JOURNAL OF THE FORESTRY COMMISSION

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EDITING COMMITTEE

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Our thanks are due to the following photographers whose subjects are indicated below: Mr. R. M. Adam for the Scots pine at Guisachan; Mr. R. C. B. Gardner for the Newland Oak; Mr. V. Blankenburgs for the views of the Plashetts Bridge; Mr. R. Lines for the Breton sculptures; Miss T. K. Wood for the lining-out plough; Mr. I. R. B. Marshall for the rooter; Mr. G. Stewart for the helicopter; and Mr. G. Holmes for the American nursery views.

All the text figures are based on sketches by the respective authors.

EDITORIAL

The Commissioners

During the year Mr. A. P. F. Hamilton retired from the Commission on the expiry of his term of office, and Mr. Robert Taylor resigned. Captain John Maxwell Macdonald of Largie, Tayinloan, Argyll, who is a professionally qualified forester, and Mr. Thomas Taylor, of Bridge of Weir, Renfrewshire, who is a Director of the Scottish Co-operative Wholesale Society, were appointed.

The Commission is now constituted as follows:

The Earl of Radnor, K.G., K.C.V.O., *Chairman*
Major D. C. Bowser, O.B.E., J.P.
Lt. Col. Sir Richard Cotterell, Bt., J.P.
Mr. Lloyd O. Owen, J.P.
Major Sir John Stirling, K.T., M.B.E.
Mr. Edward Bryan Latham, M.M.
Major F. W. Strang Steel.
Alderman E. Gwynfryn Davies.
Captain John Maxwell Macdonald, B.Sc.
Mr. Thomas Taylor.
Mr. H. A. Turner, *Secretary*

Honours

Mr. C. A. Connell, Conservator of Forests for South-West England, has been awarded the O.B.E. as a tribute to his thirty years' service. Mr. Connell, who is well known for his interest in fire protection, was previously in charge of our forests in East England and North-East England.

We are also happy to record the award, in the New Year's Honours List for 1961, of the M.B.E. to Mr. M. E. W. MacKenzie, Senior Executive Officer in the office of Director, Scotland at Edinburgh, who first joined the Office of Woods as a Boy Clerk in 1916.

Head Forester Frank Watson, of the Dean Forest, who began his service with the Office of Woods as long ago as 1912, has also received the M.B.E. in recognition of his long and distinguished service.

Promotions, Transfers and Appointments

Mr. H. A. Turner, Secretary of the Forestry Commission, has been promoted to the rank of Under Secretary in the Administrative Class of the Civil Service. Mr. J. J. V. Summers, formerly a Higher Executive Officer, has been promoted to an Administrative Principal in the Headquarters' Office.

Mr. E. H. Macmillen, who was formerly on the staff of the Ministry of Works, has been appointed Chief Engineer, and takes up his duties at Headquarters in January 1961.

Promotions from District Officer to Divisional Officer during 1960 were:

Mr. P. W. Holtam, who has moved from North Wales to take charge of Utilisation Development work at Headquarters.

Mr. G. G. Stewart, who has moved from Research Branch at Edinburgh to the North-West England Conservancy.

Mr. J. D. Matthews, who has charge of the Genetics Section of the Research Branch, and is stationed at Alice Holt.

Mr. E. M. Conder, Divisional Officer, has left North-West England Conservancy for the office of Director, England, in London, where he will have charge of sales of timber.

Two Divisional Officers in England have exchanged duties. Mr. J. B. Stocks has moved from the office of Director, England to the South-East Conservancy at Woking; and Mr. P. F. Garthwaite has moved from Woking to London.

Miss Ann Brooks, formerly Chief Clerk to the Director of Research and Education, is now engaged on Acquisitions and Estates duties at the office of Director, England.

Mr. M. A. E. Gubby, formerly Chief Clerk in the Forest of Dean, has been transferred to Organisation and Methods duties at Headquarters. His place in the Dean has been taken by Mr. E. F. Whiting.

Retirements and Departures

Mr. J. B. Kennedy, Divisional Officer in charge of timber sales at the office of Director, England, retired during the year, as did Mr. W. G. Roberts, a well-known District Officer in the North-West England Conservancy.

Mr. W. F. G. Webbe, who was Conservancy Engineer in South Wales for thirteen years, has retired and taken a post in private forestry; and Colonel R. I. C. Blenkinsop, Conservancy Engineer for East Scotland, has also left us.

Head Foresters who retired during the year included A. A. Parry, M.B.E., who had charge of our Isle of Wight forests; J. Williams, of the Rockingham group of forests in East England; John Kennedy of Minard Forest, West Scotland; J. J. Smith of Exeter Forest, South-West England; W. Murray of the Black Isle Forests, Ross-shire, North Scotland; John Lomas who had charge of the Lake Vyrnwy Woodlands in North Wales; and J. M. Reid, M.B.E. of the Forest of Ae, South Scotland.

Dr. Myles Crooke, who was head of the Entomology Section of the Research Branch, and Mr. J. S. Murray, who was in charge of the Pathology Section have both left us to take up posts as Lecturers in the Department of Forestry at Aberdeen University.

Obituary

We record with regret the death of Mr. L. A. Newton, who retired in 1953 from the post of Conservator in charge of acquisitions throughout Scotland.

Mr. David W. Young, O.B.E., who retired from the post of Deputy Surveyor in the New Forest in 1947 has also passed on. Mr. Young, who had previously served as Deputy Surveyor of the Forest of Dean, was well known for his deep interest in silviculture and his wide knowledge of New Forest rights and customs.

Mr. H. P. Herdman, who held the ancient office of Deputy Gaveller of the Forest of Dean, and dealt with mining matters there, died during the year.

Head Forester Charles Young, of the New Forest, has passed on, and we also lost Forester S. E. Phelps of Selby Forest, North-East England, and Forester W. J. Robertson of Clydesdale Forest, South Scotland.

Fifth World Forestry Congress, Seattle, U.S.A.

Our Chairman, Lord Radnor, led the United Kingdom delegation to the Fifth World Forestry Congress held at Seattle in August and September. Other Commission delegates were: Mr. E. B. Latham, a Forestry Commissioner; Sir Arthur Gosling, Director General; Mr. James Macdonald, Deputy Director General; Mr. J. S. R. Chard, Conservator, North-West England; and Mr. G. D. Holmes, Divisional Officer, Research Branch.

Articles by Messrs. Chard and Holmes, describing two of the Congress tours, appear on pages 1 and 5.

Machinery Exhibition, Harrogate

A successful public exhibition of forest machinery was organised by the Machinery Research Officer, Colonel R. G. Shaw, ably assisted by the staff of North-East England Conservancy, at Harrogate in May. The show was open for two days, and attracted seventy exhibitors and a large attendance of landowners and foresters from all parts of Great Britain.

Books

The following books, in whose production past or present members of the staff had a share, appeared in 1960.

