Silviculture.

Silvicultural characteristics of the more important species (continued).

Principal silvicultural systems : high forest, coppice, coppice with standards.

Tending of woods : cleaning, thinning and pruning.

Protection.

Description and life-history of the more destructive insects (continued).

Protection of nurseries and plantations against fire, frost, drought, snow, wind, weeds, birds, rodents, deer, squirrels, etc.

Description of the more destructive fungal diseases.

Mensuration.

Form factors. Increment. Yield tables. Valuation of woods.

Measurement of standing trees and whole woods.

Surveying.

Calculation of areas (continued).

Management and Accounts.

Forestry Commission costing and accounts system (continued).

Keeping of nursery and plantation records.

Description, preparation and use of working plans.

Utilisation.

Felling, conversion and marketing of timber.

Seasoning and preservation.

Estate Work.

Elements of building construction.

Road-making and bridge-building.

Meteorology.

Atmosphere : composition and physical properties.

Temperature and pressure.

Weather and climate.

Practical Work During the Two Years' Course.

Nursery work. Sowing. Planting. Weeding. Beating-up. Fencing. Hedging. Draining. Pruning. Thinning. Measurement of timber and standing woods. Felling. Extraction of timber. Rough carpentry.

Miscellaneous Work.

Trainees are employed in turn in the Divisional Office to become acquainted with the accounting methods and they are required to make collections of botanical and entomological specimens.

Arrangements are made for the students to act in rotation as foremen in charge of the Schools' working gangs.

COMMISSION'S LIBRARY: NEW BOOKS AND JOURNALS.

The following books were acquired during the past year :—

" Investigation of the Significance of Tree Mycorrhiza " (pp. 173), E. Melin.
" Treatise on Forest Trees," 1775 (pp. 259), W. Boutcher.
" The Trees and Shrubs of Britain," 1838 (8 Vols.), J. C. Loudon.
" The Planter's Guide," 2nd Edn., 1828 (pp. 527), H. Steuart.
" The Practice of Silviculture," 3rd Edn. (pp. 355), R. C. Hawley.
" The Theory and Practice of Silviculture " (pp. 495), F. S. Baker.
" Lord Lovat, A Biography," Sir Francis Lindley.
" The Land " (pp. 336), R. G. Stapledon.
" A Text-book on Forest Management " (pp. 156), M. R. K. Jerram.
" Proceedings of Fifth Pacific Science Congress, Canada, 1933." Vol. 5 (pp. 878).
" Un Codice Veneziano del 1600."

Below is given a list of periodicals taken regularly :—

" Forestry " (S.F.G.B.).
" Quarterly Journal of Forestry " (R.E.F.S.).
" Scottish Forestry Journal " (R.S.F.S.).
" Nature."
" Journal of Animal Ecology."
" Journal of the Central Landowners' Association."
" Journal of the Land Agents' Society."
" Review of Applied Entomology."
" Countryman."
" The Tree Lover."
" Timber Trades Journal."
" Wood."
" Empire Forestry Journal."
" Illustrated Canadian Forest and Outdoors."
" Indian Forester."
" American Forests."
" Journal of Forestry " (U.S.A.).
" Experiment Station Record " (U.S.A.).
" Biological Abstracts."
" Kew Bulletin of Miscellaneous Information."
" International Review of Agriculture."
" Der Deutsche Forstwirt."
" Forstliche Wochenschrift Silva."
" Zeitschrift für Forst und Jagdwesen."
" Zeitschrift für Weltforstwirtschaft."
" Tharandter Forstliches Jahrbuch."
" Allgemeine Forst und Jagd Zeitung."
" Forstwissenschaftliches Centralblatt."
" Forstliche Rundschau."
" Centralblatt für das gesamte Forstwesen."
" Schweizerische Zeitschrift für Forstwesen."
" Revue des Eaux et Forêts."
" L'Alpe."

SWIFT MOTHS.

By S. E. PHELPS.

My reason for writing on swift moths is that I feel it is a somewhat neglected subject. From my own experience I can say they are as formidable as many of the pests foresters have to deal with. There are two species of importance, namely, ghost swift (*Hepialus humuli*) and the common swift (*H. lupulinus*). In 1931 a small part of a P. 30 plantation of European larch and beech was attacked by the larvae of *H. humuli*, but this was not serious. In December, 1934, however, both *H. humuli* and *H. lupulinus* were found in large numbers in the nursery. Beech and ash suffered most. In seedbeds sown broadcast the seedlings could be brushed flat with a stick where they had been eaten off just below ground level and whole beds were completely destroyed. The total loss amounted to approximately 300,000 seedlings. As the season of attack is autumn and winter, when the plants are leafless, the damage is not readily observed unless some of the plants are pulled up, when it is seen that the seedlings have been eaten right through just below the ground. Larger plants have perpendicular tunnels bored through them extending to about an inch above ground level.

As for the life-history of *H. humuli* and *H. lupulinus*, their general appearance and habits are similar.

H. humuli has a wing-spread of 1½ to 2½ in., the male being a silvery white colour and the female buff colour.

H. lupulinus is smaller, being about 1 in. across the wings, and the colour is yellowish brown with white markings. The colouring is less distinct in the female.

Both *H. humuli* and *H. lupulinus* are on the wing in June and July when eggs are laid on grass or other vegetation. The caterpillars hatch in about a fortnight and immediately commence feeding on the young roots. The larvae of *H. humuli* when fully grown are from 1½ to 2 in. long and about ¼ in. thick, almost white in colour with a reddish brown head and two rows of black spots down the back. They have six pairs of short legs. The only difference in the larvae of the two species is that those of *H. lupulinus* are slightly smaller.

In April or May the caterpillars pupate, the pupae having a number of small spines which are used to help them to get to the surface of the soil when it is time for the moth to emerge. As an experiment I kept a dozen larvae in jars, feeding them on young roots ; of the nine which lived to develop into moths, eight turned out to be *H. lupulinus* and one *H. humuli*.

As to control measures, the larvae are, of course, readily eaten by insectivorous birds and are attacked by certain parasitic fungi ; digging the ground as often as possible would appear to be advisable and it is better to avoid, if possible, leaving plants standing in lines for two or more years where the larvae are numerous.

I tried vaporite, under my Divisional Officer's instructions, as a dressing; this was ploughed and dug in, at the rate of 2 oz. to the square yard. It killed a few, but was not really effective. I also tried naphthaline at the same rate on another plot and this was more successful, as all the larvae afterwards dug up were dead and in some cases discoloured. Treating ground already stocked with trees was next tried to see if the chemicals had any effect on the plants; both vaporite and naphthaline were worked into the soil between the rows with the Planet Junior hand cultivator in the same quantity as before with no ill-effects on the plants. This exhausts the knowledge I have acquired by personal experience up to the present, but the subject is obviously one worthy of the closest attention.

PITPROPS.

By D. W. YOUNG.

Thinning is already in progress in some of the Commission's early plantations, and year by year the area will increase on an ever-steepening curve. The possibility of our being able to dispose of the produce from thinnings has been a matter of speculation for some time past. It is going to make a great difference to the cost of plantations if markets to absorb all of it can be found.

So far no new forms of utilisation have cropped up which hold out a prospect of absorbing large quantities. Wood wool manufacture is a form of utilisation which is worth more attention than it has received so far. In the main it appears probable that the old forms of utilisation will still have to be our stand-by. The three most important outlets are :—

1. Poles for rustic work. (Practically confined to larch.)
2. Pitwood.
3. Pitprops.

Of the first two, nearly everyone has had experience and little need be said. Rustic poles, provided they are of good quality and appearance, seem to have an inexhaustible market. The very big margin between current prices in the wood and retail prices seems to leave room for a considerable expenditure on freight.

The use of random pitwood is confined to certain very important districts. The price at 27*s.* to 30*s.* is fairly low, but allowing 3*s.* a ton for felling and cutting and 5*s.* or 6*s.* for haulage to rail, one still has 18*s.* to 21*s.* to cover freight and profit. Within a radius of 70 to 100 miles, the freight being 10*s.* to 15*s.*, it is probably as good an outlet as we can expect. More particularly as sent in green some 26 cu. ft. go to the ton.

A large number of mines use only pitprops, which are sold not by the ton but by lineal feet measure. Pitprops are peeled and cut to lengths and subjected to six months' seasoning, so that instead of 26 cu. ft., 36 cu. ft. to 46 cu. ft. go to make the ton. This, obviously, provided the price is proportional and allows for manufacturing costs, will permit of a freight 50 per cent. to 70 per cent. greater. Reference to the recent report on mining timber will disclose wide differences in prices. Examples are given in the following table, together with the approximate number of running feet of properly seasoned props which go to the ton.

Top Diameter.	Running feet per ton.	Prices per 100 ft. run.	Same prices per ton.
3½	670	3*s.* 6*d.*– 7*s.* 6*d.*	22*s.* 6*d.*–50*s.* 3*d.*
4	525	4*s.* 6*d.*–10*s.* 0*d.*	23*s.* 6*d.*–45*s.* 0*d.*
4½	425	5*s.* 9*d.*–12*s.* 3*d.*	24*s.* 6*d.*–52*s.* 0*d.*
5	350	7*s.* 0*d.*–15*s.* 6*d.*	24*s.* 6*d.*–54*s.* 3*d.*
5½	300	8*s.* 0*d.*–18*s.* 6*d.*	24*s.* 0*d.*–55*s.* 4*d.*
6	255	8*s.* 6*d.*–20*s.* 0*d.*	21*s.* 6*d.*–51*s.* 0*d.*

The lowest prices quoted do not offer much attraction. Even with a railway freight of only 10*s.* one is left with 13*s.* 6*d.* to cover cost of manufacture (which alone exceeds 10*s.*), carting, and the intrinsic value of the wood. The highest prices, on the other hand, even for the smallest categories, after paying a freight of 10*s.*, leave 40*s.* for manufacture, carting and material, and would still be worth getting if the freight were twice as heavy. For the higher categories they would be still more profitable.

Home-grown pitprops have never been used in this country to any great extent. There has always been a prejudice against them which is hard to explain, because it apparently did not extend to pitwood. It was to get over this prejudice that the Chairman arranged that certain of the Commission's areas should supply certain collieries with props without too much regard to price. As a result of this arrangement the New Forest has been supplying some of the Kentish collieries with props for the past two years. These pits are deep and the "crush" is particularly severe, and the managers when they agreed to make the first trial were very doubtful starters. The prices were keen and returns proportionally small, but during the space of the two years we have sent away something approaching a million running feet without a single complaint as regards quality or manufacture. This prolonged test of home-grown props alongside imported under very stringent conditions of "crush" should effectively lay prejudices to rest.

It is fair to say that what we have supplied has been almost exclusively Scots pine, and the majority of it has come from woods older than we shall have in the Commission's own plantations for some years to come. For several months, however, we supplied the smaller categories from a wood under 30 years, and there were no complaints.

A smaller experiment in the Forest of Dean with Douglas fir a few years ago led a manager to say that he was prepared to take all his pitprops in Douglas fir if we had the quantities to offer. With possible reservations with regard to very young Corsican pine and Sitka spruce, I do not think we need have any misgivings about our home-grown props standing the test, provided they are adequately, but not over, seasoned.

Cost and efficiency of manufacture are obviously all important, and it is thought a few notes on our own experience may be helpful.

Though we have been working at it for two years, it cannot be said that we have reached finality as regards tools or method. At the outset the thing seemed hopeless. Men, apparently working hard, managed with difficulty to cut and peel 200 running feet per day. This is worth mentioning as others may have the same experience, though as a rule the branches on the trees in some of our open-grown stands are coarser than the general run of the Commission's more densely planted and younger plantations. By perseverance this stage was passed, and the men found the way to an outturn which was at least possible. Unfortunately, one cannot point to any tool or method and say therein we found the solution of our problem. A variety of tools

and methods was tried, and practically all in some modification or another are being used by one or other of the gangs working for us. Each gang found they were getting better outturn from one method or another and stuck to it. Actually there is far more difference, so far as outturn is concerned, between individual groups than between the methods they use. It is rather difficult to hand on experience of this kind in writing. All that will be attempted is a brief description of the more important tools and methods used.

The first question was one of organisation. Whether it was better to bring the material to a common dump and have it manufactured there, or to let the men work it up *in situ*. The dump method has everything in its favour where :—

1. The haul to railhead is long and better done by motor, the dump being near a hard road.
2. The material can be taken from where it lies in the wood straight to the dump in one haul.
3. Other produce than pitprops is to be cut from the material.
4. The dump is overlooked or otherwise protected against pilfering.

In thinning young plantations produce will have to be man-handled to the ride in any case. In these circumstances if the distance from railhead is an economic one for horse haulage, or, alternatively, if the rides are good enough to take motor lorries, it is probably better to manufacture on the rides. It is all a question of handling. Loading of props is a long and tedious business, and double handling should be avoided if at all possible.

Some shelter at the dump, or wherever the props are stacked, is desirable as in full sun they tend to check badly. On the other hand, props stacked in fairly open conditions are much brighter and more attractive than those stacked under trees, which become very black and may appear unsound to a buyer. Good thick skids should be used for the stacking so as to lift the props out of the vegetation and open stacking should be used. A good arrangement is 10 props barely touching, overlaid with two or three props laid crossways, and then 10 more props, and so on up to a standard number to facilitate stocktaking. Stacks should not be too high or they will be difficult to load from.

The peeling operation includes cross-cutting and stacking.

While many peeling and trimming tools were tried, those in use at present boil themselves down to three—the draw knife, the sharpened spade and the axe. Practically all gangs use the draw knife at one stage or another. Some use it entirely. Experienced axe men freely resort to the axe for trimming, but the draw knife is the most generally used tool. Care should be taken that this is not of too highly tempered metal. A tough metal is preferable, even if it has to be sharpened more often. The knife slips rapidly over the internodes on to the knots, and a tough knot will easily take a chunk out of a highly tempered tool and ruin it.

Some gangs rough peel with the sharpened spade in the full length, cross-cut and then trim with the draw knife. It is only in the full length that the spade is effective; short lengths tend to slip about. In good

hands it can be a very effective tool not only for peeling, but for trimming knots too. It should be a well-worn spade. A new spade with full-length blade tends to spring back from the work.

Experiments were made at first with peeling and trimming logs right through before cross-cutting, but, apart from the rough peeling, this is seldom done now, though some gangs close-trim the knots with the axe or spade before cross-cutting. This is an important part of the work as a lot of time can be lost in trimming knots with the draw knife. It is a good plan to let the gangs fell and knot the trees they have to peel. They thus have every inducement to do the knotting properly. Apart from knots, a skilled hand will make a bent log look quite presentable. An occasional casting out of dogs' hind legs from the piles will prevent this being carried too far. We have had some wonderful trophies in this office from early cullings, admirable examples of Queen Anne table legs. They owed their origin not so much to an aesthetic revolt against straight lines as to an attempt to make too much out of a log. By trying to get two 4½'s and one 3 an impossible bend was included in the second 4½, and its top diameter was on the light side. If instead one 4½, one 3½ and one 3 had been cut a portion would have been wasted and an extra cross-cut involved, but there would have been three perfectly good props. This is one of the things the men learn.

The trimming is more important than the actual peeling, though it need not be carried to the nicety of Post Office stayprops and telephone poles. In the peeling there is no objection to leaving under-bark. The bulk of it in any case either peels off in the stack or gets knocked off in transport.

There is almost as wide a difference in the method of using the draw knife by different gangs as in any other operation incidental to the preparation of props. In the early efforts we devised an elaborate dog for holding the props while peeling. It was a Heath Robinson affair with a bit of an old cross-cut saw as the upper jaw. A counter weight and pedal also entered into it. It was a wonderful contraption, perfectly sound in conception, but was abandoned for simpler woodmen's devices. Some use the parallel bars which hold the prop so long as the pressure of the knife is on it. Others use a kind of tripod—two poles set across one another with another behind to support them. The cross pieces lean away from the man, so that the more the prop which is rested on the top V is pulled, the tighter it jambs in the fork. The prop is easily lifted and turned and the men have not only both hands free, but they work at a convenient height, doing first one end of the prop and then the other.

A large proportion of the men dispense with any dog at all. They stand the prop on end, resting the other end against their body. Leaning over, they work the knife towards them, turning the prop as they work, and changing ends as soon as one end is complete. Though the work with the dog is the more business-like operation, I have noticed no difference in the outturn. It is to be hoped that sooner or later some mechanical apparatus can be devised to do the work.

Where the material is brought to a dump it should be possible to use an oil-driven cross-cut saw with advantage. Actually, we have not had dumps large enough. Haulage is a considerable item and the material is hauled by the shortest route to a hard road. For this operation some use the double-handed cross-cut, which certainly seems wasteful. Some use a single-handed cross-cut, but the majority use small hand saws. It made one shiver to hear some of them chattering through the logs, and a test was made with bow saws. These are used for all sorts of cross-cutting in parts of this country and over large areas on the Continent. They should offer less friction in the resinous wood, but they never took on with our men.

While it would be absurd to attempt to arrive at a standard method for all types of produce and all conditions, one feels that the present catch-as-catch-can solution of our problems is not altogether satisfactory. All that can be said of them is that they have brought the business into the sphere of practical politics. The men earn a moderate wage and the costs are possible at 1s. 8d. per 100 ft. run. This is itself a compromise. The hundred feet run is better than the cubic foot or ton, but it would be more correct to have a separate rate for each size of prop. In the smallest props there are some 15 sq. ft. of bark to be peeled per cubic foot, while with the larger props it is less than 10. There are other factors which enter into it. The 3-ft. props require twice as many cross-cuts as the 6-fts., though the area of sawing is little more than half as great. The light 3-fts. can be thrown across to their pile, while the 6-fts. have to be laboriously carried. On the whole, the 4-fts. are probably the easiest to prepare. A 6-ft. prop becomes a bigger undertaking, but probably a flat rate for all props from 3 to 5½ ft. is as fair an arrangement as can be devised, but it means that you must treat your order for props as a whole and not look too closely into the costs of individual sizes. As a rule the 4-fts. and 4½-fts. will enter more largely into the order.

THE CADNAM OAK.

By D. W. Young.

This famous old oak is situated at Cadnam in the New Forest. It is nothing much to look at, only half the stem survives. That half supports a fairly healthy crown which by its weight causes some anxiety owing to its proximity to a cottage. It owes its fame to a curious habit of developing a large proportion of its buds and flushing a number of its leaves round about Christmas time. This was supposed to give indications of the kind of weather which was to ensue in the coming year.

Until this Christmas I had never seen the tree and must confess regarded the matter purely as a superstitious legend. A new road is to be driven through the Forest at this point and some anxiety was expressed as to whether the tree would have to come down with others to make way for the road. Not knowing the exact position of the tree, I wrote to a friend interested in these things. He responded by leaving some twigs at my house two days before Christmas. Each of these twigs carried a few green leaves and a number of buds on the point of breaking. The green leaves were somewhat shrivelled by frost, but there was no question that they were newly-flushed leaves and not merely survivors from the summer, and about one in eight of the buds was just on the point of bursting. I visited the tree myself on 14th January and though the newly-flushed leaves were more shrivelled by frost there were a number of shoots an inch to an inch and half long, green-barked and obviously the growth of the last three weeks.

William Gilpin, writing in his "Forest Scenery" in 1791, says of the tree :—

> "Having had the account of its early budding confirmed on the spot, I engaged one Michael Lawrence, who kept the White Hart, a small alehouse in the neighbourhood, to send me some of the leaves to Vicars Hill, as soon as they should appear. The man, who had not the least doubt about the matter, kept his word, and sent me several twigs, on the morning of the 5th January, 1782, a few hours after they had been gathered. The leaves were fairly expanded and about an inch in length. From some of the buds two leaves had unsheathed themselves, but in general only one.
>
> "Through what power in Nature this strange premature vegetation is occasioned, I believe no naturalist can explain. I sent some of the leaves to one of the ablest botanists we have, Mr. Lightfoot, author of the 'Flora Scotica,' and was in hopes of hearing something satisfactory on the subject. But he is one of those philosophers who is not ashamed of ignorance where attempts at knowledge are mere conjecture. He assured me that he neither could account for it in any way nor did he know of any other instance of premature vegetation except the Glastonbury Thorn.

"The philosophers of the forest, in the meantime, account for the thing at once, through the influence of old Christmas Day, universally believing that the oak buds on that day, and that day only."