Experimental Design and Analysis in Forest Research by J. N. R. Jeffers, Statistician in the Research Branch. (Published by Almqvist and Wiksell, 26 Gamla Brogatan, Stockholm, Sweden, for the International Union of Forest Research Organisations, price 30 Swedish Kronor).

Guide to British Hardwoods by Dr. W. B. R. Laidlaw, formerly in the Research Branch. (Leonard Hill, London, 30s. 0d.).

Trees and Bushes by H. Vedel and J. Lange, a Danish textbook translated by C. H. R. Hillman, formerly a District Officer in South-West England, and adapted by H. L. Edlin, Publications Officer (Methuen, London, 16s. 0d.).

Wild Life of Wood and Forest by H. L. Edlin. (Hutchinson, London, 25s. 0d.).

Contributions to the Journal

We welcome articles on any subject having a bearing on the Commission's work, from any member of the staff, whatever his rank or profession. Contributions should be forwarded through the usual channels—normally the Conservancy office—to the Editor at Savile Row, and should be accompanied by a note of the author's rank, official station and postal address. They should preferably be typewritten, in double spacing, on one side of foolscap sheets. We can accept a limited number of photographs, and also rough sketches, diagrams or finished drawings. There are no set limits of length, but, in order to give everyone a fair chance of inclusion, articles should not normally exceed 3,000 words. Brief notes may sometimes be as valuable as full-length reports.

This Journal circulates only among Commission staff, and some intending contributors may feel that their article merits the wider readership of the general forestry profession. In that event they should consult the Editor, who will advise them as to which of the several forestry journals appears appropriate for their particular work.

JOURNAL OF THE FORESTRY COMMISSION
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TOURS ON THE WEST COAST OF NORTH AMERICA—FIFTH WORLD FORESTRY CONGRESS

By J. S. R. CHARD
Conservator, North-West England

The Fifth World Forestry Congress was held at Seattle, Washington, U.S.A. from the 29th August to the 10th September, 1960, and to any British forester lucky enough to attend, one of the highlights of its proceedings was undoubtedly the opportunity which this gave to see something of our commonly planted West Coast conifers in their native habitat. Seattle is well placed for such a purpose, as it lies practically at the centre of the "green" Douglas fir region, and within the overlap in range of its northern and several of its southern associates. One cannot compare climate from such a short stay, but the weather at any rate was much the same as at home, the only noticeable difference being the greater light intensity of a latitude corresponding roughly with that of Brittany. In the woods the first thing that always struck one was the relatively greater depth of soil on comparable sites, and perhaps correlated with this, exposure gradients were everywhere less apparent. Many components of the ground flora were familiar, by genera if not by species, and some, such as bracken, willow herb, and the introduced foxglove, were identical, but there is of course no heather, and even after clear felling, the formation of a closed turf appeared to be unusual. With the trees themselves, it was an intriguing experience to find how theoretical preconceptions quickly fitted into place, and with adjustments one way and another, began to fill out a pattern of distributional and ecological relationships which previously one had never really grasped. In a necessarily short article, I intend to concentrate on this aspect as being probably of the greatest general interest.

My first introduction to West Coast conditions, coming down the Fraser River valley after a four-day journey across Canada, brought surprise at the extent to which hardwoods monopolise the more fertile sites when the big timber has been logged-off. The vine maple (*Acer circinatum*) is a difficult and persistent weed, which despite its glorious autumn colouring, we should be careful not to allow entry to our own woods. Red alder (*Alnus rubra*) often forms continuous thickets on waterlogged soils following clear felling, and although it dies off early where the site dries out, it excludes Douglas fir and tends to be followed by hemlock (*Tsuga heterophylla*); while continuously impeded drainage favours red cedar (*Thuja plicata*). Along stream sides red alder grows to a large size and provides useful timber, so that with us it has perhaps unjustly fallen into disfavour through faulty site selection. It was interesting also to see another commercially important hardwood, the bigleaf maple (*A. macrophyllum*) keeping its place in mixture with second growth Douglas fir in much the same way that invading sycamore does in plantations at home. But if this ecological niche exists in Britain, our own species has the better form and timber qualities to fill it.

In Vancouver a twenty minutes' walk from the centre of the city takes one into the 400 acre Stanley Park, running down to the seashore, where some relics of virgin timber survive with a 90 year old regrowth of Douglas fir, hemlock, red cedar, Sitka spruce and occasional *Abies grandis*. Here I was first able to examine the huge decaying stumps of the "old growth", often cut 8 to 10 feet

above the ground, and look more closely at the characteristic ground flora of sword fern (*Polystichium munitum*), Oregon grape (*Mahonia aquifolium*), red huckleberry (*Vaccinium parvifolium*) and salal (*Gaultheria shallon*), interspersed where vine maple is absent with dense struggling carpets of seedling hemlock and red cedar. The mineral soil is everywhere hidden by rotten wood, and in these conditions, when small openings are made to release the regeneration, Douglas fir has had to be re-established by planting. This aversion to raw humus explains why, in nature, it mostly follows fire.

The campus of the University of Washington, where the main business of the Congress took place, brought out the beauty of two common associates of Douglas fir whose ornamental value we have unaccountably neglected: the showy Pacific dogwood (*Cornus nuttalli*), of which some individuals flower in spring and some in autumn, and the coppery barked, evergreen madrone (*Arbutus menziesii*) which grows all along the rockier shores of Puget Sound.

The University's School of Forestry is well known, and the first excursion attended from Seattle was to its Lee Memorial Forest, a 160 acre tract on which studies of growth and soils have been conducted since 1937. This has now become an almost isolated relict of typical lowland forest conditions, and consists partly of an older crop dating from the original logging of 1890, and partly of regrowth which followed a fire in 1920. It was particularly interesting to compare this younger 35 to 40 year old natural stand with some of the Commission's plantations of the same age. On the deeper soils its composition by volume varied from 100% Douglas fir to a 75%-25% mixture with hemlock, with local red cedar, bigleaf maple, dogwood and bitter cherry (*Prunus emarginata*), while on the shallower soils red cedar increased to over 50% and changed where seasonal waterlogging occurred to 100% red alder. Although produce of this size was unsaleable, thinning demonstrations had recently been conducted in the denser portions of the stand, and before treatment around 600 stems and 160 square feet (quarter-girth measure) of basal area per acre had been recorded. However, the average over the whole area appeared to be less than half of this, due to irregular initial stocking and rapid suppression of the smaller trees, and as a generalisation the standing volume rarely approached what we would expect for the same height and age (Quality Class I/II, elevation 500 feet, rainfall 40 inches per year).