Where angels of this Mr. Lightfoot's stature fear to tread fools should be chary to rush in, but one is sorely tempted to speculate over such an interesting phenomenon. There are a number of tree-like species which show a tendency in a mild autumn to develop their buds before Christmas. The apple, hazel, privet and prunus species are cases in point. If the season is very mild the honeysuckle, thorns and other species will even flush a few leaves. This development is, of course, the response to external stimuli provided by the mild conditions. That a tree should flush leaves in the coldest back-end experienced for 30 or 40 years is a rather different matter. It suggests to me an atavistic tendency. How far it is true in tropical climes I do not know, but the life of the trees indigenous to our temperate zones seems to follow a definite rhythm, starting in the spring root development and followed by shoot growth. A further period of root development at midsummer precedes the Lammas shoots. Then follows another period of active root growth. Between that and the root development in the early spring no shoot growth normally intervenes. This miss of a beat in the ordinary rhythm no doubt protects our trees from the severity of winter. Perhaps in the prototype the rhythm was complete and the Cadnam Oak is an example of throw-back, but it is very inconsiderate of it to show such wanton disregard of the decent rules of the game mechanistically minded botanists have provided for it.

The tree appears to be over 200 years old and its days are numbered. We have collected some of its acorns and hope that some of its progeny will develop the same uncanny habits.

NEW FOREST CALLERS.

By G. L. Cole.

In a former Crown Woods Division there are naturally some incidents outside the zone of forestal operations which are possibly unfamiliar to those serving in one of the Divisions formed since the Forestry Commission was created, so perhaps a few reminiscences may be of interest to readers of the Journal.

My first relates to the ancient "Rights of Common." During the past year a gentleman who had recently acquired property possessing "Forest Rights" (to use his own expression) called to ascertain exactly what these Rights were. To deal with such an enquiry and in order to trace the property in the Register of Decisions of Forest Rights, published in 1848 under the Act of 17th and 18th Victoria, Chapter 48, it is necessary to know in the first instance (1) the name of the owner in 1858, and (2) the Tithe map number of the property under consideration. Unfortunately, the enquirer could not supply this information, but produced a tracing from the 25 in. O.S. showing the property. With this and by reference to the Tithe map of the Parish it was possible to track down the claim, which proved to be that of "Common of Pasture." The enquirer was obviously disappointed; he had been given to understand the property carried "valuable Forest Rights"—a familiar phrase used in connection with the disposal of property (known to possess such rights) in the New Forest area. He said that he had not, nor did he intend to acquire cattle in order to exercise the right, and wondered whether the Forestry Commissioners would substitute a fuelwood right—say, 6 cords of wood yearly—in lieu of the prescribed right to depasture cattle! Needless to say, he is still "wondering"; the proposal was not entertained!

Following a prosecution (and conviction) for day poaching, a brother of the defendant called at the Divisional Office to collect the gun which had been taken from the culprit by the keeper at the time of the offence and which the Magistrates had ordered to be confiscated. The weapon, of the pre-historic type, had been placed in the local armoury with other "exhibits" of a similar type, and the caller pleaded for the restoration of the gun on the grounds that it really belonged to his father and had been a family heirloom for generations! Needless to say the request was not gratified as the keeper who seized the weapon had been angling after it for a long time.

The gypsy fraternity is, of course, well known in the New Forest area, and generally speaking is a law-abiding section of the community. A year or two ago, in connection with the introduction of a new (gypsy) compound, it was decided to have a parade of the families who had been selected to occupy the fresh area. It was a most difficult job to compile the "Census," every other one was inter-related, and in the end, having inspected and approved the applicants up to the number decided on beforehand, it was thought the easier plan would be to leave the gypsies to grade themselves!

The gypsy compounds referred to are not exactly salubrious places, and are not easily accessible by nurses, and it is alleged that foxes elude the hounds by taking cover in them. On humanitarian grounds on occasions which are described as " interesting " the expectant mother is given a special permit to camp in a more convenient place for a month. As a rule these permits are arranged by the District Nurse or County Clinic, but sometimes the women apply personally. These applications often coincide with Christmas and the spot selected (by the applicant) is generally near a good patch of holly—which gives good shelter no doubt! On one occasion the woman was asked when the baby was expected. There were grounds for suspicion it would dally more than a month—and the holly might not last. " Oh ! " she replied, " we don't know ; it's like that with us women, they just comes and goes."

Apropos camping, there is the camper, or campers who, to economise in postage and charges on a remittance, make personal application for the necessary permit.

During last summer one of these called—after official hours ; he apologised for late arrival, having had a long car journey from the north and unanticipated delays *en route*. Concluding the applicant was aware of the scale of charges, which are brought out in the A.A. handbook by the way, the form of permit, for 2 nights by request, was prepared ; but when the fee (2*s*.) was asked for the atmosphere changed ; uncomplimentary remarks were made by the caller regarding the " gross imposition " of the Forestry Commissioners in making any charge at all, and he left rather hurriedly with the retort that he would rather drive on to —— than pay such an unfair " tax " !

Another type of camper is the one who wishes to be " well informed " beforehand. In the early spring a year or two ago an " advance agent " for a ladies' camp called with the view of having everything in order for the proposed camp during the following August. First of all details of the campers—six in number—were voluntarily given ; then followed a salvo of questions such as :—

1. Shall we have the site we select (in conformity with the regulations) quite to ourselves ?
2. Would there be any possible danger from straying cattle ?
3. Would there be any fear of being molested by gypsies or tramps ?
4. Whether it was quite safe to drink the water from the Forest streams ?
5. Which vicinity was recommended to ensure a regular supply of milk, dairy butter, etc. ?
6. Would it be safe to leave the camp unoccupied during the daytime ?

Having been supplied with answers to the various " things we want to know " the enquirer decided to talk it over with the rest of the party and write us later. However, the camping season passed and the promised communication did not materialise !

Callers of all types are familiar at the New Forest Divisional Office. For instance, there is the historian who comes along with such questions as :—

What is the age and present girth of the Knightwood Oak ?—a famous New Forest landmark by the way ; and whether we can tell him (or her) the name and address of the inhabitant who remembers the actual planting of the tree !

Whether the Rufus Stone is really the original one ; and by whom it was erected ?

Why the well-known Twin Oak (at Cadnam) is described as such ?

Where exactly did " Brusher " Mills—the famous snake-catcher of years ago—live ; and whether there is a successor to him, and, if so, the most likely place to find him ?

But an enquiry of some years' standing—both written and oral—relates to one, a Captain Arthur Philip, R.N., who retired in 1763 and took up residence in the New Forest. Afterwards he became the first Governor of New South Wales. It is believed that he studied Forestry at one time, and various individuals and bodies—including the Southampton Record Society—are anxious to get some record of the gentleman in question, especially as the (N.S.W.) Colony last year (1935) commemorated the 150th anniversary of his governorship ; so if perchance any reader has information relating to the above-mentioned Capt. A. Philip, R.N., perhaps he, or she, would be good enough to pass it on to the Deputy Surveyor, New Forest.

All callers are not in person ; a good many enquiries are made by telephone. On one occasion a lady rang up, very perturbed, to say that a Forest pony had strayed into a field belonging to her and had given birth to a foal ; and wanted to know what she should do in such a dilemma ! ; whilst the present Deputy Surveyor relates that a short time ago he received a frantic telephone call at his private address from a lady resident in the Forest enquiring if he was aware that ivy was growing up the " Scissors " beech ! It was fortunate he had a car ! !

In the " good old days "—often referred to at New Forest—the touring (horse) coaches were a feature ; and each day during the summer months the village of Lyndhurst was enlivened by the efforts of the horn-blower round about lunch time. The favourite " call " as the conveyance passed the Divisional Office was " Scenes that are brightest " —not always appreciated when one was enveloped with " Urgent's," " Immediate's," " Pressing's " and the like. With the advent of the motor-coach tours the conductor had to introduce a " talkie " ; so nowadays we hear a set announcement as the coaches pass the Office : " We are now passing the New Forest House of Parliament, where all the laws of the Forest are made." Possibly this priceless information prompted two dear old ladies to walk upstairs to the main Office one summer afternoon to ascertain whether they could inspect the New Forest Act of 1877 !

New Forest dialect is no doubt puzzling to the uninitiated. On one occasion a typical " New Forester " was deputed to pass an urgent 'phone message to the Office ; incidentally the call was from a distance of about 3 miles. The sender of the message started off at full blast ; the receiver—the writer of this article by the way—was momentarily deafened. On being requested to speak in a natural tone the sender shouted louder than ever, " I'm at Boldrewood "—evidently being under the impression that a distance of 3 miles called for full volume of voice. However, in the end it was possible to understand the message, which ran : " Will you tell Mr. X that all the acarns has bin picked up and the carter be taken 'em down along to the varm. They be all zound and dry " !

In conclusion I will relate an episode bearing on the Industrial Staff which has been handed on to me. At one time a former Deputy Surveyor was taking stock of the younger Forest workers with the view of selecting suitable candidates for the School of Forestry. One youth, of good physique and promising appearance, showed up well till the question regarding education was put to him. To this he replied : " Well, Sir, I never went to school, but I knows a lot I does." From our general knowledge of the typical New Forester we have no doubt he did, but his knowledge was not quite of the kind to qualify him to be included in the list of candidates recommended for entrance to the Forestry School !

DIVISIONAL NURSERIES.

By W. J. Hale.

Every forester strives to attain a high standard of efficiency in nursery practice and hopes to produce good nursery stock, but only too often he finds that insect attacks, frost, floods or drought have shattered his dreams.

An incessant watch has to be maintained for the first sign of insect attack, for it is chiefly the cockchafers, cutworms, wireworms and leatherjackets, to name only a few, that give rise to consternation. The seeds have germinated well and there is every promise of a splendid crop, when one observes that all is not well, for here and there the seedlings are being attacked, and a search being made, the root of the trouble is soon discovered. If the seedlings are bitten off above the ground it is most assuredly the work of the cutworm.

The cutworm attack may be spasmodic and the damage may often be attributable to leatherjackets. Although the cutworm when fully grown somewhat resembles a leatherjacket, it can easily be distinguished from the latter by the fact that it has legs, while the leatherjacket has no legs. The cutworm feeds above ground, biting off the plants, whilst the leatherjacket as a rule feeds below the soil surface, destroying the root and underground stems of plants attacked. On warm, damp nights, however, the leatherjacket will also feed on the surface, cutting off the plants at soil level in a similar manner to cutworms. Where a seedling has been bitten off, a careful search at the spot an inch or so in the soil, will reveal a cutworm, or perhaps several cutworms, for the agrotis may have as many as five to a brood.

During the past autumn such an attack occurred in the Ringwood Nursery, and various methods were used to eradicate the pest, including lightly forking over the beds between the drills. By this method over 16,000 cutworms were collected and destroyed—one bed alone accounted for 780 of them. When an attack is in progress, hoeing is of some value, disturbing the cutworms, injuring some and exposing others to the attacks of birds.

When such attacks occur, remedial measures must be quickly adopted, otherwise much damage will be done. Cockchafers and wireworms likewise take heavy toll of the seedlings. It is not sufficient, however, merely to adopt remedial measures against insect attacks; it is far better to look for preventive measures, and here crops up the vexed question of weeds. A grass path will serve as an ideal breeding ground for cockchafers and the crane-fly, and charlock and other weeds for the agrotis. Therefore, to reduce insect attacks, the paths should be kept free from weeds, and the weeds in the seedbeds and nursery lines kept down to the minimum.

Each year in our nurseries insect attacks can be marked down as being responsible for a certain percentage of loss of nursery stock. This brings me to another point—"profit and loss." Many experiments have

been carried out, and much has been written with the object of raising the standard of nursery production.

With forest-tree nurseries it is not possible to produce two crops of forest trees on the same area in one year, hence a little care is needed in being able to utilise the nursery area to its fullest capacity. A little judicious thought in laying out the seedbeds will often result in a great saving of time and expense. It may be known, but I think it is worth mentioning, that if seedbeds are prepared, say, 3 ft. wide and the 15-in. or 18-in. wide alleyway cut down at the time of sowing, close to the sown bed, and should the weather during the period of germination be very dry, the soil will crumble away for about 3 in. on each side of the seedbed and a resultant loss will occur of 6 in. of sown seedbed, equivalent to a 16 or 17 per cent. loss. The same thing may happen if the period of germination is accompanied by heavy showers. A similar proportion of seedbed might easily be washed away. To overcome this it is easy to prepare the bed 3 ft. 6 in. wide and to sow 3 ft. of the bed, leaving the 3 in. on each side to prevent the crumbling away of the actual seedbed.

Next comes the question of lining-out, and here again it presents its problem. How can the fullest extent of the area be utilised at a minimum expense to carry a full crop of useful plants ? A method quite economical has been carried out in some nurseries, whereby all transplants which are to be used in the forest during the first year are raised on close-bedding principles. This method chiefly applies to the pines, such as 1-year C.P. and 1-year S.P., and quite sound transplants can be successfully produced by this means. The beds are laid out across the section of nursery and one gang of four workmen, usually two men and two boys, comprises a working unit. A line is first laid down parallel to a secondary path for a length of 52 ft., this being sufficient to form eight beds 5 ft. wide with 18-in. alleyways between the beds. The first trench is taken out along this line, a second line is run out across the nursery section at right angles to the first line to serve as a guidance. Transplanting boards 5 ft. in length, with 1-in. spacing for the smaller seedlings and 1½ in. for the larger seedlings, are used for the bedding out. The first board, having been filled with seedlings, is laid down along the trench, then an 18-in. space is left for the alleyway and the second board is placed in position, and so on until the first line of each of the eight beds has been completed. A spacing of 7 in. between the lines has been found quite adequate.

The procedure adopted is similar to the ordinary lining-out except that the beds run across the section and the lines run longitudinally. By this method the area will contain more plants than would have been the case if ordinary lining-out principles had been adopted.

With 1-in. spacing in the lines 14,000 plants go to the 100 sq. yds.

,,	1½-in.	,,	,,	9,500	,,	,, ,,
,,	2-in.	,,	,,	7,000	,,	,, ,,

The cost of lining-out may vary from 1*s.* 6*d.* to 2*s.* per 100 according to the spacing adopted and weather and soil conditions. Incidentally, the cost of weeding and lifting of plants is relatively low, and the hoeing and weeding can be done from the alleyways, thereby keeping the soil

light, as no treading of the beds takes place. I would particularly advocate this method, as experience has proved that better transplants have been raised by these means, and where a limited area of nursery is at the Forester's disposal it commends itself.

Another point I would stress is, that having formed your working unit, keep that unit working together and do not change the men to other jobs if unnecessary. There are, of course, other methods which serve to cheapen the cost of production, but it certainly appears that if a good 1-year seedling can be raised, a 1-year 1-year transplant of C.P. or S.P. is better than a 2-year 1-year plant and the cost of production is considerably less.

The fertility of the soil is one of the greatest considerations in successful nursery management. In large nurseries the question of keeping up the fertility is a big proposition, and if farmyard manure has to be used it is an expensive item. Personally, I think that farmyard manure not only introduces additional weeds into the nursery, but it has a tendency to give a false impression, for good plants may be produced after the application and the second year's crop on the same area may be very poor.

Where possible to obtain, no better treatment for the soil can be applied than ordinary woodland humus, but unfortunately this cannot be obtained in sufficiently large quantities to permit its use other than on the seedbed areas. Bracken humus has proved very efficient for manuring the nursery lines, and where this can be obtained it is infinitely superior to farmyard manure. The constant use of the hoe is as good as an application of manure, for by the use of the hoe the seedling weeds are destroyed, the soil is aerated and harmful gases are allowed to escape, the little capillary tubes are closed and the moisture is retained in the soil.

To return to the question of the nursery gang. Endeavour to inculcate that fine spirit of *esprit de corps* into the various working units, and on all occasions to insist on neatness rather than a slap-dash method solely with the object of showing a cheap labour cost in the Progress Report, irrespective of whether the work is properly done or the plants live or die. Neatness creates interest, and interest ensures care and attention, which are the chief factors in successfully raising the standard of nursery production in our forest nurseries.

CHAFER DAMAGE.

By W. D. Russell.

Foresters residing in districts where the nurseries are not adjacent to old woods of broadleaved trees may have felt surprise at reading in the last Journal of the large-scale depredations of chafer beetles. Lacking immediate contact with a problem it is very easy—and natural—to relegate it to a position of minor importance. This question of chafer damage is, however, of great importance to those having nurseries situated either in or near old woodlands of oak, beech and other hardwoods. Some further details, therefore, of the beetles, their incidence and the damage they do may not be out of place.

Of the four chafers regarded now as pests in forest nurseries, the large chafer, *Melolontha melolontha*, and the brown chafer, *Serrica brunnea*, have been long recognised as enemies of the nurseryman, serious or otherwise, according to the degree of infestation. As an example, one nursery with which I was associated had an annual outturn of about a million seedlings and transplants, *Serrica* caused a yearly loss of about 5,000 plants. Control measures in the way of segregation and treatment of the infected areas were carried out annually, but as the loss from this cause was low and there were other things to worry about, *Serrica* was regarded as comparatively unimportant. Much the same applies to the summer chafer, *Rhizotrogus solstitialis ;* when present it is destructive, but usually it occurs in too small numbers to be a serious menace. A curious fact about this chafer has been observed in Nagshead Nursery, Forest of Dean. In 1931 and 1932 it preponderated in the chafer population of the nursery, causing a considerable amount of damage. Now it is so scarce as to be a negligible influence on plant losses, the numbers of larvae found being exceedingly low. Yet, on any summer evening, in the open spaces near the village, less than a mile from the nursery, the adult beetles are to be found in large numbers. No reasonable explanation has been found for this phenomenon.

The last member of the quartet, the garden chafer, *Phyllopertha horticola*, has come into prominence in connection with forestry only of late years. Entomologists have known it as damaging garden and agricultural crops, but more recent work has shown that it is of nearly as common occurrence as *Melolontha*, and capablo of doing as much damage, despite its shorter larval life. The life cycle, from egg to adult, of *Melolontha* takes four years or more to complete. But, it is stated by competent authorities that the life cycle of *Phyllopertha* occupies one year. Beetles emerge in June, eggs are laid in July, the larvae hatch out in from three to four weeks and begin feeding at once. In a normal year they stop feeding during October and burrow to a depth of 3 to 4 ft. where they pupate, to emerge as adults in the following June. *Phyllopertha*, together with *Melolontha*, are regarded now as two of the most serious pests in tree nurseries, both in this country and on the Continent. When present in large numbers they are the cause of very serious losses. Observations have been recorded of the presence of

adult *Phyllopertha* on bracken and grass-covered slopes, particularly in Wales, but they seem also to frequent woodlands of the broadleaved species. This is true, up to a point, of *Melolontha* also, with the result that these two chafers generally predominate in nurseries adjoining growing woods. Such a nursery is Nagshead, which is practically surrounded by oak woods of varying ages. Chafer damage has been something of a problem in this nursery for many years. All four species are present, with *Melolontha* and *Phyllopertha* predominating, and *Rhizotrogus* so much in the minority at the present time as frequently to be entirely absent even from badly-infested sections. A recently-made " census of population " gave the following results :—

Melolontha. (Large.)	*Melolontha.* (Small.)	*Phyllopertha.*	*Rhizotrogus.*	*Serrica.*
180	553	1,295	—	32

To obtain the above, hand-picking was carried out in October, while the larvae were still in the upper 2–6 in. of soil, over an area of about 600 sq. yds. This area was in four unequal-sized blocks scattered at random over infested sections. It may be of interest to note that only 15 cutworms were found during the census. The distinction of *Melolontha* into " large " and " small " was considered advisable in view of the four-year larval stage. The first class consisted of 3–4 years and the second of 1–2 years old larvae. The proportion of " small " is higher than has been obtained in previous counts. This is believed due to 1934 having been a major flight year when the beetles were so thick over the nursery that they were being caught in nets and sheets and also picked up by hand as they settled for egg-laying. As long as boy labour could be obtained this last method was found as practical and economical as any. But neither netting nor picking is an efficient deterrent to egg-laying, and what is wanted is a cheap and easily-applied spray or dust that, applied during June and July, would render the soil surface obnoxious to the female beetle. A necessary condition is that the chemical should have no adverse effect upon plants.

In the nursery sections, of which the above-mentioned 600 sq. yds. were examined as samples, the transplants and seedlings had a perfectly normal appearance throughout the summer. Periodical examination from June until stocktaking in August and September showed very little chafer damage. But during September and October—when the larvae appear to feed hard preparatory to burrowing deeper into the soil for hibernation and pupation—wilting began to occur. Examination of samples showed typical damage and the section was kept under observation for a short period. Damage was found to be extending rapidly, plants being completely stripped of all fibrous and lateral roots. Most of the stock was 2-year seedlings and " stand-over " transplants. It was decided, therefore, to lift and line-out in a fallowed and hand-picked section, in order to save as many as possible. Accordingly, lifting was put in hand towards the end of October and rapidly completed. The following figures, which show the numbers at stocktaking in September and the quantities subsequently lifted and sufficiently un-

damaged for lining-out, will serve to illustrate the amount of damage which may be done where the chafer infestation is not more than three or four per square yard :—

Species.	*Age.*	*Stocktaking.*	*Lined-out.*	*Loss.*	*Percentage.*
E.L...	1+0	168	30	138	82·0
E.L...	1+1	101	47	54	53·5
J.L...	1+0	108	35	73	67·6
D.F...	2+1	6	3	3	50·0
Sw. Ch.	1+1	9	6	3	33·3
A. oregona	1+1	8	3	5	62·5

More recently, 3+3 C.P. 21 in the same section as the larch were lifted. Very little damage had occurred in this lot until the beginning of November, by which time the chafer larvae normally are deep in the soil. Very small losses were anticipated, but as soon as lifting started it was seen that losses were going to be heavy—plants showing no signs of wilting were completely stripped of roots, with the result that instead of 33 being available for planting, barely 10 have been obtained. The only theory that can be put forward for such exceptionally late damage is that the open weather and lack of ground frosts have kept the larvae feeding for a much longer and later period.

Observations over a number of years by the Nagshead Nursery foreman have brought to light two curious facts about chafers, more particularly *Phyllopertha*, the first is the comparative immunity to attack of ash and the second the peculiar attraction of the larches, which seem always to be the most heavily attacked. It would be interesting to know if similar observations have been made by other nurserymen.

Efforts continue to be made to combat this pest on the lines of rendering the soil surface unsuitable for ovipositing, destroying larvae underground before much damage can be done and so on. Recent experimental work included the use of insecticides which had proved effective in combating leatherjackets at Lord's Cricket Ground, but the results with chafer larvae were not encouraging, in fact the larvae seemed to thrive on the compounds. For the present, hand-picking at each digging continues to be the most efficient and practical remedy, but it is costly and far from being the perfect cure. Unless an effective and easily-applied deterrent to egg-laying, or a cheap and completely lethal insecticide can be found soon, the question of abandoning heavily-infested nurseries surrounded by old woodlands may have to be given serious consideration.

NORWAY MAPLE.

By N. A. Wylie.

As there may not be many examples of Norway maple (*Acer platanoides*) grown in close canopy in this country, the following details of a plantation at Tintern (Monmouthshire) may be of interest, especially as the results so far are promising.

The plantation was made in 1908 in a sheltered situation on a steep slope facing east at an altitude of 200 ft. The soil is a moist fertile loam. The trees were spaced 5 ft. apart. The average height of the dominant trees is now 56 ft. (approximately), which represents an annual average height growth of 2 ft. since planting. The current height growth has not been ascertained, but it appears to be between 1 ft. and 18 in. The form of the trees is good, being very similar to that of sycamore; they are fairly straight and clean up to the living crown.

An adjoining ash plantation has reached an approximately equal height in the same number of years, which indicates a fertile soil. It was interesting to note that after some very severe frosts in the middle of May this year the ash were completely blackened, while the maple remained green. It is not possible to say, however, that no damage was done to the maple, as the height of the trees made it impossible to investigate this.

A record of another plantation of Norway maple, which shows that the height-growth of this species may exceed that of sycamore and beech, may be found in Forestry Commission Bulletin No. 12 (Forest Gardens). The description is of two adjoining plots at Cirencester, one of Norway maple and beech, the other of sycamore and beech. The soil in each case consists of 6 in. of moderately stony loam resting on broken oolite. The rainfall is said to be 38 in. The age of the plots at the time of measurement was 24 years; and the beech in each plot had attained a mean height of 25 ft. (there is a note that the slow growth of the beech may be due to the plants having been damaged in transit and also injured by spring frost in the second summer after planting). A comparison of the Norway maple and sycamore shows that in the first plot the Norway maple were ahead of the beech, having a mean height of 30 ft. against the beech's 25 ft., while in the second plot the sycamore had a mean height of only 21 ft. and were being beaten by the beech.

The above examples from Tintern and Cirencester seem already sufficient to indicate that more Norway maple might well be planted in substitution for sycamore, until the trial of the two species is completed. It remains to be found out whether the Norway maple makes as valuable timber as sycamore, whether it grows as well in later life and whether it is as easily reproduced. With regard to the first point, the Forest Product Research publication states that the timber has qualities similar to those of sycamore and is used alternatively. The thinnings from the Tintern plot have so far been too small for conversion; they were sold as round poles to a local chair-leg turner, who found them well suited to his purpose, being similar to sycamore, but harder.

With regard to the Norway maple's powers of reproduction, the first indications are promising. Seed was produced by the trees at Tintern in 1933, only 25 years after planting, and a number of seedlings are already on the ground living under the shade of the parent trees.

The leaves of the Norway maple turn a fine yellow, which makes it a pleasing feature in a mixed wood, in the autumn, and distinguishes it remarkably from the sycamore, which presents at that time of the year an appearance almost as dismal as that of the walnut.

FOREST ROADS.

By I. Adams.

As one who has lived in the Forest of Dean for upwards of 30 years, I could not help thinking the other day that the methods now used for hauling timber from the Forestry Commission areas have certainly not improved with modern times.

When I was a boy I can well remember the timber wagons bringing timber to the local siding, their wheels dripping with mud, the horses and their drivers also covered with mud. Only last week a similar sight was to be seen, though the mud was not quite so thick.

On the same day, however, I saw a motor timber wagon pass through with a load of oak logs at the rate of at least 25 miles an hour. This led to the reflection that if the latter method of transit was more common how much valuable time would be saved and as " time is money," what a considerable amount of money would be saved also. To make the hauling of timber by motor wagons and lorries possible much better roads are needed throughout the forest area, irrespective of the ordinary country roads. At present the forest roads, or rides as they are called, are totally unsuitable for motor traffic.

The cost of getting timber, poles, etc., from where they are cut to anything like a decent road must be tremendous, thus causing considerable loss to the owner or repressing sales, as naturally buyers will take into consideration the additional cost of extraction.

Another problem we are up against is the disposing of first and second thinnings, on an extensive area particularly on hillsides, where all the produce has to be man-handled.

Sometimes this has to be carried a matter of 300 to 400 yards to get to the rides. In cases like this the cost of labour is more than the produce. In similar plantations to this, where a fairly good road had been made through the centre with subsidiary roads running into it, never more than 100 yards apart, the produce could be easily carried to the subsidiary roads ; then a horse could be used to tush it to the main road or ride. Even now, in some of our plantations, it would save us money if this were done, when taking into consideration the amount of labour this will entail for the next 15 years.

In plantations between the age of 20 and 35 years it is not advisable to have horses for tushing. If the above method had been adopted when the Forest was planned it is evident today what a saving in expenditure and labour there would have been.

I would suggest that several good roads, capable of carrying heavy motor traffic, be made through the Forest, and that subsidiary roads should be made leading into these.

While advocating the construction of a larger number of metal roads, it may be noted that, provided roads are surveyed to avoid sharp and steep gradients, a cheaper type of road can be made to meet the needs of the modern motor transport by metalling a pair of 3-ft. paths on which the wheels of the vehicle will travel. Owing to a very steep

gradient and very deep ruts, both a motor lorry and timber carriage recently found it impossible to get to and remove a supply of poles. This incurred an additional expenditure for tushing 400 yards to another serviceable road for removal by lorry, while the poles, which were badly barked through tushing, will not be acceptable at the original price.

Several local purchasers have invested in motor trailers for cheaper timber haulage and they are making full use of travelling on our metal roads which only serve a part of the district. It will be reasoned that all supplies of produce will not be available for a continued length of time near the few metal roads, therefore it is imperative that an extension of these roads be made, otherwise modern motor transport must go out of commission and the purchaser resort to the old primitive methods of transport with their drawbacks. The main drawback to the making of rides and roads is, of course, the question of cost.

FOREST PROTECTION IN THE DEAN.

By D. N. Williams.

The following article is not intended as a complete survey of forest protection in Dean Forest; it is an account of the most important influences, beneficial or otherwise, on forest and forest nursery welfare, which we deal with in the Forestry School.

As forest protection is such a comprehensive subject it will be as well, I think, to deal with it more or less in the orthodox way, emphasising the important factors as occurring locally, and the preventive and remedial measures adopted.

1. Damage by human Beings.

Under this head by far the greatest damage is caused by fire. Fires are caused here admittedly not only by people, either maliciously or carelessly, but also by sparks from the mineral trains especially on the up gradients, when greater stoking takes place. But we must take fire as one head, however caused. Fires are largely prevented by intelligent anticipation and foresight, and by general preventive measures. The main system of fire location in the Forest is by means of look-outs on high places, connected with telephones to the School and the Foresters' houses. At each fire station is a map of the Forest, on a scale of 3 in. to 1 mile, with the situation of the station well defined. From this point a series of concentric circles is drawn, the radius of the first circle being 1 in., therefore representing $\frac{1}{3}$ mile. Lines radiate from the centre and are numbered. When a fire is seen, the map is oriented and the position of the fire is located along one of the lines by means of, say, two matches. The fire is similarly located from another fire station. Each look-out station telephones the line numbers and on a map at the Crown Office, or the School, the position of the fire is determined where the two lines intersect. Of course, a large number of fires are reported by the look-out station by means of their intimate knowledge of the surrounding country, without the aid of the map. The School is informed, and the students, who, to a large extent, are responsible for helping to extinguish most of the fires, proceed to it. This is all, of course, a remedial measure. The correct practice is obviously to minimise as much as possible the chance of a fire starting. Fire lines well cut and burnt previous to spring, especially in conifer areas, are extremely useful. These lines are usually along a public footpath, or well-used track, and the danger of a dropped match starting a fire is greatly minimised, especially in a highly inflammable period. I may add, too, that the matches manufactured locally are not easily extinguished, and great care must be taken to put them out. Cigarette ends, are I think, very unlikely to cause a fire, although always quoted as a possible cause of fire.

A very practical measure in fire protection here is adequate brashing in young coniferous plantations. This is a measure which in any case has

to be undertaken preparatory to thinning, and the difference in fighting a fire or even in preventing a fire from travelling too fast in a brashed plantation, as compared with an unbrashed plantation, has to be experienced to be believed. I am thoroughly convinced that adequate, but not unnecessary, brashing is an absolute necessity, but provided that the dry branches are burnt or otherwise removed along the sides of the rides to an extent of at least 20 ft. Another practice we adopt in summer to prevent fires is not to cut the fire lines too early, thus leaving them a mass of, say, green bracken, and hence being non-inflammable. The formation of hardwood belts of beech and alder around the compartments is largely practised here, especially along the sides of railways. A system of fire notices warning the public has a certain effect, no doubt, whilst men patrolling on fire duty are, of course, very necessary in many places. Another factor in preventive measures is often lost sight of. This is the employment of tact in dealing with local people. Some people, we all know, can never be persuaded to be logical, and there are a great many of this type in this neighbourhood. They fail to see, or rather will not see, that if a plantation is burnt it obviously has to be replanted, therefore incurring extra cost, which is borne indirectly by the community. The tact I refer to is not, for example, to pound sheep indiscriminately, thus causing bad blood, without finding out first whether the sheep were deliberately put in or whether the fence was in disrepair. Another way is to provide adequate stiles where fences cross the paths, or even paths which have been habitually used, even if they are not rights-of-way. These, I feel certain, would save a good many malicious fires. Further damage by human beings, apart from fire, is often caused round here by idle gangs of men or boys, in whipping off the tops of trees, and tying the leaders in a series of knots. Although not of considerable importance, I can recall to mind one plantation near here in which we found about 150 good larch so treated in about half an acre.

Fences are often damaged, the wires being cut, and netting having holes kicked through it. The measures that can be adopted in dealing with this type of damage are very few. I think that tact would prevent much of this in course of time.

2. Domestic Animals.

Sheep are practically the only domestic animals which do damage here. The common rights in the Forest of Dean are not what one would call helpful to good forestry. Sheep abound all over the place, and by long training can run and jump like deer. They break through fences, jump them, and find out quickly any weak places in the fence, with the result that they are continually in the enclosures. They feed in the plantations and in so doing damage the trees considerably. They are also responsible to a large extent in preventing natural regeneration of oak. It is a very difficult problem—the measures adopted here being the pounding of sheep found in enclosures and the adequate fencing of all enclosures.

3. Other Animals.

Rabbits do considerably more damage than any other wild animal. Fortunately, they are not abundant in the Dean, but the last two dry summers have enabled them to increase considerably. We have two areas in which we trap them fairly intensively. We wish the students to have a knowledge of how to make snares, set them, and also to have a good working knowledge of ferreting. We make our own snares, using six strands of ordinary snare wire, and we find the cost of these not too excessive. We also find these preferable to the R.S.P.C.A. snares, which latter never properly fulfil the object for which they were designed, namely, to keep the rabbit alive and caught humanely. We keep our own ferret, pursuing the usual way of ferreting the earth and stopping them after. A good many of these earths we intend to treat with one of the methods which discourage rabbits to use the earth again. The forest rabbits have a ready sale here, but are usually in poor condition. We experience much trouble with poachers, who deliberately knock down fences, or cut the wire and take any rabbits they see. We work two students at a time, and it is one of their duties to prevent this trespass. Hares are not plentiful enough to do much damage, but where they occur, seem partial to Japanese larch. Squirrels are by no means common, and the damage that they occasion does not justify their destruction. On the other hand, grey squirrels appear to be coming more plentiful and they may kill the red squirrel and destroy the eggs and nestlings of small birds which are vitally required here. The remedy against the grey squirrel is obvious. Voles have done considerable damage; we have just discovered quite an amount of damage in P. 29 beech, where 15–20 per cent. of these plants, about 2 in. diam. at the butt, have been gnawed through to the cambium and thus killed. They have also done considerable damage to similar-sized oak plants. It is difficult to trap voles or kill them by poison or a virus. I think nature provides by far the best remedy, if only we would use it, by the preservation of such birds as owls and hawks, and animals such as stoats and weasels. It seems to me to be so utterly futile for local authorities to publish lists of birds that are to be protected, when the employees of men who have helped to frame these lists utterly ignore the recommendations and are always destroying useful birds. Voles in the nursery can, of course, be dealt with much more easily, by means of traps. We experience in Nagshead Nursery very little damage from voles and mice.

4. Birds.

Birds are not only beneficial to the forest, but are an absolute necessity to its well-being. I will quote one or two instances. In the extremely bad attacks by *Phyllopertha* in Nagshead Nursery starlings have been invaluable in July in destroying the adult beetles. Later on, in August and September, rooks have picked out large numbers of the larvae of the beetle, leaving quite distinct holes in the ground where they have worked. Small birds undoubtedly destroy large numbers of the larvae of the green tortrix moth, the mottled umber and the winter moth.

There are only a few birds which I should class as being definitely harmful. Firstly, the pigeon: these birds, augmented by large flocks of foreign pigeons, commit havoc among the acorns during a good mast year, often prejudicing any chance of natural regeneration. During the winter and spring of 1933–4, pigeons were largely responsible for destroying the chance of highly successful natural regeneration. Jays and magpies commit a certain amount of damage, the former destroying acorns, and both of them destroying beneficial small birds, but I do not think the damage they do merits their destruction.

5. Insects.

I will only deal with a few of the most important. Firstly, the various chafer beetles. These have done enormous damage in the nursery, especially *Phyllopertha*. Attacks this year have been so bad that we have had to lift and line-out all our larch seedlings and transplants to save them from further damage. This insect which has only a one year life cycle, flies during the latter part of July. The female lays its eggs at this time on stocked ground, and also on fallow. The resulting larvae, which take only about a week or so to hatch, immediately begin to skin the roots. This damage is not noticeable until August or September, when the damaged plants begin to wilt. The larvae appear in patches, and seem particularly partial to larch. What they feed on in pure fallow seems a mystery, unless it is raw humus. The larvae apparently go deep and after hibernating pupate as free pupae in May and June, ultimately emerging as beetles again in July. Thus it will be plain that the systematic fallowing which we practice has no advantageous effect, with *Phyllopertha*, as in the case of *Melolontha*, the grubs of the latter living for several years, enables us to dig them up in the summer, when they are near the surface. Measures effectively to deal with chafers seem to be very difficult to find.

A certain amount of experiment has been done this year with various chemicals, but the larvae subsequently found on the treated plants were in better condition than those on the controls! We are going to try and apply simple remedies this next year, working on the principle of trying to prevent the adult beetle from laying her eggs. Once the eggs are laid, especially with *Phyllopertha*, it is nearly impossible to prevent great damage, as one does not notice any damage whatever until the plants begin to wilt. A spray on the ground may prove to be useful in preventing the adult beetle from ovipositing, the spray being applied during the flight period of the beetle, that is, the end of July. We are considering a paraffin emulsion. We have completed a census of larvae dug up this autumn from damaged beds, and the results show a great preponderance of *Phyllopertha* in comparison with the other chafers.

Pine weevils are harmful everywhere, and I do not propose dealing with them. *Hylastes* has done a certain amount of damage to Scots pine in Horselawns, and we have counteracted this by burning all sources of breeding, such as pine logs and weevil billets.

The green tortrix moth does considerable damage every year, although the severe frost during May, 1935, must have reduced its numbers very materially. The strict preservation of all small birds seems to be the only practical remedy, although powder dusting has been tried on a small scale. The continued yearly attack of this insect must have, I think, a much greater harmful effect on the health of the oaks than is generally imagined. Every year a second set of leaves is flushed, which must sap very considerably the reserve food supply of the tree, and be a constant drain on its resources.

Retinia buoliana is responsible in many cases for very crooked stems and is present everywhere, but is not an important pest here. Incidentally, they have attacked to a fair extent the Scots pine in P. 35 planting on the School beat, and also the *Pinus contorta* transplants in the nursery. An insect whose damage appears to me to be increasing, especially on frost damaged larch, is *Argyresthia laevigatella.* I presume the increase of its parasites would be the only practicable remedy.

6. Weeds.

Dean Forest, having a fairly good soil and an abundant rainfall has a prolific weed growth in places.

I am convinced that insufficient weeding, which is unfortunately far too prevalent, has done as much damage to young plantations as most things. Especially is this noticeable in oak, and particularly in the natural regeneration of it. It is one of the disadvantages of natural regeneration that weeding is both difficult and expensive, but I have noticed time after time that one will never get a decent oak crop if it is not thoroughly weeded. Larch is another crop that suffers badly from insufficient weeding, especially in bracken. I have seen a great many larch killed through lack of weeding. If weed growth is strong, weeding is usually necessary for at least four or five years on moderate soils and situations. I am inclined to think that the whipping of fern is a superfluous operation, because two weedings are required afterwards as a rule.

Honeysuckle should be regularly cut, not forgetting that there are usually half a dozen or more stems to be cut. Birch, which is very plentiful here, does a great deal of harm by whipping in well-stocked plantations.

7. Frost.

Damage by frost both in plantations and nurseries is very considerable in the Forest of Dean. There are so many places in an extensive forest like this where the air cannot circulate properly, thus creating numerous frost hollows. We find that in the worst of these places Scots pine is the only tree that can thrive. The spruces also suffer badly. Good draining is very much a preventive measure, as it makes the situation drier, but the chief damage from frost is that caused by late frosts in May. As an example, of this, on May 15th, 1934 we experienced 12 deg. of

frost in the nursery, whilst on May 17th, 1935, we had 23 deg. of frost. The effect of this frost on young growth was devastating. Beech, ash and oak, both transplants and seedlings, were completely cut, the beech transplants not having recovered as yet. The obvious remedies against frost are of course the adequate protection in the nursery of all frost-tender species by means of laths and branches. These latter can often be used with good effect to cover transplant lines of ash or beech, for example, when one can reasonably expect a frost. Frost lift can also be largely prevented by a humus covering of beech mould, laid to a thickness of about an inch. Even the severe frost of May, 1935, did not kill any ash, although they had just started to shoot, but it had the effect of causing many double-leadered plants, and the resulting fork will continue to grow as such in many cases. Larch suffers very considerably in local frost pockets in the Forest, and will continue to be cut year after year. When beating-up these we use Japanese larch, as they are much hardier. The employment of nurses has a very beneficial effect ; *e.g.* Scots pine nurses for a beech crop, eventually removing the Scots pine. Taken generally, early frosts cause but little trouble, but late frosts are very damaging.