A subsequent excursion to the Cedar River watershed in the foothills of the Cascades range produced some closer details. Plantations are comparatively rare on the West Coast, but as this is the catchment for Seattle's water supply a severely burnt area was restocked with Douglas fir in 1931 at a spacing of 7 × 7 feet to check the run-off, and a growth plot in this so far unthinned stand shows the following result:

Year	*Basal area/acre in sq. ft. quarter-girth*	*Stems per acre*	*Average quarter-girth, over bark, breast height*	*Volume per acre in hoppus feet*
1960	159	735	5·6	4,538
1957	126	785	4·8	3,668
Increment, 3 yrs.:	33			870
Increment per year:	11			290

Average height (1960)—65 feet.

Quarter-girth over bark, at breast height of largest tree (1960) 10·7 inches.

(Quality Class II, elevation 960 feet, rainfall 53 inches per year).

Not far away four acres of 60 year old second growth Douglas fir had just had an experimental first thinning! At that age it carried 170 stems per acre, and the operation was primarily to salvage the dead and dying; it had yielded sawlogs, pulpwood and piling and a total stumpage revenue of about £200, but extraction to roadside was short and very easy. In general, thinning as we know it is not yet a practical proposition for this species; in contrast it was interesting not only to hear emphasis placed on the need for pruning crop trees in the second growth stands, but to see quite large areas which had actually been done.

The end of the valuable clear lengths that come from virgin timber has long been forecast, and along the Cedar River it has already happened. The lower slopes which were logged off first with railways and then with tractors, are fully exploited, and with fire protection have gradually restocked; now, within the last 10 years, roads have been dozed up the steeper hillsides, and high lead sets have started their patchwork cutting in the formerly unmerchantable forests of the intermediate zone. Here at around 2,000 feet Douglas fir dwindles to a scarce isolated predominant, and red cedar has dropped out altogether. Hemlock persists, and is joined by the Pacific fir (*Abies amabilis*), yellow cedar (*Chamaecyparis nootkatensis*) and noble fir (*A. nobilis*), the latter increasing with elevation until along the ridge tops at 4,000 feet it grows in almost pure stands.

High above the Cascades, the snow-capped 14,410 feet summit of Mount Rainier, set in a 378 square mile National Park of untouched wilderness, dominates the landscape for over 50 miles, and the circuit of it made in a long day's coach tour helped to confirm this pattern and extend it further. The elevational limits naturally run higher up these long flanks and deeper valleys, and aspect also plays a more pronounced part. On the warmer south facing slopes noble fir appears as the principal pioneer of old fire scars, originally cleared by the Indians for bilberry picking, and of bare ground exposed by the retreat of the Nisqually and other glaciers, while on the cooler northern slopes it is scarce and patchy, and its place, particularly round the Emmons glacier, is taken by Engelmann spruce. The greater humidity of this zone, even on southern and eastern aspects, compared with the lowland forests, is well shown by the streamers of goatsbeard lichen which festoon many of the older trees.

Above about 5,000 feet its typical associations begin to break up, and the spire-like forms, and more open stocking of their successors, correlated with deep snow cover, mark the beginning of the sub-alpine zone. Here the Pacific and noble firs are replaced by alpine fir (*Abies lasiocarpa*) and western hemlock by mountain hemlock (*Tsuga mertensiana*); only the hardy yellow cedar struggles on to join the last sprawling whitebark pines (*Pinus albicaulis*) at about 6,500 feet.

All elevations are relative, and on the scale of British mountains these different zonal limits would be telescoped, but it seems certain that nothing in our normal range of conditions compares with the last one.

Two other pines, white (*P. monticola*) and lodgepole (*P. contorta*) run sparingly through both the intermediate and lowland zones, the former on the more fertile and the latter on the less fertile exposures of bare or rocky ground. The lodgepole pine of Mount Rainier is of coastal form, but the only large stand of it, beside the Longmire camp site, may have been seeded in, about 70 years ago, with hay brought for pack horses.

One important species which the organised in-Congress tours gave no opportunity to study was Sitka spruce, but through the good offices of Cyril Hart, who accompanied us, and the courtesy of the National Parks Service,

G. D. Holmes and I had the privilege of seeing it in one of its most famous localities, the so-called "rain forests" on the western aspects of the Olympic National Park. This expedition involved flying early on a Sunday morning to Port Angeles, just across the straits from Vancouver Island, and returning at an equally late hour at night; during the day we were driven nearly 300 miles, and received unsparing attention and the kindest of hospitality.

Much of the low ground in the Olympic penninsula has also been logged off, but as one goes westwards into the fog zone of the Pacific coast there is a steady transition in the second growth from dominant Douglas fir to almost pure hemlock. Grand fir was more frequent than about Puget Sound, and a locally high stocking of culls from old growth red cedar was supporting a shingle mill. Few Sitka spruce appear until one gets right down to the seashore: the main stands are on the alluvial flats and river terraces of the Hoh, Queets and Quinault valleys, where the funnelling effect of the mountains brings the rainfall up to 130 to 150 inches per annum.

On the Hoh River, which we visited, fresh stands were being established on new alluvium under a cover of black cottonwood (*Populus trichocarpa*), and a progression could be made out with the biggest trees on the oldest terraces. The largest we saw was 300 feet high and over 100 inches in quarter girth above its rather swollen base; average specimens contained 1,300 to 1,500 hoppus feet apiece, and despite very irregular stocking many acres carried ten or a dozen of them. It was interesting to see, where a downfall had been crosscut to clear the trail, that they had started life at about 3 rings to the inch.

Associated with these giant Sitka spruce are fewer somewhat smaller hemlocks and red cedars, and an occasional Douglas fir, and beneath them an understorey of bigleaf maple and a shrub layer consisting principally of vine maple. A characteristic feature of the rain forest is the way in which all these hardwoods become draped and broken down with great curtains of wet moss, including an epiphytic clubmoss, *Selaginella oregana*, from which the filtered and reflected light takes on a peculiar greenish luminescence.

The flats along the Hoh River are one of the principal wintering grounds of the Roosevelt elk, the largest red deer in the world, which this 1,400 square mile National Park was originally set aside to preserve, and the little clearings formed as these old stands break up and the big trees fall are all heavily browsed and puddled by them. In consequence few seedlings survive on the forest floor, and the prickly needled spruce is given a clear advantage over the more palatable hemlock, red cedar and Douglas fir: regeneration is almost entirely along the tops of the decaying logs, but there it comes up in profusion. The new growth thus starts in straight lines, and one can look around and see the oldest veterans still standing in the same formation; the nurse logs have long rotted away and these huge trees are left supported on stilts formed by their heavily buttressed roots. Sitka spruce developed turf planting long before we did, and this evidence of its age-old adaptation is peculiarly reassuring!

On the surrounding slopes, hemlock, Douglas fir, red cedar, and we were told, Pacific fir, resume their dominance, but were too mist hidden to make out, and to see the latter species we were taken in the late evening to Lookout Rock and the newly opened Hurricane Ridge highway in the north-east corner of the Park. There is no noble fir or Engelmann spruce in the Olympics, and starting as a sub-dominant to Douglas fir at the lower elevations, this species, with its associated yellow cedar, runs right up to merge with alpine fir at the higher.

Perhaps the most useful of many all too brief experiences were those which helped to clarify the relationships of the different silver firs. As our pioneer plantings mature, the need for more productive and shade bearing successor

species, particularly at the higher elevations, is increasingly felt; the risk of *Fomes*, if nothing else, makes it unwise to go wholeheartedly for hemlock, and it is to silver firs that we now naturally turn.

The adaptations of *Abies lasiocarpa* appear to lie quite outside our conditions or requirements, and it may be noted that neither *A. concolor* nor the related *A. lowiana* extend into a latitude or type of climate comparable to Britain. *A. nobilis*, which also has southerly affinities, shows the most restricted distribution, and is pre-eminently a tree of the ridges and higher slopes; it thrives on the warmer aspects, pioneers bare ground, and does not regenerate under a closed canopy. In contrast *A. grandis* is a tree of the low country and ecologically they do not overlap; its range corresponds closely with that of Douglas fir, with which it mixes sporadically and intimately on the moister and more fertile sites, but never seems to form large stands. The most aggressive species, and the one with the most northerly affinities, extending into southern Alaska, is *A. amabilis*, and this now provides the main bulk of the commercial cut of silver fir along the West Coast. It seems surprising that we have so far largely ignored it, but early explorers followed either the rivers or the ridges, and it is really only since the war that logging roads and tourist highways have begun to open up the steeper middle slopes on which it predominates. Within the last year it has even been reported from the Queen Charlotte Islands.

Silviculturally, as well as in appearance, *A. amabilis* reminds one very much of the European silver fir. It regenerates in deep litter and in dense shade, even under hemlock, and has the same power of struggling on indefinitely until it gets enough light to shoot away into the canopy. Because it comes late in the succession it rarely compares for size with the giants around it, but specimens 150 feet tall and 35 to 40 inches Q.G.B.H. are not uncommon, and released advance growth puts on leaders of 18 inches to 2 feet a year. Trees felled at Cedar River amongst heart rot (*Fomes pinicola*) affected hemlock were apparently untouched. Altogether this seems to be a species which strongly merits a trial, and as soon as possible, some well sited comparisons of provenance.

Finally, it was a pleasure on getting home to re-read R. F. Wood's *Studies of North-West American Forests* (Forestry Commission Bulletin 25), with much sharpened understanding, and to realise what a sound piece of work it is.

THE LAKE STATES TOUR OF THE FIFTH WORLD FORESTRY CONGRESS

By G. D. HOLMES

Divisional Officer, Research Branch

Following the Fifth World Forestry Congress in Seattle, I was privileged to attend a tour of the Lake States in company with 46 Congress delegates including representatives of Austria, France, Formosa, Ghana, Indonesia, Japan, Liberia, New Zealand, Sweden, Thailand, Venezuela, and Russia. The tour was one of the most intensive and well organised that I have ever known, covering a route of over 800 miles through the States of Minnesota, Wisconsin and Michigan in a period of just over five days from September 12th—17th 1960. The schedule was very tight, and involved rising at 6-6.30 a.m. and retiring about midnight each day. The organisers, led by George B. Amidon (Minnesota and Ontario Paper Co.), Sidney Weitzman (Chief Watershed Management Research, Lake States Experiment Station), and William G.

Stump (U.S. Forest Service) provided a glimpse of an incredible range of subject matter and territory in the short time available. It is a tribute to their organisation that we were never more than six minutes behind at any of the 20 major stops on the tour.

Route and Itinerary

Starting from the twin-cities Minneapolis-St. Paul, the route ran north through Minnesota for about 150 miles to Cloquet and Duluth on Lake Superior. From Duluth the tour turned east through northern Wisconsin and the southern shore of Lake Superior into Northern Michigan. The last two days were spent working south through Wisconsin through Eagle River, Wisconsin Rapids, Madison, and finally Milwaukee on the shores of Lake Michigan (see Fig. 1).

Briefly the itinerary was as follows—

September 12th (1) *Minneapolis-St. Paul* (University of Minnesota School of Forestry; Lake States Forest Experiment Station).
(2) *Willow River, Minn.*, (General Andrews Nursery of the Minnesota Conservation Dept.).
(3) *Cloquet, Minn.*, (University of Minnesota Research Centre). Night at University forestry summer camp.

September 13th (1) *Cloquet, Minn.*, (North-west Paper Co. and the Diamond-Gardner Match Co.).
(2) *Cloquet* (Logging equipment demonstration). Night at Ironwood, Mich.

September 14th (1) *Ironwood, Mich.* (Ahouen Lumber Co., automatic sawmill).
(2) *Wakefield, Mich.* (Conner Lumber Co., selective logging).
(3) *Boulder Junction, Wis.* (Fire Control Demonstration, Wisconsin Conservation Dept.).
(4) *Watersmeet, Mich.* (Ottawa National Forest). Night University Forestry Summer Camp.

September 15th (1) *Eagle River, Wis.* ("Trees for Tomorrow Inc.") Camp.
(2) *Eagle River, Wis.* (Rhinelander Paper Co.).
(3) *Rhinelander, Wis.* (Northern Institute for Forest Genetics). Night Wisconsin Rapids.

September 16th (1) *Wisconsin Rapids, Wis.* (Nekoosa-Edwards Paper Co., timberlands).
(2) *Madison, Wis.* (U.S. Forest Service, Forest Products Laboratory).

The Nature of the Region and Its Forest Types

The three Lake States, Minnesota, Wisconsin and Michigan, have a Continental climate typical of the North-Temperate Zone. Rainfall averages around 30 inches per annum, of which 60% occurs in the summer months. The temperature averages 44°F., with extremes from —59°F. to 111°F. In most seasons in the Northern areas, there is only about 3 months between killing frosts each year, a fact which was partly responsible for the failure of early farming efforts in the Northern Territories.

The whole area was extensively glaciated and the countryside to-day is typically flat or gently rolling, with numerous lakes and rivers. In the main, the

forest soils are made up of glacial deposits in the form of ground and end moraines, and range from dry sandy podsols to wet heavy clay-loams. When the white man first came to the Lake States, there were 104 million acres of virgin forest in the 3 states, much of it being magnificent growth of White pine (*Pinus strobus*), and Red pine (*Pinus resinosa*). Large scale destruction of the virgin forest began as settlers arrived and felled the forest for farming. Unfortunately, much of the land cleared by the early settlers, especially in the North, was unsuitable for farming, because of poor soils and short growing season; a large area of farmland was abandoned to remain bare or to be colonised with low-grade hardwoods notably aspen ("Popple"—*Populus tremuloides* or Bigtooth aspen—*P. quadridentata*) and birch (Paper birch—*Betula papyrifera*) and Yellow birch—(*B. lutea*)—to-day approximately one-half of the original 104 million acres of forest land is classed as permanent agricultural land, mainly in the southern parts of the States.