8. Fungi.

Lastly we come to fungi. Honey fungus has caused a great many deaths, C.P. S.P. and S.S. being particularly susceptible. Little can be done to remedy this in plantations, unless deaths occur in a group, when hardwoods, for example beech, should be introduced.

Fomes annosus occurs frequently in larch, spruce and cedar. The cause is obscure.

These are the main difficulties we are daily encountering here in growing our forests. We presume there is a reason for the existence of everything, although we sometimes are at a loss to know exactly what it can be, but the fact of having something to overcome acts as an incentive to better work.

SNOW DAMAGE IN A CONIFER AREA.

By F. Watson.

The absence of very heavy snow falls in this country of recent years may tend to distract our thoughts from the danger of the serious damage which a heavy fall can cause to growing plantations, especially if the snow is accompanied by strong winds.

Many of the older foresters will have uncherished memories of the serious damage, also the cleaning up, which followed a particularly severe blizzard in the late winter of 1915-16. Plantations from 10–20 years which had already formed canopy fared the worst. This storm, which came from the north-east, swept exposed places almost clear of snow, with the result that the snow accumulated in the valleys and on the sheltered sides of slopes, and this was where the greatest damage occurred. In an enclosure here of 16-year-old European larch, areas varying from a few square yards to nearly an acre in extent, were found with hardly a tree left standing. This damage occurred on the south-west side. On the high ground and areas to the east there was very little damage.

The cleaning up which followed occupied many months; not only had the fallen trees to be removed, but numbers of badly leaning trees surrounding the areas had to be felled in addition to a large number of small scattered groups of two or three trees in the less damaged parts of the area. The produce resulting from these operations consisted chiefly of a small grade of pitwood, which was in good demand during the war years. The replanting of these areas was completed in the winter of 1917-18, the work being done chiefly by female labour. Sitka spruce was the species used chiefly on account of its rapid growth on suitable soil, as was the case here. Transplants were used, the spacing being 4 ft. × 4 ft. Planting was kept back 7 ft. from the surrounding larch; this distance was thought sufficient to prevent suppression from the larch which averaged 27 ft. in height and were lightly branched. The state of this area now after 18 years is rather interesting; a few points have been brought out bearing on the question of delayed beating-up. The larch have made very good growth and suffered but little further damage from wind or snow. They now average 55 ft.–60 ft. in height with 9–12 in. diam. butts.

The area was thinned (5th thinning) in 1932. The Sitka spruce have made rapid growth in the bigger areas; also, the centre trees in the smaller groups; but there has been serious suppression in the small groups, where these are less than 20 ft. wide; the larch branches are meeting over the Sitka, which became badly suppressed at 10 years and are nearly all killed out. The outside larch trees surrounding these Sitka areas have greatly responded to the extra light and space and have thrown out much heavier side branches. Many of the Sitka are becoming suppressed as far back as 14 ft. from the larch. I think it would have been a good plan to have used a shade-bearing hardwood species for the outside rows, preferably beech, but these may not have been available at that time.

GALE DAMAGE TO PLANTATIONS IN ARGYLL.

By A. H. Gosling.

On the night of 18–19th October, 1935, a severe gale with heavy rain occurred which caused considerable damage to plantations. The wind was S.W. when the gale started, but veered to N.W. before it was at its height in the early morning of the 19th. Gusts of 75 m.p.h. were recorded in the west of Scotland, and there is little doubt that the wind reached a velocity of 100 m.p.h. in the more exposed places. At the time the ground was sodden owing to weeks of wet weather.

Plantations formed by the Commission (*i.e.*, 14 years old and younger) suffered little serious damage, the chief trouble being in connection with blown scrub. Scrub areas are often thinned but seldom clear felled before planting. The overhead cover is removed gradually by ringing the trees at the time of planting and in the following year. It is always hoped that the branches of the killed trees will fall in small pieces, leaving a bare trunk which will itself fall later without causing damage. The gale of October upset calculation by blowing many ringed trees not rotten enough to break up when falling and also trees that had not been ringed. The damage to the young crop was generally negligible, but it was necessary to go to the expense of trimming roughly much of the blown scrub to relieve the crop beneath. At one forest this cost as much as £50, but it is estimated that this was much less than it would have cost to clear fell and burn the trees before planting. More windfall occurred in birch and alder scrub than among other species. Among alder, in particular, it was not uncommon to find trees broken off where they had been ringed.

It is interesting to note that of the older (acquired) plantations, European and Japanese larch 20–30 years suffered much more extensive damage than plantations of other species and ages. This experience is common to several forests. It should be stated that the areas of other species 20–30 years old is small, but probably sufficient to render the result of the gale significant.

In one case the windfall occurred when the wind was in the S.W., but more generally when the wind was from the N.W. though local variations are frequent. The damage in several cases has been severe.

The gale of last October occurred at a time when the larches were still in full leaf in Argyll. It is unusual for severe gales to occur when the larches are in full leaf, and this doubtless was an important factor contributing to the damage, but it is appropriate to consider in what way past treatment affected the damage done.

The damaged plantations had all been thinned during the period 1933–1935. In several cases there had been neglect previous to the first thinnings, but the plantations appeared young enough to recover and were responding well to thinning. The evidence appears to confirm the great importance of opening out European and Japanese larch plantations at an early age, so that crown development is not interfered with by overcrowding. If this is not done, when thinnings are under-

taken there is a very definite risk of windfall, even if thinnings are conducted with the greatest care. If the plantation is still at the stage when it will respond quickly to thinning, there is a period of several years following opening out, when the crowns are developing rapidly and there is not the normal relation between crown size and windfirmness. A gale at this time is not unlikely to throw the trees which show the most rapid recent development of crown.

Spring thinnings are usually preferred to autumn thinnings, but the evidence on this occasion is conflicting.

Note.—At one forest, 21-year-old Japanese larch, insufficiently thinned in early years, but not touched since 1932, suffered quite as badly as an adjacent and similar block which was slightly thinned a month before the gale. O. J. S.

FROST DAMAGE AT BENMORE, MAY, 1935.

By A. GRANT.

The Benmore plantations I believe suffered less severely from the frosts of May, 1935, than most areas owing to their proximity to sea and fresh water lochs. As a glance at the map will show, Benmore is particularly favoured in this respect, being intersected to the east and south by two arms of the Firth of Clyde, Loch Long and the Holy Loch, while inland seven miles of the Echaig Valley is taken up by Loch Eck.

Those plantations lying adjacent to the sea lochs were free from frost damage except for some slight scorching on areas above 600 ft. The plantations bordering on Loch Eck were very slightly affected below about 300 ft. elevation.

The frost damage was most severe on the higher elevations of Loch Eck side, and on the low lying portions of the Echaig Valley south of Loch Eck. In the Echaig Valley the species most seriously affected were *Tsuga* and *Abies nobilis* planted in P. 31. Although *Alnus incana* had been interplanted with these species, at 15 ft. spacing, to provide shelter for such an emergency, their beneficial effect was found to be practically nil. Norway spruce in this area escaped serious damage as their leading shoots had not come into growth. A peculiar feature was noted here among the Sitka spruce. Although the leading shoots had started into growth and the bud scales had become detached, the scales still adhered to the elongated shoot in the form of a little cap and effectually protected the young shoot from damage. On a plantation of N.S. at the northern end of Loch Eck, planted in P. 27 at 2½ ft. spacing, the plants, except where thinned for Christmas tree sales, had formed close canopy, and, as is often found in young plantations, some of the trees had reached a height of 7–8 ft., while others were only 3–4 ft. high. It was found that the smaller trees, although sheltered to a great extent by their dominant neighbours, suffered most damage, the taller trees being practically unaffected. Various theories may be advanced to explain this seeming paradox of Nature, and I should be very pleased to hear of some, particularly from foresters who may have experienced the same conditions. I may dispel one line of thought, however, by stating that the plantation is situated on a fairly steep slope with a S.W. aspect. One possible theory is that the taller trees were exposed to a movement of air, possibly a mild current off Loch Eck, which modified their frosted condition before the scorching rays of the sun reached them.

In the nurseries, where damage was slight and confined to 2–year beds of Norway spruce, Sitka spruce and tsuga, it was noted that damage did not occur until after the third night of frost. This is assumed to be due to radiation of heat from the soil vitiating the effects of the earlier nights' frost. This assumption is based on temperatures taken at Benmore Meteorological Station, where grass minimum readings were higher for the first three days than those taken at 1 ft. above soil level. An extract of the temperature readings referred to is given below. The frost was preceded by a period of bright sunshine and high day tempera-

tures which would have raised the soil temperature and accounted for the protective radiation of heat.

Minimum temperatures as recorded at Benmore Meteorological Station during frost period—15th to 18th May, inclusive—were :—

Date. 1935.	*Grass.*	*Above Soil Level* *At 1 ft.*	*At 5 ft.*	*Max. Day Temperatures.*
15th May	32°	27°	30°	53°
16th ,,	30°	27°	30°	50°
17th ,,	27°	25°	28°	49°
18th ,,	22°	22°	25°	52°

I wish to thank Mr. H. Watson for allowing me to use the above readings.

FROST DAMAGE AT FLEET, MAY, 1935

By R. R. DONALD.

The weather between 24th April and 15th May was very dry with bright warm sunshine. There were very slight showers on 2nd May but not sufficient to disturb tilth, and again on the 13th May there was slight rain about 9 p.m., but the wind was dry and cool.

On the 14th May there was very slight frost in the early morning followed throughout the day by cold northerly winds. On 15th May we awoke to to discover the most severe late frost experienced in recent years, which played havoc across Britain; at Dumfries, 33 miles from Fleet, the grass minimum temperature was 19°. About 9.15 a.m. rain began to fall and came on more heavily until about 3 p.m. The wind veered to north and soon reduced the beneficial effect of the rain. On the 16th there was more, but less severe, frost, the grass minimum at Dumfries being 27° but there was $\frac{1}{8}$ in. ice on glass in Fleet nursery; bright sunshine and drying winds prevailed on this day, while on the 17th we had cold dry northerly winds bringing occasional showers of sleet from the surrounding hills which were covered with snow. As small seeds were sown in the nursery on this date, one will gather that the rain or sleet had little effect on the tilth. The 18th May was dry with cold winds and on 19th May there was rain in the forenoon followed by dry north-easterly wind on the 20th. From this date until 2nd June there was a spell of bright, hot weather with cool east winds in the evenings. Such is an idea of the weather preceding and succeeding the frost damage; given rather fully to indicate the possibility of less severe damage had the frost been followed by a damp period instead of the drying winds. Ash transplants newly lined-out suffered badly but are making wonderful recovery stimulated by periodic working of the soil and dressings of sulphate of ammonia. The damage done to these was according to time of flushing and not to exposure, elevation, etc., as one might expect, but it could be noted that where the branches of beech trees overhung a plot of ash, the damage was less immediately within range of the shade.

In the forest, the beneficial effects supposed to result from shade were rather disappointing. Generally speaking, there seemed to be no reason why certain plants were frosted and others were not, except for the date of flushing, but heavy grass and herbage seem to render trees in their midst more liable to frost, as plants on bare ground suffered less. The least damage of all was under fairly heavy coppice over ten feet high.

Naturally regenerated sycamore and planted sycamore suffered alike and only escaped a bad "scorching" where scrub was fairly heavy. Ash on the whole were badly blighted, no matter what their size, and even the big old trees of ash, beech and oak were blackened. European and Japanese larch suffered least of all and practically only on the side shoots. The beat-up plants of Japanese larch suffered a great deal more than the beat-up plants of European larch; Sitka and Norway

spruces of all ages were badly scorched ; elongated shoots of plants of these species in P. 28 were badly damaged, while leading shoots which were at the stage of having flushed but scarcely begun to elongate were untouched. In younger plants of the spruces very often both leading shoots and side shoots were badly damaged.

While this frost was the most severe late frost for a considerable time, and while it is to be hoped that we do not experience the like for many years to come, I should think it has given us cause to consider a few things relative to preventing serious damage.

It has been noticed now in Fleet Forest for two years that late frosts did not do much damage to plants which were planted anything from 4–12 ft. from a wall. It would seem that side shade, or perhaps more properly called side shelter, was very beneficial even to European larch and that coppice growth may well be encouraged provided it be not allowed to smother the plants. This side shelter scheme could be tried in nurseries also. High screens could be set up on the east side, or branches could be put in from north to south at intervals across the nursery. Screens of netting and branches could be made and kept in readiness so that they could be placed over beds when the local prophets forecasted late frosts. Efforts such as these would surely decrease heart-rending scenes such as we have witnessed this year.

HARDWOODS: DATE OF SOWING.

By R. R. DONALD.

As the aim of good nursery practice ought to be to produce the best possible plant for planting in the minimum of time at the minimum cost, it behoves us to take note of circumstances which favour or otherwise the welfare of the seedlings under our charge; not to bottle these notes up and forget about them, but to give others a peep at them and, what is even of greater importance, to take full advantage of them in endeavouring to secure better results in the following season. The few lines I am about to write are (as regards Fleet Nursery) merely the result of one season's observations.

Oak.—Small beds were planted with acorns at 2 in. × 2 in. in December, 1934, and in January, February and March, 1935. There was no great difference in time of germination, but sufficient to show a decrease in the height of the seedlings later on. At the end of the growing season the maximum height of the seedlings in all units was fairly constant, but there were more large seedlings in the December sowing than in the January sowing, and so on. Of course, the question arises here: is the date of sowing the cause? It may not be. There were three unit areas sown in each of the four months, average-sized acorns being taken in all cases, and equal number of acorns sown in each unit. The average weights of the acorns sown per unit for the different months were as follows:—

December sowing	.. ..	1 lb. 11 oz.
January ,,	.. ..	1 lb. 9 oz.
February ,,	.. ..	15 oz.
March ,,	.. ..	1 lb. –

The question arises in one's mind as to the relationship between vitality and weight. Presumably the difference in weight was due to variation of moisture content. When the acorns were gathered in what one might term a "green" state, they were sprinkled over with very dry sand to lessen risk of heating and subsequent moulding and rotting. In early spring, when it was noticed that the outer shells of the acorns were wrinkling slightly as if they were getting too dry, they were periodically slightly sprinkled with water to keep them "fresh."

This may account for the slight increase of weight from February to March. This may all be only surmise on my part, but it is the result of observation. Might I be allowed to say here that it would be of great interest to us in the North to have the views of our Southern colleagues on the subject of storage of hardwood seeds?

Regarding frost damage, it would seem that no matter at what time acorns are planted they do not germinate early enough to suffer greatly from late frosts.

Beech.—In the nursery small beds of beech were sown in December, 1934, January, February and March, 1935. The seed germinated on 21st March, 4th April, 22nd April, and first week of May respectively.

Vermin seemed to attack seed sown in January more than seed sown in any of the other months.

The frost of 15th May completely wiped out the beech seedlings of all sowings except the March one, only a few of the seedlings in the latter being killed. One would have thought that a plant from a seed germinating on 21st March would be strong enough to withstand any frost by 15th May, or at least have sufficient dormant buds left to shoot away when the tips were killed, but, alas! it was not so. Beech nuts, sown from early April onwards until early May, showed very good growth, a general maximum being about 15 in.

From this year's experience it would appear that April is early enough for sowing beech.

Sycamore.—When the beech mast was gathered, there was a small proportion of sycamore seed unavoidably gathered with it. The beech-sycamore mixture was sown from 12th to 14th March. The beech germinated very well—but little could be seen of the sycamore seedlings. Then came the devastating frost of 15th May, and in the following few days our beautiful beech beds faded away into nothingness. On the other hand, the sycamore grew on and on, attaining normal height. Sycamore seed was sown until about 3rd April. The conclusion arrived at was that the seed of this species ought to be sown not later than early in March if possible, and certainly before beech.

It may be of interest here to show the result of a small unofficial experiment tried, on the effect of tilth on germination of sycamore. Five beds were prepared, ranging from one of very fine tilth to one which had received very little preparation. During August, sample strips were counted in each bed, the number of seedlings being as follows, starting from the bed of finest tilth: 177, 140, 122, 108, 95.

UPKEEP OF DRAINS.

By J. F. Macintyre.

In offering suggestions on this operation, which I have rarely heard discussed outside the Commission, I shall probably lay myself open to criticism, but only general remarks are made, except as regards one case which I have studied closely.

Existing drains on an area to be taken over are usually a good guide as to what is best for future use. It has been noticed that in the Border country there are three distinct periods of drain types, broadly divided into 100 years old, 50 years old, and present-day systems. The oldest type closely resembles our own modern idea, but the middle one was of a type which I find causes a good deal of trouble. I refer to drains cut at right angles to the contour line. As an instance, a drain of this type received a normal repair, and after eight years it had become 6 ft. deep and 4 ft. broad, with erosion still increasing. On the other hand, a drain laid out correctly is still doing good work after being in use for 80 years, with only 1 ft. of an increase in depth.

Where a system of turfing has been carried out, it is good policy to determine the number of drains to be left without repair, as it would be superfluous to repair all drains. Care must be taken in the case of a pure spruce stand not to overdrain the ground. A knowledge of the soil and subsoil can easily determine this. It is impossible to lay down a fixed distance between the drains which are to be maintained, but on broad lines I would suggest on a gentle slope 20 yds. apart, the distance to be reduced as the slope decreases. Where no change in the vegetation has taken place, it may be necessary to repair all drains on bad ground. These references are purely relative as cases may arise that demand special attention. I will refer to a case later. In a pure spruce plantation where the stand is fairly even, it is advisable to repair drains the year before the canopy is formed. The drains thus cleared remain good over a long period, and the operation is useful when " brushing up " or thinning is carried out.

The special case to which I referred was of a site that I noticed while visiting what was one of the best stands of Sitka spruce in Scotland. The site was of peat, on boulder clay. This special type occurs frequently in Scotland, and should be subject to special treatment in its early stages, the natural flora being *Spiraea ulmaria*, *Conium maculatum*, *Carduus palustris*, *Juncus communis*, *Deschampsia caespitosa*, etc. The peat is black or blackish brown, and is both damp and friable. Spruce is quickly established on this type and growth is rapid. Trees on such ground are seldom really windfirm, and damage may take place after thinning has been carried out. All drains should be kept running and, in particular, watch should be kept for springs in the vicinity, so that spring water may be carried off the area as quickly as possible. The reason for this is that such water has the faculty of developing this type of peat. Springs are often used to improve pasture land, the usual

system adopted being to lead the water into a drain and block it, and allow it to spread over the slope below. This is systematically carried out until quite a large area is treated and improved.

The question of cost of repairs is too large a subject to treat here, but I find that these are best done on day-work, as it is difficult to determine a price where there are different types of soil and vegetation. To say that no drain at all is better than a drain out of repair is perhaps a sweeping statement, but it may be justified when one considers that the natural movement of the water has been interfered with. Experience shows that frost holes can be made less dangerous if drains are kept in repair. Plantations on ground similar to the particular case I have referred to should be well drained, as they are often liable to severe frost damage, especially in the case of Sitka spruce.

PEAT COMPOST EXPERIMENT.

By G. J. Thomson.

During this season an experiment has been started at Knapdale Forest for the purpose of composting peat, the idea being to try and make the peat suitable for application to the nursery, thereby raising the humus content to the substitution of farmyard manure, which, locally, is of poor quality, expensive, scarce and difficult to transport.

A very good type of hardwood peat was found in a bog within easy reach of the nursery. It is interesting that the upper 6 in. or more of peat in this bog was of a bad sour type, which had to be discarded.

Seven heaps were made, each treated differently with artificial fertilisers as breaking-up agents, and in some cases, with drain tiles to assist aeration.

Heap measurements were 5 ft. high, with 7 ft. base, 3 ft. top and 12 ft. long. These were treated with :—

(1) 10 cwt. basic slag dusted in between each layer of peat, so that each layer would have about the same amount.

(2) 5 cwt. basic slag, as above.

(3) Control. (Not treated in any way).

(4) 2 cwt. dried blood, as above.

(5) Same as No. 1 but with drain tiles laid through the heap at 2 ft. intervals, and 2 ft. from ground level.

(6) Same as No. 4 but with drain tiles as in No. 5.

(7) Same as No. 3 but with drain tiles.