The greatest devastation of the vast northern forests took place at the turn of the century from 1870-1910, when extensive logging for lumber on a "cutout and move out" basis, destroyed almost all the remaining primæval softwood forests. Only a few areas in inaccessible positions escaped the logger's axe. Disastrous forest fires, up to 1 million acres per annum in some years during and shortly after the logging era, added to the destruction of ground cover.

To-day, almost the whole area has been cut over, and the existing forests consists of second-growth of a variety of species, the exact stand composition depending on the soil and past history of each site. In general, the natural forest-types of the region may be represented as follows, the approximate extent of each type being shown in fig. 1.

(I) Beech—Maple—Yellow birch—Hemlock.
(*Fagus grandifolia, Acer saccharum, Betula lutea, Tsuga canadensis*).

(II) Jack pine—Red pine—White pine.
(i.e. *Pinus banksiana, P. resinosa, P. strobus*).

(III) Spruce—Fir.
(i.e. White spruce—*Picea glauca*, Black spruce—*P. mariana*, Balsam fir—*Abies balsamea*).

(IV) Oak—Hickory.
(i.e. Red oak—*Quercus borealis*, Black oak—*Q. velutina*, White oak—*Q. alba*, and Bur oak—*Q. macrocarpa*).

The present species distribution compares approximately to these limits, although the proportions of species vary greatly with soil conditions. Thus, dry sandy soils are frequently occupied by Jack pine and oak, while moist loams are characterised by White pine, Sugar maple, Yellow birch, aspen, White spruce and hemlock. Black spruce and tamarack (*Larix laricina*) occur mainly on peaty swamp soils.

Softwoods, particularly Red pine and Jack pine, have become re-established naturally on large areas, but there are many former softwood sites now occupied by low-grade hardwoods. Following logging, such areas seeded in with aspen and birch, which now occupy large areas of land capable of growing good softwoods or better quality hardwood crops.

In round figures, there are now about 56 million acres of commercial forest land in the three States, of which some 20 million acres have been classed as bare or devoid of valuable forest growth, and about 17 million acres of understocked land. These figures can be broken down to problem types as follows:—

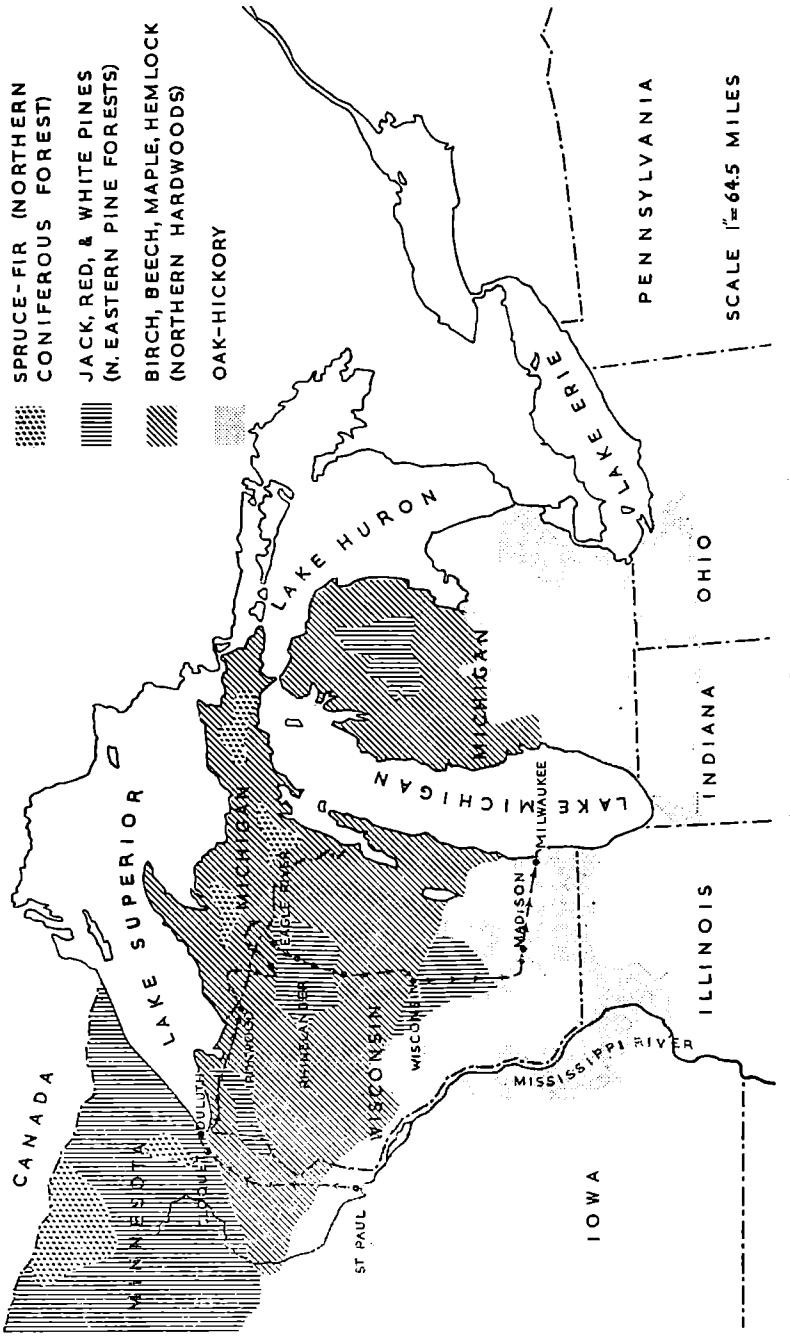

Fig. 1. Route Map of the Lake States Tour.

(1) Bare or poorly stocked land .. .. .. 14 million acres
(2) "Off-site aspen"—(i.e. seeded aspen growing on former pine sites where it stagnates and fails to produce merchantable sizes) .. .. .. 6 million acres
(3) Moderately stocked stands .. .. .. 17 million acres

Restoration of these sites represents the major forestry problem of the region. To bring the areas into good production it is estimated that about 12 million acres require re-planting with desirable species, and a similar area requires "release" treatment to allow useful softwoods to regenerate and develop free of hardwood competition.

Before discussing methods of dealing with this problem, it is necessary to look at the ownership of land.

The Pattern of Forest Ownership

The lack of permanent and responsible ownership of forest land prior to 1925 was one of the major causes of neglect of forest land. However, a pattern of permanent ownership has now emerged, enabling a long term programme of land restoration to be adopted based on—

(1) Extensive public ownership.
(2) Organised forest protection.
(3) Large scale re-forestation.
(4) Revision of tax laws to provide incentives for good forest management.