The operation was carried out in April, 1935, and a few notes on the procedure may be of interest.

After the site had been selected, it was first necessary to run two drains, 5 ft. deep, through it, with 15 yds. between them. The heaps were made on either side of these drains at right angles, with 21 ft. between them, 7 ft. in centre for heap, 3 ft. on either side in case they should slide, and 4 ft. on either side of that for the trench from which the peat was taken ; the ends of these trenches open into the drains. The two rows of heaps between the drains take up about 8–10 yds., which leaves 5–7 yds. between them for loading purposes.

The top layer was stripped to a depth of 1 ft. and rejected, the peat below this being used for the heaps ; one layer of peat, then one layer of basic slag or dried blood as the case may be.

Very wet weather was experienced during the operation, and it may be worth noting that the water ran from the drain tiles which are on a slight slope from the centre.

Surveying the heaps in July, it is interesting to note how they are cracking up, and how aeration is taking place. By pushing a stick into the centre of the heaps it is noticeable that those having drain tiles leave less moist peat adhering to the stick than those without. Also, those with dried blood seem to be breaking up more rapidly than those with slag.

Once the heaps have dried out sufficiently, it is thought that some method of pulverising will be adopted before the peat is used for nursery dressing, but this and subsequent results will afford material for a note in the Journal another year.

Note.—Later observations confirm that physically the heaps with dried blood have broken down best. The Research Officer is arranging an experiment at Tulliallan to determine the effect upon conifer seedbeds of peats from the various heaps.

O. J. S.

MISCELLANEOUS NOTES.

Provenience of Larch Seed.

Dr. Hans Burger, a member of the staff of the Swiss Forest Research Institute at Zurich, has recently published* an interesting report on some experiments carried out in Switzerland with races of European larch. The experiments were started by Engler in 1900 with a series of plots of native larch from elevations ranging from 2,300–6,900 ft. above sea-level and continued in 1906 with a similar series of Swiss origins to which was added a plot of Scottish larch from seed obtained through the late Professor Somerville of Oxford. No particulars are given as to exact origin, but the latitude (57° 40′) suggests Speyside as a possible source of the seed. At the age of 16 years the Swiss larches were so heavily attacked by canker that practically all were killed; the Scottish larch was also attacked but recovered quickly and there were no casualties.

In another series, planted in 1911 near Magglingen in the Jura, the position 18 years after planting was as follows :—

	Bonaduz.	*Untervaz.*	*Mons.*	*Scotland.*
Deaths (per cent.) ..	87	80	93	11
Mean height (ft.) ..	13	14·4	13·8	18·5

Within the next five years practically the whole of the Swiss lots died out, the Scottish origin alone remaining as a moderately good, completely stocked crop, individual trees in which showed outstandingly good form. It should be observed that in each of the experiments the planting site was at a relatively low elevation and Burger describes the climate of these sites as more or less of the oceanic type. The Alpine larch, on the other hand, grows under conditions which are definitely continental. It is to this fact that Burger ascribes the failure of the Swiss origins and the relatively outstanding success of the Scottish larch. Conclusions from results in other countries are always dangerous, but if Burger's explanation is correct we have further support for the preference of larch of true Scottish origin for planting under our typically oceanic conditions. Equally the prejudice against Alpine larch finds further justification.

It need scarely be emphasised that the strong resistance of the Scottish larch to canker is a very important character; the crucial period for larch is not the first few years after planting but is round about the 15th year. The existing provenience plots in England and Scotland have mostly over 10 years to run before they reach the point when they can give really useful information.

W. H. Guillebaud.

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* Hans Burger. Einfluss der Herkunft des Samens auf die Eigenschaften forstlicher Holzgewächse. IV. Mitteilung Die Lärche. (Aus den *Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen.* Vol. 19. No. 1. 1935.)

Twisting of Japanese Larch Shoots.

In April, 1933, the Chairman and the Assistant Commissioner visited a P. 29 plantation of Japanese larch in Radnor Forest and remarked upon the curious curvature of many of the leading shoots. Three of the plants were thereafter kept under observation, the method employed being to trace on a piece of paper held against the plant the actual outline of the shoot. Drawings were made during 1933 and 1934 at monthly intervals, from May to October, by the District Officer, Mr. F. E. B. de Uphaugh.

In May, 1933, the leading (P. 32) shoots were all strikingly curved; by the end of June two out of the three shoots observed showed some signs of straightening, but the third was still very crooked. At the end of August one of the shoots was perfectly straight and the other two only slightly curved. The succeeding month showed that the process of correcting the bends had gone too far, the shoots were now curved in the opposite direction, a tendency which was still more pronounced at the end of October when the last record was made.

The same (P. 32) shoots were again recorded in the following year (P. 34). The May drawings bore little resemblance to those of the previous October, showing that the shoots had gone on curving during the intervening period. During June, 1934, curvature was active and by the end of the month all the shoots had a very different outline from that at the beginning. During the remainder of the growing season there was a general tendency towards straightening up, but in one of the plants the curve actually was more pronounced in October than it was in the previous month. The P. 33 and P. 34 shoots varied in total length from 32 to 54 in., they were not charted in the same way as the P. 32 shoots, but are described in the report as crooked or very crooked.

It seems surprising that such active movement should be found to occur in the two- and three-year-old shoots of Japanese larch. Possibly these movements originated in the tree as reactions to the stimulus of light; they would doubtless have a useful function in a natural forest where there is often keen competition for any extra light available.

W. H. G.

The Divisional Officer, Mr. A. P. Long, has made the following observations on the above note :—

"I cannot attempt to explain fully the behaviour of the trees in question, but in the first place there is a very considerable amount of wind in the valley in question. Secondly, as is most noticeable in the case of tortrix deformation, when a plant tries to recover it always overshoots the vertical in apparently what is an effort to re-establish the centre of gravity by a process of balancing. Thirdly, practically all the Japanese larch in Radnor Forest show some tendency to corkscrew. Hitherto I have generally associated this with very rapid growth, but it does not appear to be so in this case. Some of the ident. numbers have a much more pronounced twist than others, and one might be inclined to ascribe this fact to some very marked contrast between present conditions and the natural habitat. Fourthly, it looks as though

the vast majority of the twisted trees will eventually straighten themselves out, though I am very doubtful about the most vigorous specimens."

Treatment of Pyrus Seeds.

In the 1935 issue of this Journal reference was made to the treatment of seed of certain species of *Pyrus* previous to sowing. The following note gives details of this treatment, as applied at Kennington Nursery.

It has been found in the case of *Pyrus aucuparia* that, by separating the seed from the fruit immediately after collection and either sowing immediately or stratifying in sand, a complete germination takes place in the following spring. Unless the seed is separated, full crops are not obtained until the second year. The method adopted has been to collect the fruits when fully ripe, place in water and crush by hand until the seed is free and the fruit reduced to pulp. Further separation is then effected by placing the whole mass in a culinary sieve and washing until all the fleshy substance is dispersed. The seed is then sown or stratified immediately. Three species have been dealt with up to the present with the following results, in each case from 1 lb. of fruits :— *Pyrus aucuparia*, 2,400 seeds ; *Pyrus aria*, 700, and *Pyrus intermedia*, 600.

W. G. Gray.

Simplified Girdling.

Girdling or " ringing " of birch scrub is most easily done when the sap is ascending in the early spring. It frequently happens, however, that the operation has to be carried out in winter. At Longart Forest a simple and efficient method of winter girdling is in use. The tool employed is an axe, preferably a light one. The workman makes one horizontal cut on the trunk at a convenient height, followed by another about 5 in. lower. He hits the bark between these two cuts sharply, with the back of the axehead, and a section of bark " flies " off the trunk. The operation is repeated until the tree is girdled. This can be done very quickly and the entire bark is removed, leaving none of the inner bark which so often maintains life in girdled trees. Smooth stems are most easily dealt with in this way, of course, but fairly rough trees may also be girdled by this method.

F. W. A. Oliver.

Collection and Cleaning of Beech Nuts.

Select a fairly open tree, clear away weed growth from underneath it if necessary before the mast falls ; when enough seed has fallen sweep up with a hard broom and put through a ½ in. sieve. Bag this up and then, if possible, procure an old type of winnowing machine from a farmer ;

on being put through this the light rubbish and empty husks will be blown away and small stones and earth will be screened, leaving a good sample of seed.

Seed collected in this manner for two seasons worked out at 3*d.* per lb.

E. C. KIBBLE.

PRUNING OF OVER-SIZED DOUGLAS FIR.

Some Douglas fir, which a few years ago were leader-pruned, have been compared with surrounding unpruned trees. An article on the same trees appeared in the 1932 Journal, having been written by Mr. R. E. Pallett, who was at that time Forester at Bruton. Reference should be made to this, but the history of the trees, briefly, is as follows.

The plantation was made in P. 30 and consisted of 2+3 Oregon Douglas fir about 4 ft. high, the trees being pitted. After one growing season (in April 1931), a small group, not specially selected, had this one year's growth of the leading shoot pruned back to a suitable bud. After this therefore the unpruned trees had the advantage of the one year's growth after planting, which averaged about 6 in. over the pruned trees.

The growth of the trees seems to have been adversely affected for two years after pruning, but later their average yearly growth increased in comparison with the untreated trees. Allowing for the first year's growth which was practically all cut off there is little difference now in the total height of the two.

In general appearance and habit there is now little or nothing to choose between the pruned and unpruned trees. The pruning marks can now only be seen on careful scrutiny of the trunks. Mr. Pallett mentioned that after pruning, as was to be expected, a number of double and treble tops formed. Presumably these were subsequently removed as there is no sign of them now.

In order to get further information on this question of pruning after planting, an examination was made of some Douglas fir plots at Brecon. These were 2+2+2 planted P. 30 at 1,150 ft. elevation on fairly uniform grass/bracken ground. There are three plots: (*a*) leader-pruned, (*b*) side-pruned, (*c*) control. It was found impossible, with no previous knowledge of the plots, to distinguish with certainty, so alike were they in habit. It was not at all easy to find the point of pruning on the stems, though this was complicated by a considerable amount of frosting back causing double leaders in both plots. The average height of the trees in both plots was about 8 ft., and trees were generally growing healthily considering altitude, exposure, etc. The side-pruned trees were more easily distinguishable. They averaged only about 5–6 ft. and though of fairly good colour had the appearance of being partially in check. Mortality was about equal in each plot.

The conclusions to be drawn with regard to the leader-pruning of large Douglas fir (back to a bud on the leading shoot) would appear to

be almost completely negative: it has little or no deleterious effect on the subsequent habit or growth of the tree, nor is there any advantage to be gained from it.

A fairly heavy side-pruning of living branches, however, seems to have a decidedly bad effect on the growth of the tree for a number of years.

R. COWELL-SMITH.

PLANTING OF DERELICT GRASSLAND.

One hundred and seventy acres of run-out pasture land, abounding in coarse grass, covered in many places with mole and ant hills and water-logged in its lower parts, formed part of the planting programme at Bourne Forest in P. 35. The method of treatment afforded an interesting example of the value of subsoiling when land, long unbroken by the plough, has to be tackled.

Lying fully exposed, save for the local shelter of a wood on its western side, this area presents an undulating appearance. The soil is a clay loam of great depth and is much compacted.

Ploughing commenced in December, when furrows, 4 ft. 6 in. apart, 15 in. broad and 5 in. deep, were turned. The objects of the ploughing, namely, the preparation of a broken-up and weathered medium for 1-year oak seedlings, was not, however, achieved by this method, which left a compact, clayey soil in the furrow and on the slice. Some 15 acres were treated in this manner at a cost of 5*s.* per acre. For the additional cost of 2*s.* 6*d.* an acre, the remainder of the area was sub-soiled, the slice being still 15 in.wide, but only 3 in. in depth. The sub-soiler worked 10 in. below the furrow, leaving an excellent friable loam into which a Schlich spade could easily be pushed. Rain and frost quickly weathered the soil and closed the cavity.

The spring months were devoted to planting with a mixture of oak and ash, the latter inserted in groups of 9 plants formed 25 per cent. of the crop. The oak were notched in with Schlich spades and the ash semi-pit-planted—all at 4 ft. apart in the rows. On the part ploughed in the ordinary manner, the plants were inserted through the slice, with the exception of a small number placed in the furrow.

Costs and losses on the two sections varied as shown below :—

	Sub-soiled Area.			*Ordinarily-ploughed Area.*	
	Planting.	*Death-rate.*		*Planting.*	*Death-rate.*
Oak	6*s.* per 1,000.	8 per cent.	Oak	9*s.* 6*d.* per 1,000.	85 per cent.
Ash	12*s.* 6*d.* ,, ,,	10 per cent.	Ash	15*s.* ,, ,,	30 per cent.

Subsequent growth has revealed the marked superiority of the plants on the sub-soiled area and dissections show that they possess much better root systems, having deeper tap roots and more fibrous secondaries.

Little weeding was required and, despite the May frosts and prolonged drought, growth has been very satisfactory. Planting costs, rate of survival and growth, all clearly show the value of the sub-soiler.

A. BIRKITT.

Effect of Peat on Plant Growth.

When deepening drains on peat land at Harwood Forest I have noticed the beneficial effect obtained by throwing the peat round the plants—Sitka spruce in this case. This effect is specially noticeable on a piece of ground about two acres in extent with peat to the depth of at least 10 ft.

The area was turf-planted in the spring of 1932, drains of ordinary depth being cut. These drains were deepened during the following year and the peat from the bottom thrown round the plants on one side of the drain only. On inspection 3 years later I noticed that the plants round which the peat had been thrown looked green and healthy and had made quite good growth while the remainder looked in check and decidedly yellow. As this piece of land is practically level the effect of draining could not account for the difference in growth. Possibly the peat thrown round the plants acts as a sponge, absorbing some of the moisture before it reaches the plant—excessive moisture being the main drawback on peaty land.

From these observations I feel it would be advisable when deepening drains to throw the peat to each side alternately. This would entail no additional expense and would benefit two rows of plants instead of one.

W. Hodgson.

Direct Sowing of Pinus contorta.

In April, 1928, it was decided to carry out an experiment with *Pinus contorta* where heather was newly burnt off an area of about 50 yds. square. The site chosen was on a gentle slope facing north on an elevation of 1,000 ft. The heather was duly burnt on the 27th April of that year, and the seed sown broadcast carefully over the area on the following day. There was no preparation of the soil; the seed was allowed to lie on top of the ashes and to germinate there. Unfortunately heavy rain fell a few days after the seed was sown, and the seed was washed into little groups, but in spite of this germination was good. When observations were made in August, 72 seedlings were found to the square yard; these were on the average from 1 to 1½ in. in height. There was nothing else worthy of note that year except that bilberry made its appearance with a few young heather plants; all the pine seedlings looked healthy.

During the winter of 1928–29 a number of seedlings disappeared, owing to frost-lift, and the plants' inability to take root again, owing to the hard nature of the soil. When the seedlings were counted in August, 1929, there were on the average 27 to the square yard and in height they averaged from 2 to 3 in. In November of that year these plants turned a deep blue colour and remained so through the winter 1929–30. The most noticeable feature during 1929 was the vigorous growth of heather which practically covered the whole area and bilberry also was very strong in patches.

Stock was taken again in August, 1930, when it was found that the number of plants per square yard was 17, most of the plants were of a

yellowish colour owing to the very wet season and had only grown about 1 in. ; the heather had grown considerably which made the plants difficult to find.

From 1930 to 1934 stock was taken regularly and the plants have remained at the same number per square yard ; they grew well, making an average of about 3 in. each year. The seasons of 1933 and 1934 were very dry, but the plants did not suffer in any way and kept their green colour, although in a few cases a yellowish colour was observed. The plants are now on the average 12 in. high, although the tallest plants are as much as 2 ft. in height.

The heather is now 8 in. high and in some places is almost as tall as the plants ; bilberry has practically disappeared, heather taking its place. It may be noted that blackgame have never made any attempt to attack these plants, and they have often been amongst them, while Scots pine planted nearby have been badly damaged. C. McNAB.

The plants in December, 1935, ranged from 12–40 in. in height. Many had made a growth of 16 in. in the current year. In some places the plants were still very close together, as many as 40 to the square yard being counted, having an average height of 30 in. It is proposed to thin out the crop, transferring some of the plants to bare parts of the area. J. K. MASSEY.

SPLITTING OAK LOGS FOR STAKES.

Foresters who are lucky enough to have some large oak on their areas which could be used for stakes might try splitting them with ordinary blasting powder. If the logs are very large, ordinary methods are difficult, as I have proved from experience.

The log should be bored midway between the ends and the hole made rather more than halfway through with a $1\frac{1}{2}$ in. auger. Powder is then poured in varying in quantity according to size of log ; about half-a-pound being sufficient for a large log. This is then rammed down tightly and a length of fuse put in ; on top of this a paper wad is inserted and the remaining space filled in, a little at a time, with dry chalk or dry brick rubble. Each lot should be tightly rammed. The fuse can then be lighted and the lighter retire to a safe distance. If the charge has been prepared properly the result should be a clean and complete split, much cleaner than with wedges and certainly with much less work. I have split a 10 ft. log of oak 2 ft. 6 in. in diam. quite cleanly with one charge of powder.

Among other trees which I have split successfully in this way were a large-sized yew and an ungainly beech which had fallen right across a fence track.

The best of blasting powder is that it may be obtained from almost any gunsmith, and is quite safe to use provided that ordinary precautions are taken. No detonator is needed so there is no danger when tamping

D. R. BEAUMONT.

Young Ash at Westbury

An area at Westbury of about 11 acres of P. 31 ash slopes towards the west and the ground is rather stiff overlying chalk, the chalk in some cases being only about 9 in. below the surface. The ash were about 12–18 in. high and well rooted. The generally accepted theory is that ash when young need plenty of shelter. Against this, however, is the fact that on two or three open spaces on this area the trees have done far better than anywhere else. When planted the ground was practically bare and in summer produced very little else but dogs' mercury. The plants grew right away from the start and some by the end of the summer of 1931 had put on from 1–2 ft. Many now are from 7–9 ft. high and very strong. I kept some of the best plants pruned which improved them considerably.

D. R. B.

Beech Growth under Coppice.

Most of the planted area at Westbury is under beech. Some of the ground carries a heavy growth of bracken and bramble and on the downs, thick grass. Many of the plants on such areas do not put on the growth observed on the bare ground although in some cases the plants used are older. An area of about 6 acres of P. 33, covered with thick coppice, was thinned to about half a crop and planted with beech 1+2. These in many cases have made very good growth and there have been few failures. A small portion of P. 32 planting was also planted this way with the same success, some of the plants being 3 ft. and 4 ft. high. This in my opinion is chiefly due to the fact that the overhead coppice has kept down the brambles which over-run the ground in a year or so. The overhead coppice also has the effect of drawing the plants up instead of pushing them down as heavy bracken and brambles do. Heavy bracken also once down remains sodden for weeks at a time which, of course, is very bad for the plants.

D. R. B.

Nurseries at Home or Away.

Owing to rather heavy losses during some seasons in planting Corsican pine, I decided to carry out a small experiment and compare losses in plants from the home nursery with those from away, or plants from Ringwood. At Wareham during the end of March, two half-acre plots were marked out and planted with C.P. 1+1 Ident. No. 33/25 size 3 in., 1,000 from each nursery. Each lot was exceptionally good, if anything, home plants having a finer root system. Home plants were lifted and planted on same day, away plants being lifted 3 days previous to planting. These were planted with garden spades. Losses were compared in December, 1935, and are as follows:—

Home losses 6·2 per cent. Away 5·4 per cent.

This tends to show that there was nothing in the idea, but it is only fair to say that the away plants came from a neighbouring forest and travelled by road straight from nursery to planting. The conditions were not very different from that of a large forest with the plantation in a remote position from the nursery.

One thing leads to another and, while making these observations, I compared this planting of home-grown plants which was made in the third week of March with some of the same batch of home-grown plants which were put in on the 22nd October, 1934. Both were spade-planted and of the same identification number. The early planting was made in dry weather with the soil very dry. The plants did extraordinarily well. I decided to compare growth, taking ½-acre plot and the ½-acre plot of home plants late planted. Measurements were taken in December, 1935, of 200 plants in each plot, every 5-in. plant being measured. Figures are as follows :—

Early planting, plants averaged 4½ in. Late planting 1·7 in.

A few of the best plants were : 1 plant of 9¾ in., 5 of 9 in., 2 of 8 in. and 14 between 7 in. and 8 in. This says much for the early planting of Corsican pine, in any case on the poor soil at Wareham.