Of the total 56 million acres of forest land, about 22 million acres is now in public ownership, being more or less equally divided between Federal, State, and County Forest authorities. Almost all this public forest area has been built up from cut-over and burned land, and abandoned farms, i.e. literally "the land that nobody wanted". The fact that over 80% of the land in State and County forests was acquired through non-payment of taxes gives the clue to its quality and past treatment. The balance of 34 million acres is privately owned, most of it by farmers and the remainder by industrial Companies using forest products.

Conversations with foresters representing all these classes of forest owners revealed a solid conviction of the value of forest conservation, and a refreshingly "earthy" attitude to the economics of re-forestation of understocked areas. It was fairly generally conceded that from the investment angle, re-forestation shows a relatively poor economic return. Nevertheless, replanting of denuded and understocked land goes on apace on private as well as public land, less as a business enterprise than restoration of an essential basic resource.

On the basis of land ownership, responsibility for re-forestation of the 12 million acres requiring replanting is divided as follows—

Federal—1 million acres; State—2 million acres; County—2 million acres; Industry—3 million acres; and Farmers and Others—4 million acres.

To complete such a programme in say 28 years will involve planting at the rate of 500,000 acres per annum; a formidable target which has so far not been achieved. The 1959 planting programme was 120,000 acres, of which 110,000 was on State and Private land. However, the programme is expanding through increases on public land, and public support of private owners through the Tree Farms Scheme. Forest Industries also have rising planting programmes and in some areas give tangible assistance to small owners in planting forest land. A notable case in Wisconsin is the "Trees for To-morrow" organisation which is sponsored by the paper and power companies of the region to encourage planting by small owners, through—

(1) Distribution of free plants to small owners.
(2) Contract planting at a nominal charge.
(3) Preparation of forest management plans.
(4) Dissemination of information through literature, demonstrations, lectures, etc.

This organisation has been a marked success, and since its formation in 1944 has prepared management plans for nearly a million acres of forest, and distributed 8 million free plants.

Methods of Re-forestation and Stand Improvement

The main points emerging from brief visits to nurseries and re-forestation areas can be summarised as follows:

Choice of Species. The native Red, White, and Jack pines are the most commonly used species, together accounting for over 90% of the trees planted. Red pine and Jack pine are the usual choices on the poorer sandy soils, with White pine or Jack pine on the moister loams. White spruce is being used on an increasing scale on heavier soils, and Scots pine and Norway spruce of North European Continental origins are planted on a limited scale.

Plant Production. The current programme of 120,000 acres per annum involves a considerable nursery production, viz.:

Forest Nursery Production 1960

	Ownership					Totals
	Federal	State	County	Industry	Commercial Nurseries	
Number of Nurseries	3	16	11	8	30	68
Plant Production .. (millions)	15	73	7	7	38	140

Federal nurseries produce stock mainly for use on Federal land, while state and County nurseries produce largely for farms and private owners.

Nursery methods follow a fairly standard pattern, and those seen at the General Andrews Nursery of the Minnesota Conservation Dept., at Willow River illustrate some essential points. This nursery consists of 173 acres of stone-free sandy-loam, p.H 5·5, which was levelled by bulldozing and "land-planing" to facilitate mechanisation and eliminate drainage differences. Annual production is around 12 million plants, mainly Red, White, and Jack pines, Black spruce, and Balsam fir, all of which are raised as root-pruned 3 year seedlings. Transplanting seems to be regarded as an expensive luxury, justified only if the plants are destined for very difficult sites.

Fertility maintenance is based on a 3-year seedbeds: 1 year green crop rotation, the land being given a heavy dressing of peat (250 cu. yd. per acre) before seedbed formation, with mineral PK fertilizer additions both to the greencrop and the seedbeds before seed sowing. Application of soil sterilisers, usually vapam (sodium methyl dithiocarbamate) is fairly general before seedbed formation. (This costs $300.00 per acre, but it is thought justified because of

improved survival and growth and reduced weeding costs). Permanent overhead irrigation lines are a feature of the nurseries, and water is applied literally throughout the growing season. It is also becoming common to apply nitrogen top-dressings, as urea, in solution through the irrigation system. (See Plate 11, central inset).

Nearly all seedbeds are prepared with boarded sides, (9 inches high), to support lath shelters which are applied to prevent sunscorch. (See Plate 10, central inset). All nursery operations are highly mechanised, including peat spreading, seedbed formation, vapam drenching, fertilizer and seed sowing (all drilled), root-pruning, inter-row weeding and plant lifting and grading.

Planting Methods. In most areas, land is ploughed or "furrowed" using several patterns of double-mouldboard plough, planting being done in the furrow bottom. Planting machines are used extensively, and the large areas of level and even-textured soil provide near-ideal conditions for their operation. Costs are generally 30-50% less than handwork; one planter + driver planting about 1,200 trees, (i.e. about 1 acre), per hour. Several elaborate planting machines were seen, fitted with equipment for injection of insecticides for white-grub control and tanks of water for soaking the soil at each planting spot! Almost all planting is done in the spring to avoid losses through frost-heave which follows autumn planting. Much of the area planted is bare land and relatively little vegetation clearance is necessary.

Stand Improvement. There are considerable areas where the growth of softwoods, usually Red pine or Jack pine, is overtopped by undesirable hardwoods, notably aspen, birch, and oaks. "Conifer release" operations by cutting, supplemented if necessary by planting, have been carried out in some areas. Also, successful release is being achieved by aerial foliage spraying with 2, 4 —D + 2, 4, 5 —T ester mixtures (@ 1-2 lb. (acid) in 2-3 gal. oil/water spray per acre in late summer), at a cost of $3.00–$5.00 per acre. This technique is cheap and effective and is being applied on an increasing scale.

Forest Protection

Fire—Fire protection is a major part of the work of the Federal and State Forest Services, who control an extensive network of fire detection and control centres throughout the region in close co-operation with all forest owners. The scope of the organisation can be judged from the fact that in Wisconsin alone, there are more than 200 Federal and State fire towers, overlooking some 18 million acres. District and sub-District Stations are well equipped with ploughs, water trucks and trailers, well-drilling gear, etc. Radio communications are general, as is the use of light aircraft for regular detection patrols and fire control.

The Wisconsin Conservation Department laid on an impressive demonstration of fire control methods, but the only new item of equipment was a d.m.b. fire-trace plough fitted with an electrically ignited propane burner for simultaneous ploughing and counterfiring.

One of the most impressive features was the effort and ingenuity applied to publicity on fire prevention, through T.V., radio, press, road signs, displays, and demonstrations. Fire losses have been reduced to an almost nominal figure compared with the catastrophic fires of the past, and annual losses are down to about 0·05% of the area protected.

Disease and Insect Pests. Blister-rust (*Cronartium ribicola*) continues to be a real threat to successful re-forestation of White pine, and planting is restricted to sites at least ¼—½ mile distant from any *Ribes* species. Both Federal and State authorities are active in assisting owners of White pine stands to destroy gooseberry and currant bushes in the area. Breeding for resistance continues,

and some recent work has shown promise of direct control of the fungus using antibiotics (actidione and phytoactin), applied as a bark spray in oil, or as overall aerial foliage sprays to infected stands.