S. W. COLWILL.

TURF PLANTING AND WEEVIL DAMAGE.

Extensive weevil trapping was carried out on 11·5 acres of turf-planted Sitka spruce last season. Though the traps (billets, bark and bundles of twigs) were carefully attended and regularly replaced, it was noticed during the very hot weather that quite a number of the plants were dying, and no sign of weevil damage visible on the stems. At first it was thought to be caused by drought but, on opening carefully the turf, it was found to be weevil damage. Quite a number of weevils were taken from the turf and the roots were badly damaged. This seems to raise the question : " Is it advisable to turf plant on any area where old pine has been growing ? " Personally I think not.

O. R. T. ASTON.

TREE ROPING.

Occasion for the use of ropes and blocks when felling is rare, but sometimes it is necessary. Having decided to fell the tree in a certain direction, the next consideration is to fix the tackle. Taking as a difficult example a tree leaning badly due north and the only available direction for fall as north-west, it is important to select the position for anchorage of the land block at a point west of south in order to direct its fall. Theoretically, south-west would be the correct position to set the land block, but this must be varied according to the balance of the crown of the tree.

Advantage should be taken of hitching to a standing tree or by means of a cart hook to a sound stub, for these are safest; but, should either be out of the required direction, then three stakes driven in

tripod fashion and lashed together would suffice or, better still, place a 6-ft. post horizontally in a trench at right angles to the direction of the ropes. The depth of the trench can be decided according to the expected severity of the pull, probably varying from 2 to 3 ft. deep, then remove sufficient earth to allow the ropes to slope to the bottom of the trench and fasten to the post.

It is usual to work two 9-in. pulley blocks, one single and one double with 100 ft. × ¾ in. diam. hemp rope, and in addition 50 ft. of 1-in. diam. hemp rope to secure the tree. Arranging the ropes calls for little explanation, except that simple knots should be made, otherwise after a heavy strain they will be found difficult to untie. One end of the rope can be made safe, well up in the tree, by passing it around the bole, looping it over the major portion of the rope and returning it twisted. At the other end, fix the double block by making a slip knot, but instead of hooking in the loop, do so in that portion of the rope which binds the loop. It will then be found that neither of these methods gives trouble to release after operations, even though the ropes tighten with greater strain.

Sometimes efforts with single and double blocks just fail to "turn" a tree, even with wedges "lifting" behind in the saw cut. Another single block added would give the extra power needed, but usually one would not be available for such an emergency. However, a substitute would be welcomed and opportunity is open to utilise a "witch block," which is actually a wych elm branch, stripped of its bark and possessing two separate double-pronged forks, which diverge approximately 2 ft. apart.

Having reversed the blocks to bring the double block down, fix the witch with the single block up in the rope. It will be realised that the fork at the smaller end of the witch prevents it from slipping out of the rope, while the lower fork functions as a "crook" to receive an extra running rope from the double block, so providing about a fifth extra power.

The branch of any tree may be selected as a witch, but wych elm is favoured for its toughness and open nature of branching, the latter being a point of importance when it is reckoned that an acute crook checks a running rope.

D. J. Davies.

Forest Fires and Water Supply.

Everyone will agree that if water is obtainable it is one of the most effective weapons against fire; a bucketful does its work surely, and there is not so much fear of subsequent outbreaks as there is when dry earth is employed. Many a forester can notice on his beat streams of water running through the plantations in the winter time varying in length from a short stretch to possibly several miles. For some months we watch this run away and perhaps clear any obstacles out of its course which may cause obstruction, but often when we come to a spell of dry weather, in the spring, we find the streams are nearly dry and the weapon we should like to make use

of has disappeared. To correct matters a few bags of cement or stone-work with a flood gate will provide a supply which can always be relied upon, the water can be let out when not required to enable one to clear the ditch and prevent it from becoming silted up. A watercourse through a plantation behind a flood gate also becomes a fire barrier. Cost no doubt would vary according to material available in certain districts, but sometimes the necessary work may be done for, say, £10, and this expenditure is well worth while. C. LEES.

TREATMENT OF RIDES.

When laying-out planting areas the rides are marked out 28 ft. wide, and on large areas this means a large acreage wasted and as it is too expensive to trim them all each year they constitute a danger during dry seasons, especially where public footpaths exist with the coppice bracken and grass on each side. These rides can be trimmed and burnt at a cost of 9*d.* per chain, and if 25 per cent. of these were cleared each year, in the event of a fire it would facilitate the work of extinguishing.

It would probably prevent the fire spreading to other compartments if there was a clear space 28 ft. wide to work from, and taking the cost of 9*d.* per chain into consideration it would be money well spent. As an alternative the rides could be planted up with two rows of Norway spruce; this would reduce the width to 12 ft. As the demand for Christmas trees is increasing, and they are a paying proposition, these would be weeded each year and produce revenue. The remaining 12 ft. could be trimmed at the same time at a very little cost, which would improve the general look of the plantations. A. E. WALKER.

COCCID ON OAK.

In August 1934 a coccid (*Coccus* (*Asterolecanium*) *quercicola*) was found in a P. 27 oak area; at this time it was thought that the attack was not serious but it has spread extensively to other areas. Some of the affected plants have died down to the ground, and others not so severely attacked have died back 12–18 in. The plants damaged last year which have died back to ground level have thrown out young shoots which strangely enough show no sign of the coccid on them. The plants lose their leading shoots and become mere bushes. This year the insect was not noticed until the second week of September and I would suggest that if it appears next year certain areas should be marked and the affected plants cut down to the ground, the cut material being burned, while the plants on other areas should be sprayed to prevent the spreading of the pest. A. E. W.

Note.—A recent note appearing in *Nature* regarding the occurrence of this pest in New Zealand is of interest. The scale attacks *Quercus pedunculata*, often causing serious injury to both old and young trees. The scale is also prevalent in the United States, where it is attacked by a Chalcid parasite, *Habrolepis dalmanni*. This parasite has been introduced extensively into New Zealand and is now well established.—W. H. G.

To Make Wire Netting Taut

When erecting wire netting for rabbit fencing, take two pieces of wood 2 in. by 4 in., cut a little longer than the height of the netting to be put up, then with a brace and bit drill holes about a foot apart, having one close to the top and bottom, then clamp the netting in between the pieces of wood, secure a fairly long chain to the top and bottom of the clamp and pull from the centre; with the wire strainer you can then get the netting as taut as you wish.

A. E. W.

Weeding young Oak Plantations.

I have had a fair amount of experience in the planting and care of young oak during the past 8–10 years, and I think the young trees are all the better if kept weeded until they are out of danger of strong weeds if a good plantation is to be produced.

Of course, it would depend on many things as to how long to weed, as circumstances may differ in many places. For instance, the soil may be excellent in one place while in another it may not be so good and therefore the young trees may not grow so fast as on the better soil. Then again the weed growth may differ. On some soils weeds are not particularly troublesome, but on others there is a very heavy growth of bracken, brambles, coppice shoots, etc. In the latter case weeding has to be done for a much longer period. I have in mind the P. 27 areas in Doward (Highmeadow) planted 3 ft. × 2 ft. with one-year-old seedlings.

These areas were kept well weeded for the first 3 years owing to the bracken, brambles, etc., which grew there. During the first and second years foxgloves were very prevalent and had to be kept in check owing to the leaves smothering some of the young plants. Very few of the trees were lost, but after the third year weeding had to be stopped owing to the belief that the trees would do more for themselves if left alone. The result was that hundreds of the trees died and gaps occurred.

When the time for cleaning came again, which was three years later, it was a very expensive job and the heavy crop of vegetation (coppice, etc.) made the work difficult. Honeysuckle had also gathered strength and the trees, having become weak and lanky, tended to fall over.

W. L. Christie.

Thinning Oak Plantations.

In Knockalls Wood (Highmeadow) there is an oak plantation of about 8 acres which was planted some 30 years ago with 1-year-old seedlings at a distance of 3 ft. × 2 ft. It is now being thinned for the third time.

It seems hard to believe that in patches there are gaps of 10 ft. and 12 ft., yet the canopy is almost intact. The trees are 25–30 ft. in height.

The instructions have always been to thin lightly, and only to take out dead and suppressed trees. The result is that one may come up against a group of 8–10 trees all about the same height, all of which are dominant. Round these groups the other trees are suppressed and

marked to be cut, hence the irregular spacing. In many cases if some of these dominating trees were taken out it would give more room to the smaller trees, but it may be that they are too far gone to recover sufficiently to keep up with the stronger ones ; also, there is the danger of strong winds blowing some over as they have not sufficient strength to stand up. The method adopted is nothing more nor less than a natural thinning.

It seems that in this class of plantation the thinning should have been started earlier, and some of the dominating trees removed, so as to favour the less vigorous ones. The remaining trees would then have strengthened themselves and developed better crowns, and thinning would not have been so liable to cause windfall. W. L. C.

Larch Disease in Highmeadow.

Owing to the scarcity of labour during the latter part of the war and a year or so after, it was found impossible to do the necessary cleaning of some of the young plantations in the Highmeadow Woods. These plantations still exist, but are poor specimens of what a larch plantation should be. At the present time owing to the cutting down of maintenance costs I am afraid most of our European larch plantations will be inferior in quality to those planted years ago. I have in mind trees planted 40–45 years ago as a catch crop with old oak. They have 60–80 ft. clean, straight stems, with little or no signs of disease. Will the plantations we are now tending compare favourably with these ? I doubt it !

Most of the E.L. planted during the last 20 years are badly diseased. In the old days trees were tended and anything that was doing damage or likely to injure them was taken out. When there is a large amount of coppice and strong bramble present I think it essential to keep the trees free, so as to let in the air and light, as larch is not nearly so liable to get disease if the branches die off naturally. This would mean extra expense, but in the long run it would pay.

When a plantation is badly diseased it is difficult and sometimes impossible to sell the produce of thinnings ; the colliery proprietors do not like diseased timber, nor do buyers of rustic poles, therefore it appears to me the best policy is to do all that is possible in the early stages to ensure a healthy and vigorous plantation.

W. J. Humphries.

An Appeal to Foresters.

Some years ago an article appeared in this Journal under the title of " From an Office Window at Whitehall," urging the desirability of improving efficiency and creating a better understanding between Foresters and the Commission's Clerical Staff. As one of the latter I appreciate this appeal and would like to stress it still further.

In reports on progress, fire, accident, etc., the more material information given the easier it is to deal with matters in the respective offices of the Commission.

Foresters are on the spot and see and understand the reason for what may appear to us to be high expenditure on some particular operation, but which, due to the special conditions existing locally, may be quite justifiable. In the absence of a note explaining the high cost it is not surprising that queries arise. These take up the time of the clerical staff and the men in the field and could often be avoided.

Sometimes a Forester is inclined to think when a query is raised that he is being "got at." This idea is altogether wrong. Nine times out of ten the enquiries are due to lack of information, and could be obviated by a brief explanatory note from the Forester in the first instance. I do not, however, mean to infer that a note will excuse constant high costs.

I think it is agreed that in all forest operations the Forester is the man who matters most. He has often to organise and carry out a great deal of work which eventually produces our established forests. Whether employed in an office or out-of-doors we are all doing our best to help the same good work along, and the more we do to help and understand each other the easier and more pleasant our work will be.

T. W. Morris.

Sowing green Ash Seed.

Our experiment was carried out in Fairoak Nursery in July and August of 1934 in the sowing of green ash seed. Six sowings were made at intervals of from 4 to 9 days from the 10th July to the 10th August. The seed was sown the same day as collected or the day following. In all 91 lb. were sown. The results a year later (August, 1935) are shown below :—

Date Sown. 1934.	*lb.*	*Treatment.*	*Seedlings.*
10th July	10	Manure hot bed.	Nil.
19th ,,	8	,, ,, ,,	Nil.
28th ,,	8	,, ,, ,,	3
28th ,,	16	Covered with manure and soil.	113
2nd Aug.	24	Soil only.	267
10th ,,	25	,, ,,	5,600

The first sowings were made much too early. The best results were obtained from the sowing on the 10th August, when the seed had developed but not ripened off. It may be worth while when seed is plentiful and cheap to collect and sow about that date.

J. Roberts.

Former Students at Parkend.

An effort is being made to compile for inclusion in "The Deansday Book" a complete list of students from the opening of the School in

1904 onwards, and to keep the list up to date. All ex-students are asked, therefore, to provide the following information :—

Years at the School (*e.g.*, 1904–06, 1932–34).
Name.
Grade and Forest.
Present address.

They should subsequently notify changes of address when these occur.

Any information which can be given about students who did not enter the service of the Commission will be appreciated.

Replies should be addressed to the Editor of Deansday Book, School of Forestry, Parkend, Lydney, Glos.

W. D. R.

Employment of Woodcutters.

Many of our forests are approaching the stage when thinning of the earlier formed plantations will become a regular part of the routine of operations. I would suggest that, where such is the case, the recruitment of skilled woodcutters might be receiving attention and any forest workers' holdings, vacant or becoming vacant, should be earmarked for men of this type. One such man in each scheme would suffice, as he could train the young men during the early stages of thinning and, what is perhaps more important, he could keep the cutting tools in efficient working condition.

The principal source of supply for this type of labour is to be found in woodmerchants' camps, where the finest axe-men in the country are to be found. It would be advisable to engage married men only and preferably those with young families, as they are more likely to become permanent than those without "encumbrances." "Paterfamilias" finds that having a fixed address gives his family educational and other advantages which they could not expect in the nomadic life of the woodmen's camp. As a rule these men are hard-working, intelligent, intensely loyal, and make excellent small-holders when they settle down.

A. Grant.

Recreation Hall, Forest of Ae.

As most of the Forestry Commission areas are situated in remote parts of the country the employees have few amusements and social activities to while away the long winter evenings. The erection of a recreation hall has been made possible here by the kindness of the Forestry Commission in granting a site, presenting an old hut and a small sum of money. In spite of donations received from several well-wishers, the money was insufficient to carry out the necessary alterations and an appeal was made to the residents in the district, who provided prizes and subscriptions, and a free-gift scheme was started. With the money derived from this, along with the proceeds

from a whist drive and dance, sufficient funds were raised to buy material for the renewal of the floor, the roof, and other parts damaged when the hut was dismantled and moved.

All the labour was given free and carried out during the summer evenings; everyone lent a helping hand, and although there were no skilled men present at any time the hall was completed in less than four months, under the zealous supervision of the Forester. Paint was provided by the Forestry Commission to decorate the exterior and others assisted with the painting of the interior. On the night it was opened all who had taken part must have felt honoured by the tributes paid to their handiwork by the large number of people who attended the ceremony.

It is now two years since the hall was opened and during that period much pleasure has been derived from whist drives and dances held in it, as a result of which financial aid has been given to various local charities. All the functions held in the hall have been very successful, and their popularity has spread for many miles around. A bowling club has been formed, and the cherished desire of each member is to win the cup and have his name inscribed upon it. To do without a hall now would be regarded with dismay, and it is to be hoped that in time recreation halls will be established in many remote areas belonging to the Commission, so that others may participate in the enjoyment they bring to lonely valleys and glens.

C. PARLEY.

SHREWS ATTACKING VOLES AT GLENFINART.

On Sligrachan Hill, on the 20th May, 1935, while repairing drains in early afternoon, I saw a shrew attack and kill a young vole. About a month later (on 19th June) I witnessed a similar attack, and on this occasion there were others with me. There was no doubt about the sanguinary character of the attack for the prey was actually disembowelled. On both occasions the weather conditions were good, the sun shining brightly.

I made a point of trapping a shrew and some voles and keeping them together, but in captivity there was no sign of conflict and with the death of the animals my experiment ended. D. Ross.

THE SUCCESS OF TSUGA.

Do we as foresters give *Tsuga heterophylla* a proper place in the forest? I have found in my experience that as a forest tree it is quite successful.

On the Novar Estate, this species was extensively used for underplanting larch which had been severely damaged by canker. The larch were subsequently cut as poles for an electrical scheme, the minimum size for the poles being 35 ft. long, and 5 in. diam. at the small end. During felling the tsuga were sometimes drawn down with the larch and kept down until the larch were trimmed and removed but comparatively few of them were broken or uprooted; they also withstood the dragging

operations excellently, very few being skinned where the poles rubbed against them. The felling of the larch poles took place in the spring of 1926. I revisited the plantation early in 1935 and found the tsuga in flourishing condition.

Tsuga planted at Glenfinart in 1931 in two small plots have also grown well. The plots are both sheltered, but one is in the open and the other is surrounded by birch scrub. The plot in the open has an average height of 3½ ft. The soil is gravelly owing to a stream having burst its banks and flooded the surrounding ground. The plot surrounded by birch scrub has an average height of 6 ft., the soil being a good sandy loam.

At Glenfinart Nursery, tsuga seed was sown in 1934; the seedlings, now in their second year, only average 2½ inches in height, the frost of May, 1935, affected them severely.

D. R.

A good Crop of Norway Spruce.

During 1935 a stand of old Norway spruce was being felled by a contractor, and I was asked to take a few measurements of trees and note anything of interest. The stand was 100 years old, and was grown on good loam overlying carboniferous sandstone and rocks of the coal measure type. There were about 120 to 130 trees per acre, and this spacing allowed a certain number of birch, etc., to grow up through the lower part of the stand. These were responsible for the good state of fertility of the soil. There was no appearance of pruning having been resorted to. The trees had at least one-third of their height in the form of an active crown. Increment for the last few years had been very slow; from 7 to 9 rings per inch. At least 50 per cent. of the large trees suffered from heart rot, and from 8–14 ft. had to be counted as practically useless. The tallest tree was 125 ft. high with a mean quarter-girth of 17¼ in. over bark. The largest was 100 ft. with a timber measurement of 87 ft. by 20¼ in. quarter-girth over bark. This gave a content of 247 cu. ft. About 20 per cent. of the trees reached the 100 ft. mark, and would average from 140–170 cu. ft. per tree.

I examined the sawn timber fairly closely and found it was of very good quality. One consignment of keel blocks, 12 ft. × 14 in. × 14 in., was as good as any spruce I have seen. Cones were collected and sent to Tulliallan for seed extraction.

J. F. Macintyre.

Red Deer.

A good many of the Commission's forests in Scotland have to be fenced against deer, and a few remarks about them, however unnecessary in Scotland, may interest foresters in England. Deer, where numerous, can be one of the forester's greatest pests, and they are as cunning as

foxes. They have to be excluded with a 6-ft. fence, and any weak parts in the fence are soon discovered by the deer. High ground and knolls to the outside are vantage points from which the animals may spring. A river or a loch for a boundary will not stop them. Part of our area here adjoins Loch Ard, and it was thought fencing could be saved by leaving the lochside unfenced. But it was no use; deer swam right across the loch mostly under cover of darkness, and left again at dawn. A fence had eventually to be put up to keep them out.

When stormy weather drives deer down off the hills, and when grass gets scarce in the winter, they are difficult to deal with, and, in spite of everything that is done, some will get through the fences. Trappers have to keep a good look out, and shoot every one that gets in. Sometimes herds of 200 or 300 deer are seen outside our enclosures. In the winter of 1933–34, we fenced in about 2,000 acres of hill land which was frequented by deer, and before we finally closed in the fence we had some drives with the whole squad to remove as many as we could, but they were difficult to drive from an area where they had lived for years. We had, finally, to close the fence and, to clear the area, we had to shoot the remainder.

The damage that red deer can do in a forest is considerable; they eat off the leaders and side shoots of the plants, they are very fond of Douglas fir, and on newly-planted areas they will pull up the plants and leave them lying about half chewed. Roe-deer do similar damage, and they are more dificult to keep out of plantations, being smaller and more nimble. Both kinds do considerable damage by rubbing their antlers on young trees and completely barking them.

S. H. A. Paterson.

Direct Sowing versus Planting.

Very often controversies arise about the above, and some foresters maintain that more direct sowing should be done, in fact, some even say that it should be done on a large scale. As I have had the experience of direct sowing in various forests, I would like to make a few observations.

First of all, I will give the advantages of direct sowing; these may be said to be that it is a cheaper method of forming a plantation than planting, that it saves nursery work, it is more natural, and there is no check of lifting, lining-out in nursery, and planting in the forest. Against direct sowing there is the disadvantage that it cannot be done on all soils, only on selected areas where the soil is suitable. In most cases more preparation has to be done to the soil than for planting. There is the damage which can be done by mice, small birds and game birds. Mice and birds can do considerable damage; coating the seed with red lead does not stop them. Small birds and game birds also do considerable damage by dust-bathing in the seedbeds during dry weather; in fact, they can often do so much damage to an area as to render direct sowing a failure.