Several examples of severe deformation of White pine by the beetle *Pissodes strobi* were seen. This seems to be a considerable pest, affecting more than 50% of stands. Damage by animals, notably White-tailed deer, is quite common, and several examples of browsing on hardwoods and young Jack pine were seen.

Forest Industries

Much attention was given to the manufacturing and forest management activity of wood-using industries during the tour, and visits were made to several plants concerned with lumber, processed wood, and pulp and paper production.

In the hectic days of the lumbering boom at the turn of the century, sawlogs were almost the only forest product. To-day, the pattern of utilisation has changed to suit the second-growth material, and other products, notably pulpwood, utilising smaller sizes and a wide range of species, has come into the picture.

However, sawlogs still account for some 40% of the forest harvest. Pulpwood production, mainly Jack pine, spruces, and aspen, has risen tremendously in recent years, and now comprises 40-60% of forest production. Other major products are veneer logs, fuelwood, and mine timber, which together make up about 7% of total production.

Most of the major wood-using companies own large areas of forest land, collectively possessing some 8% of the commercial forest area. All the companies are naturally now concerned to protect their investment in industrial plant by sustained yield management of their forests, and further, by active promotion of good management of the large area of lands in small private ownership.

Pulp and Paper. The North-West Paper Co., Cloquet, and the Nekoosa-Edwards Paper Co., Wisconsin Rapids, both of whom utilise Jack pine and aspen, which are pulped for production of fine-grade printing and writing papers, were visited. These companies own and manage about ¼ million acres of forest land. The Rhinelander Paper Co., Eagle River, manufactures glossy and greaseproof packaging papers from spruce, balsam, tamarack (larch) and aspen to the tune of 75,000 cords of pulpwood per year. This company is acquiring forest land at the rate of 3,500 acres per year with the eventual aim of producing about 50% of its needs from company land.

Processed Wood. The Wood Conversion Co., Cloquet, is a large plant pulping Jack pine and aspen for manufacture of fibre blankets and boards used for insulation, cushioning, sound-proofing, and packaging.

Matches. The Diamond-Gardner Match Co., Cloquet, is one of the world's largest match factories. Aspen is used exclusively for production of the match fillets, and yellow birch as a veneer for cartons and boxes. This plant takes in pulp logs from a radius of about 120 miles of Cloquet.

Lumber. The Ahouen Lumber Co. at Ironwood was seen as an example of a modern, highly automatic sawmill, converting both hardwood (Sugar maple), and softwood (Red pine) at the rate of 40,000 Bd. ft. per 8 hour shift. The plant was also notable as it is the first in the Lake States to install debarking and chipping equipment so that all saw-waste can be supplied bark-free to the pulp industry.

Two old forest industries, namely maple sugar producing, and charcoal

(mainly maple, birch, beech and oak), have recently taken on a new lease of life and are assuming importance in some areas.

Forest Recreation

This topic deserves separate mention as the general public make extensive use of the forest area for recreation. In the Lake States, millions of visitors, both resident and non-resident, come into the forest for camping, hunting, and fishing holidays. These visits have increased tremendously since the war, and in Michigan alone about 1 million "hunters" visit the forests each year. (This reflects a major difference in the pattern of life compared with Europe. In 1959, it was estimated that 20% of the adult population of the United States fish or shoot for recreation, compared with less than 1% in Europe). In 1959, the legal bag in the three States was 43,000 deer and 1,250 black bear.

Research Work

We were given an opportunity to see something of the nature and organisation of forest research in the region during short visits to the University of Minnesota School of Forestry, the Lake States Experiment Station, and the U.S. Forest Products Laboratory.

The Lake States Forest Experiment Station. The U.S. Forests Service, as the Federal agency, is responsible for much of the applied research in forestry, and operates 9 regional forest research Stations throughout the U.S. This Forest Service Region No. 9, which includes the Lake States, North Dakota, Iowa, Missouri, Illinois, Indiana, and Ohio, is served by the Lake States Station centred on the Campus of the University of Minnesota at St. Paul. This location has several advantages, notably the proximity of the University School of Forestry with its facilities and a body of post-graduate students, who are able to work on specific research projects in close liaison with Forest Service personnel. From St. Paul, the research programme is organised through 7 Field Stations throughout the region. The largest and most recent being the Northern Institute of Forest Genetics at Rhinelander, Wis. Space will not permit a detailed account of the Station's activities, but they can be broadly indicated under 6 heads, viz.:

(i) Economics—including studies of forest inventory and survey methods, forest taxation, credit and insurance.

(ii) Entomology—biology and control of insects affecting natural stands and plantations, including regular population surveys of major pests, notably pine shoot moths, sawflies and spruce budworm.

(iii) Diseases—studies of biology and control of major diseases.

(iv) Utilisation—now much emphasis on study of growth/quality relationship and development of fuller utilisation of little-used species.

(v) Watershed Management—Studies of water relations beneath various forest cover types, and effects in terms of water conservation, flood control etc.

(vi) Forest Management—embraces Silviculture and Genetics. The main projects are concerned with natural regeneration and re-forestation methods, studies of growth and yield, and site relations of species, including exotics. The Genetics programme is centred at the Institute established in 1957 at Rhinelander. Here the major projects are studies of racial variation and breeding of White spruce, the physiology and hormone control of growth and flowering in softwoods, and selection for insect and disease resistance.

The United States Forest Products Laboratory, Madison. This Federal laboratory was established in 1910, as the main forest products laboratory in the country, covering National, regional and local problems of all types. At present, the major theme is development of more efficient utilisation of low-grade or unused wood, and development of new wood products.

There are over 400 employees in the Station, which is divided into 7 sections as follows:—

(i) Timber Growth and Utilisation Relations; (ii) Timber Processing; (iii) Wood Chemistry; (iv) Pulp and Paper; (v) Wood Preservation; (vi) Physics and Engineering; (vii) Packaging Research.

The section of Timber Growth and Utilisation Relations was one of the most interesting from the foresters standpoint, and it is also one of the largest, covering a wide field, including small sawmill studies, log and lumber grading methods, machining and cutting methods, wood structure and identification, wood harvesting, and structure and properties in relation to growth and management.

The foregoing has been a somewhat superficial and potted guide to the Lake States, but space has not permitted enlargement on any particular topic. However, I hope it has conveyed a semblance of a picture of the dramatic history and vast extent and variety of the forests of the region. The large scale of the forest areas was quite staggering to British eyes, and it was a most inspiring experience to spend even a short time in regions where forestry is the number one industry.

F.A.O. STUDY TOUR IN SOUTH-EAST ENGLAND

By B. W. HOLTAM
District Officer, North Wales

The Food and Agriculture Organisation of the United Nations began, in September, 1959, a series of European Study Tours on Applied Silviculture. The second of these Study Tours was held in South-East England from 20th to 30th June, 1960, when the Forestry Commission was host to representatives of the participating countries, who met at Brighton.