There is also the problem of frost-lifting ; on small areas, if the seed is sown in plots, this can be guarded against to a certain extent by sticking in twigs and branches round each plot, and taking them off in spring. On a large scale the cost of this would be almost prohibitive, and it does not always prove absolutely effective. I have seen whole areas, even where protected, with the seedlings of each plot thrown out after a severe frost, and I may say that, next to a forest fire, this is one of the worst sights that could meet a forester's eyes. Putting the seedlings back is a slow expensive job. On some areas they may have to be hand-weeded as the seedlings are liable to get choked, and on the average they require more ordinary weeding than planted trees.

On the whole there are more disadvantages than advantages in direct sowing, and the method should be adopted very cautiously. It is interesting to have small plots of direct sowing in each forest where conditions are suitable, and I have seen some nice plantations formed in this way, but to attempt it on a large scale is, I am afraid, fraught with more difficulties than many realise. S. H. A. P.

Planting on Moorland Areas.

On moorland areas one often gets a fair amount of wet, peaty ground growing heather which has to be drained and mounded. This ground at the time of planting, which is usually very soon after draining, has not had time to dry, and is often very wet and spongy, and the only species which would normally suggest itself is Sitka spruce, as the ground would appear to be too wet for Scots pine. At Loch Ard Forest in P. 30 we planted some small areas of this kind with a mixture of Sitka spruce and Scots pine and, as the plants are to-day, everything is in favour of Scots pine. They are about 3 ft. high and of good colour, while the Sitka spruce are about the same size as they were when they were planted, are yellow in colour, and look as if they might die. In P. 32 a small wet area was drained, the vegetation being molinia and other grasses, with a small percentage of heather ; the latter could hardly be seen in places. The ground being wet, Sitka spruce seemed to be the most likely plant, but we planted it with a mixture of Sitka spruce and Scots pine, as we reckoned it would dry out, and that the heather would predominate, and it did. The Scots pine are doing splendidly, while the Sitka spruce are like the ones mentioned above.

I believe in planting Sitka spruce where it will grow, and while one knows that it will sometimes hang for years and then get away, usually, if planted in an acid peat, the plants turn yellow and go back each year, until they finally die and are replaced with Scots pine.

It would appear certain that allowance should be made for the change which is likely to take place in two or three years' time. In other words, if some of the moorland areas could be drained a year or so before planting, some of the heather-clad, peaty ground which was wet at the time of draining would have dried out and could carry at once a crop of Scots pine. S. H. A. P.

Moles.

Moles, where numerous, are a source of annoyance both in the forest and in the nursery. They are very fond of frequenting places where the soil is being dug up or disturbed, and during the planting season they can do a lot of harm on newly-planted areas. They burrow right under young plants and very often destroy the roots, but the worst damage they do is in leaving the plant "hung" as it were, with the roots dangling in the runs, and there are often plants left like this with no signs of the moles showing till dry weather sets in when the plants die. Moles push up a good many plants and one can easily see where they are working, and often the plant leans over to one side.

It is advisable, where moles are working, to send men or boys over the area to firm the plants. In nurseries moles burrow down the lines, and they are destructive in seedbeds; when this occurs, the lines and seedbeds have to be gone over every morning, and the plants put back again. A preventive measure is to dip pieces of paper in paraffin or creosote and put them in the runs; this will drive away moles from a nursery, and sometimes even from a planted area, but it is only a temporary measure. The best thing is to trap them systematically, thus reducing their number. S. H. A. P.

Blackgame.

In various forests with which I am familar and where there are blackgame there have been small areas, usually on old cultivated grassland, where whole flocks of these birds make their roosting places. It is sometimes difficult to get trees established on these small areas, as the birds in remarkably short time, even in an hour, reduce to ground level plants of the normal planting size. What I have tried and found successful is to lift some large plants about 3 ft. high from the edges of the plantations nearby and use these on the threatened areas. Large plants from a nursery will do if they can be got.

Another method if there is any brushwood about is to scatter some of this over the ground and plant amongst it. This tends to keep the birds off the area, as they avoid roosting amongst material of this kind. They like dry bare ground where they can see about them as soon as it becomes daylight. S. H. A. P.

Frost Damage at Knapdale.

In spring, 1935, damage by frost was fairly general in the open and slight to nil under scrub but varying with density. On the whole the damage was not so bad here as on more inland areas.

Flushing side shoots of spruces were killed, but in most cases terminals were not so far advanced, and escaped. In many cases, now that adventitious buds have come away, one can hardly realise that things looked so bad. Some isolated spots, however, suffered severely as, for instance, on a fairly high ridge which is exposed to the sea where *Abies nobilis*,

P. 35, have been completely killed. Lower down the same ridge an experimental plot of eucalyptus has been very badly damaged, and many deaths have occurred, but some plants are breaking again from the base. These plants had just been received and had been heeled in when the frost period arrived and, although under scrub, were damaged. Another particularly bad patch was in a P. 34 bog open to the sea and only a few feet above sea level; here, recovery of Norway and Sitka spruces is slow, but there are no actual deaths due to frost.

In a similar bog in P. 31, Oregon alder which had been used in 1935 to beat up the Norway spruce were all killed; they were commencing to flush and do not show any signs of coming again at the bottom. Some ash in P. 34 had their first leaves browned but the growing point was not affected; sycamores were similar.

To summarise, it may be said that spruce suffered most, larch was not affected, hardwoods but slightly, and these have fully recovered, except Oregon alder (recently planted) and the eucalyptus plot.

G. J. THOMSON.

FROST DAMAGE TO ALNUS OREGONA.

Some 7,000 1-year seedlings were planted on Greskine Forest (C. 15, P. 35) at an elevation of 680–720 ft., the aspect being E. and S. of the site, fairly well sheltered from wind. The average height of the plants when planted was 2 in., being seedlings from Benmore, received in good condition, having been well packed in moss. Planting was completed by 11th April, 1935; the terminal buds had commenced to burst into leaf at the time of planting.

The weather at the time of planting was dull, with frequent heavy showers of rain; these conditions prevailed until near the end of April, frost being registered in the locality several mornings at the end of the month. By this time buds had burst into full leaf, but little damage was done other than the outer edge of some of the leaves becoming brown and shrivelled.

On May 10th all the plants were looking well. Frost was registered on the mornings of 13th May, and from the 15th to 18th; 7 deg. were registered on the 15th. Snow fell to the depth of 3 in. on the morning of the 17th.

On May 18th the seedlings had been severely frosted, the leaves being a dark brown colour and hanging as though wilted. On going over the 3½ acres on 28th May, it was found that by gripping the shoots between two fingers the bark peeled off a large number of the seedlings right down to the roots, while on others the bark peeled off to within about ½ in. from the surface of the turf. From one to three minute, living buds could be seen above the surface of the turf; under normal conditions these buds would have been dormant.

On 3rd June it was found that the 2 deg. of frost on the morning of 31st May had done further damage by killing off a large percentage of the plants that had previously been only partly damaged. The

percentage of deaths has been estimated at 70. The plants that survived the frost are from 2–7 in. in length, the shoots having sprung from buds at the base of the plants.

The type of soil that the plants have grown in has evidently had little or no effect so far as frost damage is concerned, as there is no difference between those on peat and those on mineral soil. P. BROWN.

PRE-GERMINATION OF ACORNS.

In the autumn of 1933 a small quantity of acorns was gathered on Fleet Forest and surrounding district. These were stored in a room with concrete floor and were sprinkled over with sand. It was noticed during the winter that a few of the acorns were sprouting. As the proportion was small, no particular attention was paid to the pre-germination, and the sprouted acorns were planted in mixture with non-sprouted ones. However, when the seedlings were being lifted in winter, 1934–35, it was noted that some of them had one long tap root, while others had forked roots, and a good many had fibrous roots. Thoughts were then turned to the intentional pre-germination of oak.

In the autumn of 1934 acorns were gathered in larger quantities and stored in sand on a concrete floor. Owing to the very mild winter a large proportion of these acorns sprouted, and the sprouts attained a length of about 3–4 in. In the spring of 1935, 500 pre-germinated acorns and 500 non-germinated were planted in adjacent lines in the nursery.

The following counts at different times are of interest :—

Date.	Pre-germinated.		Non-pre-germinated.	
	No. of seedlings.	Percentage.	No. of seedlings.	Percentage.
17th June ..	364	72·8	217	43·4
12th July ..	413	82·6	293	58·6
August ..	433	86·6	318	63·6

The above table shows that pre-germination of the acorns results in earlier and, on the whole, better germination.

The shoots of all the seedlings were measured and the average length of the seedlings from the pre-germinated acorns was 5·8 in. against 5·6 in. for seedlings from non-germinated acorns.

At different periods since August the roots have been examined, and the results are as indicated in the first paragraph. It is rather unfortunate that owing to frost the plants could not all be lifted and classed according to type of root and amount of fibre, before this short article was sent in, but a short report on the roots may follow in another Journal.

From what has been put forward it would appear that the pre-germination of acorns results in production of a more useful type of plant.

R. R. DONALD.

LIST OF TECHNICAL STAFF.

Headquarters.

At 9, *Savile Row, London, W.*1.
Story, Fraser, Education and Publications Officer.
Guillebaud, W. H., Chief Research Officer.

At Imperial Forestry Institute, Oxford.
Macdonald, James, Research Officer, England and Wales.
Sanzen-Baker, R. G., District Officer.

At 25, *Drumsheugh Gardens, Edinburgh.*
Macdonald, J. A. B., Research Officer, Scotland.

England and Wales.

Assistant Commissioner's Office (55, *Whitehall, London*).
Taylor, W. L., Assistant Commissioner.
Ross, A. H. H., District Officer (Acquisitions).
Pearson, F. G. O., District Officer (Utilisation).

Division 1 (*Chopwellwood House, Rowlands Gill, Co. Durham*).
Hopkinson, A. D., Divisional Officer.
Batters, G. J. L., District Officer.
Fossey, R. E., District Officer.
Thom, J. R., District Officer.
Good, G. H., Estate Officer.

Division 2 (15, *Belmont, Shrewsbury*).
Long, A. P., Divisional Officer.
Fairchild, C. E. L., District Officer.
De Uphaugh, F. E. B., District Officer.
Best, F. C., District Officer.
Smith, R. H., District Officer.

Division 3 (*Beacon House, Queen's Road, Bristol*).
Scott, Frank, Divisional Officer.
Ryle, G. B., District Officer, Higher Grade.
Broadwood, R. G., District Officer, Higher Grade.
Cowell-Smith, R., District Officer.
Backhouse, G.W., District Officer.
Haldane, W. D., District Officer.

Division 4 (*Grand Buildings, Trafalgar Square, London*).
Felton, A. L., Divisional Officer.
Lowe, George, District Officer, Higher Grade.

Stileman, D. F., District Officer.
Muir, W. A., District Officer.
Rouse, G. D., District Officer.

Division 5 (*Llandaff Chambers, Regent Street, Cambridge*).
Jones, E. Wynne, Divisional Officer.
Connell, C. A., District Officer.
Cownie, F., Estate Officer.
Cadman, W. A., District Officer.
Ross, J. M., District Officer.

Division 6 (*The King's House, Lyndhurst, Hants*).
Young, D. W., Deputy Surveyor.
Forbes, R. G., District Officer, Higher Grade.
MacIver, L. E., District Officer, Higher Grade.
Yarr, W. J., Assistant to Deputy Surveyor.

Division 7 (*Whitemead Park, Parkend, Lydney, Glos*).
Popert, A. H., Acting Deputy Surveyor.
Forster Brown, W., Deputy Gaveller (Mines).
Wylie, N. A., District Officer.
Roper, John, Survey Clerk.

School for Forest Apprentices.
Russell, W. D., District Officer (Instructor).—Parkend, Lydney, Glos.

SCOTLAND.

Assistant Commissioner's Office (25, *Drumsheugh Gardens, Edinburgh*).
Murray, J. M., Assistant Commissioner.
Cameron, John, Land Agent.
Mackie Whyte, J.P., District Officer (Acquisitions).
Webster, John, District Officer.
Chard, J. S. R., District Officer.

Northern Division (51, *Church Street, Inverness*).
Fraser, James, Divisional Officer.
Mackay, J. W., District Officer.
Oliver, F. W. A., District Officer.
Beresford-Peirse, H. C., District Officer.
Spraggan, D. S., District Officer.
Gibson, W. N., District Officer.

North-Eastern Division (12, *North Silver Street, Aberdeen*).
Steven, H. M., Divisional Officer.
Newton, L. A., District Officer, Higher Grade.

Bird, D. H., District Officer, Higher Grade.
Warren, A., District Officer.
Watt, A., District Officer.

South-Eastern amd Western Division (53, *Bothwell Street, Glasgow*).
Sangar, O. J., Divisional Officer.
Whellens, W. H., District Officer.
Gosling, A. H., District Officer.
Macdonald, J. M., District Officer.
James, J. E., District Officer.

School for Forest Apprentices.
Watson, Harry, District Officer (Instructor).—Benmore, Argyll.

FORESTERS.

England and Wales.

Name.	*Grade.*	*Name.*	*Grade.*
Division 1.			
Anderson, T. E.	Head	Everitt, F. W.	II
Weir, A. B.	I	Simpson, G. A.	II
Bewick, W. J.	II	Liddell, Joseph	II
Anderson, J. T.	II	Frank, Harold	II
McNab, Colin	II	Massey, J. K.	II
Gough, W. R.	II	Rowell, James	II
Hodgson, William	II	Scott, J. F.	II
Division 2.			
Butter, Robert	Head	Lomas, John	II
Shaw, J. L.	Head	Edwards, D. T.	II
Jones, H. W.	I	Jones, David	II
Anderson, J. W.	I	Jones, Alfred	II
Fraser, Robert	I	Evans, J. E.	II
Roberts, W. G.	I	Reese, W. H.	II
Harris, W. A.	II	Watkins, Stanley	II
Harrison, Percy	II	Wilkinson, W. E.	II
Brown, G. H.	II	Tucker, E. J.	II
Cowe, J. F.	II	Pye, W. E.	II
Division 3.			
Williams, John	I	Harrison, Phillip	II
Squires, C. V.	I	Caddy, Thomas	II
Hollis, G. W.	I	Edwards, L. T.	II
Wallington, H. J.	I	Wellington, C. R.	II
Laney, Horace	II	Carnell, Reginald	II
Pritchard, Roderick	II	Jones, W. E.	II
Jones, A. H.	II	Lewis, T. H.	II
Pallett, R. E.	II	Young, H. C.	II
Wild, P. W. S.	II		

England and Wales.—continued.

Name.	*Grade.*	*Name.*	*Grade.*
Division 4.			
Dyer, H. C.	I	Aston, T. H.	II
Nelmes, F. J.	I	Phelps, S. E.	II
Wallington, A. W.	I	McKenzie, Colin	II
Richards, G. H.	II	Kirkup, J. T.	II
Butler, Robert	II	Hyett, Samuel	II
Cottenham, W. C.	II	Halsey, H. R.	II
Gulliver, G. H.	II	Reid, Duncan	II
Division 5.			
McGlashan, John	I	Parry, A. A.	II
Tribe, William	I	Smith, J. J.	II
Hendrie, T. F.	II	Wyatt, Lionel	II
Clark, J. S.	II	Jackson, W. V.	II
Bewick, Robert	II	Birkett, Albert	II
Johnson, Harry	II	Button, G. H.	II
Gilson, R. B.	II	Saunders, H. J.	II
Price, Alfred	II		
Division 6.			
Forgan, William	Head	Adams, J. H.	II
Aston, O. R. T.	I	Colwill, S. W.	II
Hale, W. J.	I	Kennedy, J. B.	II
Parker, F. H.	II		
Division 7.			
Smith, Frank	Head	Adams, Isaac	II
Humphries, W. J.	I	Watson, Frank	II
Lewis, Tom	I	Lees, George	II
Williams, D. N. (School)	I	Morgan, T. R.	II
Walker, A. E.	II	Roberts, E. James	II
Christie, W. L.	II	Davies, J.	II
Taylor, G. J.	II	Little, T. E.	II

Scotland.

N. Division.			
Anderson, William	Head	Cameron, Roderick	II
McEwan, James	I	Stewart, P. C.	II
Murray, William	I	Mackenzie, John	II
Mason, William	I	Mackintosh, Alexander	II
McClymont, William	I	Gordon, James	II
Mackay, Kenneth	I	Munro, George	II
Macintosh, William	I	Mackenzie, George	II
Macdonald, Donald	II	Mackie, A.	II
Drysdale, Alexander	II	Murray, Robert	II
Gunn, John	II	Mackay, William	II
Kennedy, John	II		

Scotland.—continued.

Name.	*Grade.*	*Name.*	*Grade.*
N.E. Division.			
Cameron, John	Head	Kennedy, J. M.	II
Shaw, Robert	Head	Murray, G. J. A. M.	II
Lamb, J. A.	I	Mackay, William	II
Edwards, Johnston	I	Kennedy, J. A. M.	II
Mitchell, F. M.	II	Robbie, James D.	II
Robbie, John D.	II	Scott, John	II
McConnell, James	II	Ross, W. L.	II
Corbett, John	II	Ritchie, M. A.	II
Allan, James	II	Milne, W. G.	II
Ross, Allan	II	Urquhart, D. J.	II
Allan, Thomas	II		
S.E. and W. Division.			
Paterson, S. H. A.	I	Grant, Alastair	II
Simpson, A. N.	I	McDonald, J. D.	II
Macintyre, J. F.	I	Watson, James	II
Cameron, Hugh	I	Sinclair, Laurence	II
Reid, J. M.	I	Graham, J. McK.	II
Fraser, A. M.	I	Steele, R. P.	II
Graham, Alexander	I	Munro, Duncan	II
Calder, J. M.	II	Macrae, A. D.	II
Cameron, Alistair	II	Stoddart, W. F.	II
Donald, R. R.	II	Brown, Peter	II
Macmillan, Hugh	II	Mackay, Angus	II
Macrae, Murdo	II	Ferguson, J. M.	II

Research and Experiment.

Gray, W. G. (Oxford)	II	Mackenzie, A. M. (Headquarters)	II
Grant, Alexander (Edinburgh)	II	Maund, J. E. (Oxford)	II

Farquhar, James (Edinburgh) II

REGISTER OF IDENTIFICATION NUMBERS.

FOREST YEAR, 1935.

The order of arrangement is as follows :—

Serial numbers (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.

35/1 14 lb. ; *Juglans nigra ;* 1934 ; England (Kent) ; gift from J. Harper.

35/2 2¼ lb. ; *Nothofagus obliqua ;* 1934 ; Chile ; gift from Chilean Government.

35/3 1¼ lb. ; *Nothofagus procera ;* 1934 ; Chile ; gift from Chilean Government.

35/4 11 lb. ; *Abies cephalonica ;* 1934 ; Greece (Mt. Aenos, Cephalonica) ; gift from Grecian Government.

35/5 1 lb. ; *Nothofagus obliqua ;* 1934 ; Chile ; gift from Duncan, Fox & Co.

35/6 1 lb. ; *Nothofagus procera ;* 1934 ; Chile ; gift from Duncan, Fox & Co.

35/7 3 oz. *Nothofagus dombeyi ;* 1934 ; Chile ; gift from Duncan, Fox & Co.

35/8 432 lb. ; *Quercus rubra ;* 1934 ; Holland (Guelders) ; Nederlandsche Heidemaatschappij.

35/9 1,998 lb. ; *Pinus laricio* var. *corsicana ;* 1934. ; Corsica (Valdoniello, altitude 3,900–4,600 ft.) ; J. Grimaldi ; 99·3 ; 33+12.

35/10 250 lb. ; *Pinus pinaster ;* 1934 ; Corsica (Restonica Valley, altitude 1,100–2,500 ft.) ; gift from J. Grimaldi.

35/11 2 lb. ; *Quercus libani ;* 1934 ; Lebanon (Wadi Fisséné, Baalbek) ; gift from Forestry Branch, Jerusalem.

35/12 100 lb. ; *Larix europaea ;* 1934 ; French Alps (Altitude 4,200 ft.) ; Vilmorin-Andrieux ; 98·5 ; 44+4.

35/13 295 lb. ; *Pseudotsuga douglasii ;* Canada (New Westminster, Lower Fraser, British Columbia, altitude 16 ft.) ; Canadian Government ; 97 ; 79.

35/14 1,241 lb. ; *Picea sitchensis ;* 1934 ; Canada (Massett, Queen Charlotte Islands, British Columbia, sea level) ; Canadian Government ; 97 ; 82.

35/15 108 lb. ; *Picea sitchensis ;* 1934 ; Canada (Skidegate, Queen Charlotte Islands, British Columbia, sea level) ; Canadian Government ; 89·7 ; 79.

35/16 55 lb. ; *Abies grandis ;* 1934 ; Canada (Oyster River, Campbell Lake, British Columbia, altitude 550 ft.) ; Canadian Government ; 98·4 ; 49.

35/17 25 lb. ; *Pinus contorta ;* 1934 ; Canada (Prince George, British Columbia, altitude, 1,870 ft.) ; Canadian Government ; 98 ; 89+2.

35/18 8½ lb.; *Pinus contorta;* 1934; Canada (Tekwa, Smithers. British Columbia, altitude 2,000 ft.); Canadian Government.

35/19 1 lb.; *Pinus contorta;* 1934; Canada (Quesnel, Williams Lake, British Columbia, altitude 1,750 ft.); Canadian Government.

35/20 1 lb.; *Pinus contorta;* 1934; Canada (Vavenby, Clearwater, British Columbia, altitude 1,500 ft.); Canadian Government.

35/21 7½ lb.; *Pinus contorta;* 1934; Canada (Shuswap, Salmon Arm, British Columbia, altitude 1,200 ft.); Canadian Government; 99·2; 93+1.

35/22 1 lb.; *Pinus contorta;* 1934; Canada (Hazelton, British Columbia, altitude, 1,150 ft.); Canadian Government.

35/23 12 lb.; *Tsuga heterophylla;* 1934; Canada (Massett, Queen Charlotte Islands, British Columbia, sea level); Canadian Government; 95·4; 61+8.

35/24 4½ lb.; *Tsuga heterophylla;* 1934; Canada (Skidegate, Queen Charlotte Islands, sea level); Canadian Government.

35/25 29 lb.; *Alnus oregona;* 1934; Canada (Massett, Queen Charlotte Islands, British Columbia, sea level); Canadian Government.

35/26 1¼ lb.; *Alnus sitchensis;* 1934; Canada (Skidegate, Queen Charlotte Islands, British Columbia, sea level); Canadian Government.

35/27 1 lb.; *Arbutus menziessii;* 1934; Canada (Point Atkinson, Vancouver, British Columbia, sea level); Canadian Government.

35/28 500 lb.; *Picea excelsa;* 1934; Austria (Inn Valley, Northern Tyrol, altitude 1,900–2,600 ft.); J. Jenewein; 95·4; 80.

35/29 250 lb.; *Larix europaea;* 1934; Austria (Inn Valley, Northern Tyrol, altitude 1,900–2,600 ft.); J. Jenewein; 91·9; 41+2.

35/30 292 lb.; *Picea excelsa;* 1934; Denmark (Jutland); J. Rafn & Son; 99·1; 86.

35/31 56 lb.; *Picea excelsa;* 1934; Germany (Black Forest, Freudenstadt-Hord-Nagold, altitude 1,470–2,300 ft.) J. Rafn & Son; 98·2; 76.

35/32 10 lb.; *Pinus montana* var. *uncinata;* 1934; Denmark (Jutland); J. Rafn & Son.

35/33 3 lb.; *Cupressus macrocarpa;* 1934; U.S.A. (California); J. Rafn & Son.

35/34 1 lb.; *Picea alba*; 1934; Denmark (Jutland); J. Rafn & Son.

35/35 3 lb.; *Acer campestre;* 1934; Italy; J. Rafn & Son.

35/36 4 lb.; *Quercus cerris;* 1934; Denmark (Lolland); J. Rafn & Son.

35/37 1¼ lb.; *Eucalyptus gunnii;* 1934; Australia; J. Rafn & Son.

35/38 4 lb.; *Picea omorica;* 1934; Servia (Sarajewo, altitude 2,600 ft.); J. Morawitz & F. Kluger.

35/39 655 lb.; *Picea sitchensis;* 1934; U.S.A. (Olympic Peninsula, Western Washington); Manning Seed Co.; 91; 73.

35/40 245 lb.; *Larix europaea;* 1934; Central Alps (altitude 2,300–3,300 ft.); Silvaterra (Wallpach-Schwanenfeld); 85; 49+2.

35/41 452 lb.; *Picea exelsa;* 1934; Northern Italy (Valley of Eisack, altitude 2,300–3,000 ft.); Silvaterra (Wallpach-schwanenfeld); 94·2; 62+4.

35/42 1¼ lb.; *Picea sitchensis;* 1934; Canada (Campbell Lake, British Columbia, altitude 550 ft.); Canadian Government.

35/43 ¼ lb.; *Pseudotsuga douglasii;* 1934; Canada (Bella Coola, British Columbia, altitude 500 ft.); gift from Canadian Government.

35/44 ¼ lb.; *Pseudotsuga douglasii*; 1934; Canada (Campbell Lake, British Columbia, altitude 550 ft.); gift from Canadian Government.

35/45 50 lb.; *Alnus incana;* 1934; Austria (Inn Valley, Northern Tyrol, altitude 1,600–2,000 ft.); J. Jenewein.

35/46 312 lb.; *Pinus laricio* var. *corsicana;* 1934; Corsica (Valdoniello, altitude 3,300–4,600 ft.); O. J. Rossi; 99·4; 54+2.

35/47 197 lb.; *Larix europaea;* 1934; Silesia (Sudeten); H. Hanel; 89·7; 40+1.

35/48 22½ lb.; *Thuya plicata;* 1934; U.S.A. (Pierce County); gift from Manning Seed Co.; 97; 3.

35/49 4½ lb.; *Tsuga heterophylla;* 1934; U.S.A. (Pierce County); Manning Seed Co.

35/50 1¼ lb.; *Tsuga heterophylla;* 1934; U.S.A. (Mt. St. Helen); Manning Seed Co.

35/51 9 lb.; *Abies grandis;* 1934; U.S.A. (Pierce County); Manning Seed Co.

35/52 1 lb.; *Pinus monticola;* 1934; U.S.A. (Central Oregon); Manning Seed Co.

35/53 10 lb.; *Pinus contorta;* 1934; U.S.A. (Eastern Washington); Manning Seed Co.

35/54 21½ lb.; *Pinus contorta;* 1934; U.S.A. (Oregon); Manning Seed Co.; 96·8; 13+63.

35/55 3 lb.; *Sequoia gigantea;* 1934; U.S.A. (California); Manning Seed Co.

35/56 20 lb.; *Juglans regia;* 1934; France; Vilmorin-Andrieux.

35/57 3 lb.; *Alnus glutinosa;* 1934; France; Vilmorin-Andrieux.

35/58 514 lb.; *Larix leptolepis;* 1934; Japan (Nagano); S. Ando; 98·7; 65+11.

35/59 70 lb.; *Pinus contorta;* 1934; U.S.A. (Williamson River, Klamath, Oregon, altitude 3,400–5,000 ft.); J. B. Woods; 93·9; 39.

35/60 30 lb.; *Robinia pseudacacia;* 1934; Hungary; J. Rafn & Son.

35/61 2 lb.; *Chamaecyparis lawsoniana;* 1934; Denmark; J. Rafn & Son.

35/62 1 lb.; *Sequoia sempervirens;* 1934; U.S.A.; J. Rafn & Son.

35/63 1 lb.; *Sequoia sempervirens;* 1934; U.S.A. (California); gift from Manning Seed Co.

35/64 5 lb.; *Alnus oregona;* 1934; U.S.A. (Washington); J. B. Woods.

35/65 30 lb.; *Tsuga heterophylla;* 1934; U.S.A. (Washington); J. B. Woods; 98·4; 37+13.

35/66 6 lb.; *Picea excelsa;* 1934; Rumania; gift from Rumanian Government.

35/67 6½ lb.; *Cryptomeria japonica;* 1934; Japan; J. Rafn & Son.

35/68 5 lb.; *Ulmus campestris;* 1934; Spain; gift from Spanish Government.

35/69 1,004 lb.; *Pinus sylvestris;* 1934; England (East); own collection.

35/70 2 lb.; *Nothofagus procera;* 1934; Chile; gift from Chilean Government.

35/71 2 lb.; *Nothofagus obliqua;* 1934; Chile; gift from Chilean Government.

35/72 2 lb.; *Nothofagus dombeyi;* 1934; Chile; gift from Chilean Government.

35/73 528 lb.; *Fagus sylvatica;* 1934; England (North); own collection.

35/74 1,327 lb.; *Fagus sylvatica;* 1934; England (Midlands); own collection.

35/75 1,227 lb.; *Fagus sylvatica;* 1934; England (East); own collection.

35/76 7,854 lb.; *Fagus sylvatica;* 1934; England (South); own collection.

35/77 2,196 lb.; *Fagus sylvatica;* 1934; England (West); own collection.

35/78 30 lb.; *Juglans regia;* 1934; England (Midlands); own collection.

35/79 224 lb.; *Juglans regia;* 1934; England (West); F. Smith.

35/80 2 oz.; *Larix leptolepis;* 1934; England (South); own collection.

35/81 250 lb.; *Fraxinus excelsior;* 1934; England (Midlands); own collection.

35/82 850 lb.; *Fraxinus excelsior;* 1934; England (East); own collection.

35/83 388 lb.; *Fraxinus excelsior;* 1934; England (South); own collection.

35/84 160 lb.; *Fraxinus excelsior;* 1934; England (West); own collection.

35/85 50 lb.; *Fraxinus excelsior;* 1934; Wales (Mynydd Ddu); own collection.

35/86 50 lb.; *Fraxinus excelsior;* 1934; England (Eggesford); own collection.

35/87 10 lb.; *Betula alba;* 1934; England (North); own collection.

35/88 60 lb.; *Betula alba;* 1934; England (East); own collection.

35/89 47 lb.; *Acer pseudoplatanus;* 1934; England (West); own collection.

35/90 100 lb.; *Acer pseudoplatanus;* 1934; England (East); own collection.

35/91 15 lb.; *Acer pseudoplatanus;* 1934; Wales (Mynydd Ddu); own collection.

35/92 25 lb.; *Acer pseudoplatanus;* 1934; England (Brendon); own collection.

35/93 200 lb.; *Quercus sessiliflora;* 1934; England (North); own collection.

35/94 196 lb.; *Quercus sessiliflora;* 1934; England (West); own collection.

35/95 300 lb.; *Quercus sessiliflora;* 1934; England (East); own collection.

35/96 5,625 lb.; *Quercus sessiliflora;* 1934; England (South); own collection.

35/97 3,739 lb.; *Quercus pedunculata;* 1934; England (Midlands); own collection.

35/98 10,261 lb.; *Quercus pedunculata;* 1934; England (West); own collection.

35/99 19,544 lb.; *Quercus pedunculata;* 1934; England (South); own collection.

35/100 8,000 lb.; *Quercus pedunculata;* 1934; England (East); own collection.

35/101 20 lb.; *Quercus pedunculata;* 1934; England (Bruton); own collection.

35/102 35 lb.; *Quercus pedunculata;* 1934; England (Halwill); own collection.

35/103 50 lb.; *Quercus pedunculata;* 1934; Wales (Brechfa); own collection.

35/104 1,815 lb.; *Castanea sativa;* 1934; England (South); own collection.

35/105 100 lb.; *Castanea sativa;* 1934; England (West); own collection.

35/106 48 lb.; *Castanea sativa;* 1934; Wales (Mynydd Ddu); own collection.

35/107 1½ lb.; *Cryptomeria japonica;* 1934; England (South); own collection.

35/108 ¾ lb.; *Cryptomeria japonica;* 1934; England (Bodmin); own collection.

35/109 ½ bush. cones; *Cryptomeria japonica;* 1934; England (West); own collection.

35/110 10 lb.; *Carpinus betulus;* 1934; England (East); own collection.

35/111 140 lb.; *Carpinus betulus;* 1934; England (West); own collection.

35/112 3 bush. cones; *Alnus incana;* 1934; England (West); own collection.

35/113 10 oz.; *Alnus incana;* 1934; Wales (Crychan); own collection.

35/114 4 lb.; *Alnus glutinosa;* 1934; Wales (Llantrisant); own collection.

35/115 2 lb.; *Alnus glutinosa;* 1934; England (Bodmin); own collection.

35/116 2 lb.; *Thuya plicata;* 1934; England (Bodmin); own collection.

35/117 7 lb.; *Thuya plicata;* 1934; England (Dartmoor); own collection.

35/118 4 bush. cones; *Thuya plicata;* 1934; England (West); own collection.

35/119 $\frac{3}{4}$ bush. cones; *Pinus radiata;* England (West); own collection.

35/120 2 lb.; *Chamaecyparis lawsoniana;* England (Halwill); own collection.

35/121 $3\frac{3}{4}$ lb.; *Chamaecyparis lawsoniana;* England (Brendon); own collection.

35/122 3 lb.; *Chamaecyparis lawsoniana;* Wales (Penllergaer); own collection.

35/123 86,500 transplants; *Pinus sylvestris;* crop year unknown; origin unknown; English Forestry Association.

35/124 79,000 transplants; *Pinus sylvestris;* crop year unknown; origin unknown; Horticultural and Botanical Society.

35/125 11,000 transplants (2+2); *Pseudotsuga douglasii;* crop year unknown; origin unknown; Liverpool Corporation.

35/126 79,500 2-yr. seedlings; *Fagus sylvatica;* crop year unknown; origin unknown; English Forestry Association.

35/127 12,400 transplants; *Fagus sylvatica;* crop year unknown; origin unknown; Col. McClintock.

35/128 1,500 transplants; *Fagus sylvatica;* crop year unknown; origin unknown; English Forestry Association.

35/129 40,000 transplants; *Picea sitchensis;* crop year unknown; origin unknown; Liverpool Corporation.

35/130 200,000 2-yr. seedlings; *Picea sitchensis;* crop year unknown; origin unknown; Government of Northern Ireland.

35/131 82,000 2-yr. seedlings; *Pinus sylvestris;* crop year unknown; Scotland (Speyside); G. Brown.

35/132 12,000 2-yr. seedlings; *Pinus laricio* var. *corsicana;* crop year unknown; Scotland (Renfrewshire); gift from Sir John Stirling-Maxwell.

35/133 36,500 2-yr. seedlings; *Larix europaea;* crop year unknown; Swiss Alps; Government of Northern Ireland.

35/134 53,500 2-yr. seedlings; *Larix europaea;* crop year unknown; Scotland (Altyre); Government of Northern Ireland.

35/135 55,000 transplants; *Picea sitchensis;* crop year unknown; origin unknown; W. Duff, Forfar.

35/136 20,000 transplants; *Picea sitchensis;* crop year unknown; origin unknown; T. & W. Christie, Forres.

35/137 7 lb.; *Larix europaea;* 1934; Gordon Castle, Morayshire; own collection.

35/138 91 lb.; *Larix europaea;* 1934; Auchlunkart, Morayshire; own collection.
35/139 120 lb.; *Larix europaea;* 1934; Longmorn, Morayshire; own collection.
35/140 14 lb.; *Larix europaea;* 1934; Monaughty, Morayshire; own collection.
35/141 168 lb.; *Larix europaea;* 1934; Carron-on-Spey, Morayshire; own collection.
35/142 41 lb.; *Larix europaea;* 1934; Letterfourie, Morayshire; own collection.
35/143 584 lb.; *Larix europaea;* 1934; Lethen, Morayshire; own collection.
35/144 182½ lb.; *Larix europaea;* 1934; Drummuir, Morayshire; own collection.
35/145 198 lb.; *Larix europaea;* 1934; Advie, Morayshire; own collection.
35/146 45 lb.; *Larix europaea;* 1934; Blackhills, Aberdeenshire; own collection.
35/147 177 lb.; *Larix europaea;* 1934; Kirkhill, Aberdeenshire; own collection.
35/148 180 lb.; *Larix europaea;* 1934; Dunbennan, Aberdeenshire; own collection.
35/149 99 lb.; *Larix europaea;* 1934; Beaufort, Inverness-shire; own collection.
35/150 20 lb.; *Larix europaea;* 1934; Belladrum, Inverness-shire; own collection.
35/151 7 lb.; *Larix europaea;* 1934; Inverness-shire; own collection.
35/152 29 lb.; *Larix europaea;* 1934; Roschaugh, Ross-shire; own collection.
35/153 34 lb.; *Larix europaea;* 1934; Salen, Argyllshire; own collection.
35/154 ½ lb.; *Larix europaea;* 1934; Benmore, Argyllshire; own collection.
35/155 127 lb.; *Larix europaea;* 1934; Drummond Hill, Perthshire; own collection.
35/156 11 lb.; *Larix europaea;* 1934; Strathyre, Perthshire; own collection.
35/157 25 lb.; *Larix europaea;* 1934; Murthly, Perthshire; Murthly Estate.
35/158 4½ lb.; *Larix europaea;* 1934; Glentress, Peebleshire; own collection.
35/159 515 lb.; *Pinus sylvestris;* 1934; Scotland (N.E.); own collection.
35/160 16½ lb.; *Pinus sylvestris;* 1934; Scotland (S.E.); own collection.
35/161 1¼ lb.; *Pinus sylvestris;* 1934; Scotland (Glenmore); own collection.
35/162 1¼ lb.; *Pinus sylvestris;* 1934; Scotland (Ballochbuie); own collection.

35/163 2 lb.; *Pinus sylvestris;* 1934; Scotland (Speyside); gift from G. Brown.
35/164 1 lb.; *Larix leptolepis;* 1934; Morayshire; own collection.
35/165 13 lb.; *Picea excelsa;* 1934; Scotland (N.E.); own collection.
35/166 30 lb.; *Picea excelsa;* 1934; Scotland (S.E.); own collection.
35/167 ¼ lb.; *Picea excelsa;* 1934; Scotland (West); own collection.
35/168 3 oz.; *Picea sitchensis;* 1934; Scotland (Durris); own collection.
35/169 5¾ lb.; *Thuya plicata;* 1934; Scotland (West); own collection.
35/170 ¼ lb.; *Thuya occidentalis;* 1934; Scotland (South Laggan); own collection.
35/171 14½ lb.; *Chamaecyparis lawsoniana;* 1934; Scotland (South Laggan); own collection.
35/172 11 lb.; *Cupressus macrocarpa;* 1934; Wigtownshire; gift from Sir H. Maxwell.
35/173 31¾ lb.; *Chamaecyparis lawsoniana;* 1934; Scotland (Durris); own collection.
35/174 50 lb.; *Larix eurolepis;* 1934; Perthshire (Atholl); Atholl Properties, Ltd.
35/175 12 lb.; *Larix eurolepis;* 1934; Perthshire (Murthly); Murthly Estate.
35/176 ¾ lb.; *Pinus radiata;* 1934; Wigtownshire; gift from Sir H. Maxwell.
35/177 1 oz.; *Pinus morindoides;* 1934; Perthshire; own collection.
35/178 345 lb.; *Fagus sylvatica;* 1934; Scotland (West); own collection.
35/179 382 lb.; *Fagus sylvatica;* 1934; Scotland (N.E.); own collection.
35/180 3 lb.; *Acer pseudoplatanus;* 1934; Scotland (N.E.); own collection.
35/181 50 lb.; *Acer pseudoplatanus;* 1934; Scotland (S.E.); own collection.
35/182 48 lb.; *Acer pseudoplatanus;* 1934; Scotland (West); own collection.
35/183 5 lb.; *Betula alba;* 1934; Scotland (West); own collection.
35/184 100 lb.; *Fraxinus excelsior;* 1934; Scotland (S.E.); own collection.
35/185 50 lb.; *Fraxinus excelsior;* 1934; Scotland (West); own collection.
35/186 10 lb.; *Acer;* 1934; Fifeshire; own collection.
35/187 39 lb.; *Aesculus hippocastanum;* 1934; Fifeshire; own collection.
35/188 14 lb.; *Araucaria;* 1934; Argyllshire; own collection.
35/189 1,315 lb.; *Quercus pedunculata;* 1934; Kirkcudbrightshire; own collection.
35/190 20 lb.; *Ulmus campestris;* 1934; Kirkcudbrightshire; own collection.
35/191 6 lb.; *Alnus glutinosa;* 1934; Scotland (Glengarry); own collection.

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