The subject of this second F.A.O. Study Tour was "The Conversion of Degraded Hardwood Forests (including Coppice)".

Representatives attended from nine countries and the tour was led by Dr. M. A. Huberman, Chief of the Silviculture Section, Forestry and Forest Products Division, F.A.O., Rome. Mr. G. B. Ryle, Director of Forestry for England, welcomed our visitors and introduced the subject; Mr. James Macdonald, Deputy Director General, and Mr. J. Q. Williamson were present for part of the tour.

Mr. R. H. Smith, Conservator, South-East England, spoke of the problem in his Conservancy and outlined the history of the methods which have been evolved to solve it. He introduced Mr. J. B. Stocks who presented a paper which gave a very clear picture of the types of degraded hardwoods which we find in England and of the methods which are being used to convert these into more profitable forest crops. An article by Mr. Smith and the paper by Mr. Stocks, appear in this issue (pages 17 & 20). Later in the tour Mr. E. G. Richards, Conservator, Forestry Commission Headquarters, presented a paper on the marketing problems associated with this type of conversion.

During the tour, each participant from a visiting country read a paper on the conversion of degraded hardwood forests in his own country—presenting the problems and the methods employed to deal with them. It soon became clear that this is a problem which exists in all the participating countries in varying degrees.

The participating countries and their representatives were:—

France:	Mr. J. Marion (who came as an independent visitor).
Germany:	Professor Dr. Bonneman
	Dr. H. G. Sommer
Irish Republic:	Mr. G. McCool
Italy:	Dr. A. Puggelli
Luxemburg:	Mr. G. Rischard
Netherlands:	Mr. G. W. Mulder
Sweden:	Mr. B. Lindfelt
Yugoslavia:	Professor S. Djikič
	Dr. T. Nikolovski
United Kingdom:	Mr. G. B. Ryle
	Mr. R. H. Smith
	Mr. C. A. J. Barrington
	Mr. J. B. Stocks
	Mr. P. F. Garthwaite
	Mr. S. R. Payne
	Mr. T. V. Dent
	Mr. J. R. Hampson
	Mr. I. T. W. Bell
	Mr. B. W. Holtam }
	Mr. A. A. Rowan } Interpreters
	Mr. C. E. Allison }

Members of the tour assembled at the Old Ship Hotel, Brighton, on Monday, 20th June, 1960. Opening discussions occupied the next day when the enthusiasm shown by all participants indicated that this was to be a most interesting tour. This was followed by daily field excursions to forests in South-East England and by evening presentation of papers and formal discussions; many informal discussions were continued into the small hours of the morning!

At Bedgebury Forest on 22nd June we saw the National Pinetum, various conifer crops and chestnut coppice in various stages of development and exploitation. In the afternoon, by courtesy of the owners, the turnery works of the Kent Woodware Co., near Hawkhurst, were visited to see one of the local industries which is supplied with selected produce from the areas of degraded hardwoods which we were to see later in the tour.

The following day, Thursday, 23rd June, was spent at Wilmington and Vinehall Forests. Great interest was shown in the various stages of the establishment of new crops under shelter of scrub overhead cover, with accompanying benefits of frost protection, reduced cracking of the heavy clay soil and reduced weed growth. At Vinehall Forest it was possible to compare the relative merits of planting under overhead shelter and planting after complete clearance of scrub. Here, too, we were shown very interesting mixtures of beech/Norway spruce and of oak/Norway spruce, and we were able to see the effect of the removal of cover from strips of three rows of Douglas fir only—in a 3-row/3-row Douglas fir/oak mixture. Other species planted were Scots pine, Corsican pine, Western hemlock, and *Abies grandis*.

Friday, 24th June was a "free day" when, under the guidance of Mr. G. B. Ryle, tour members visited the new Science Block at Brighton College in the morning, and Brighton Corporation's nurseries in the afternoon.

Arundel Forest was visited on Saturday, 25th June, to see the results of earlier methods of conversion of degraded hardwoods; it was emphasised that the methods employed in these early conversions, when intimate 1-row/1-row mixtures of oak or beech with a conifer were used, have been superseded. We also saw various stages in the management of chestnut coppice, including regeneration by layering.

It was made clear that systematically managed chestnut coppice can be profitable, and differs markedly from the various forms of "degraded" hardwood coppice.

At the Slindon estate near Chichester, on Sunday, 26th June, the famous National Trust beeches were admired. Further examples of conversion of hardwood crops were seen where a variety of conifers have been used, including Corsican pine, which has succeeded best on grassy areas, and Norway spruce, which is a first choice in frosty hollows. Here too, studies had been made of the effect on the new crop of different rates of removal of the overhead cover. Much attention has also been given to the best method of mixing conifers with beech, both from the silvicultural and the economic aspect.

A visit to the Wormley factory of Messrs. Cooper & Sons on Monday, 27th June, gave one an insight into the mass production of walking sticks which are exported to many parts of the world. Our guests were amused to hear of the export to the U.S.A. of "Irish" blackthorn shillelagh from this factory! Chestnut and ash are the principal species used for walking sticks and this market provides an excellent sale for three to four year old chestnut coppice.

Alice Holt and Chiddingfold Forests and the Research Station at Alice Holt were visited on this day. Variations of hardwood conversion methods were seen, including the conversion of thirty-seven year old planted oak of Quality Class III which was being underplanted with Western hemlock, Lawson cypress, *Thuja plicata* and *Abies grandis*. At the Research Station, Mr. T. R. Peace welcomed the party and conducted a tour of the various sections whose officers explained the work which was in progress.

We ended the day supported by stout walking sticks—souvenirs of our most interesting visit to Messrs. Cooper and Son's factory.

The Tour's field excursions ended on Tuesday, 28th June, with visits to Alton and Micheldever Forests. Further variations of method, including well known examples of the conversion of hazel and birch were seen at these forests, where beech, either pure or mixed with conifers, has been the principal species planted.

Wednesday, 29th June, was devoted to the final session and to discussion of the draft report. It was evident, during this final session, as it had been throughout, that this was a most successful tour. Experienced planning and careful attention to each day's needs by Mr. J. V. Summers of Forestry Commission Headquarters, the stimulating leadership of Dr. Huberman which invoked such enthusiastic contributions from all participants, together with the friendly and responsive co-operation of all members of our field staff, combined to make this a most enjoyable, interesting and rewarding tour. Our company was honoured by the attendance of the wives of four of our party and of Miss Eden, of Headquarters. Signora Pugelli, Frau Sommer, Mrs. McCool, Mrs. Summers and Miss Eden enlivened our leisure hours with their charm and graced our company at the two sherry parties at which our guests were entertained.

In this worst of all English summers, the weather at Brighton was kind.

THE TREATMENT OF HARDWOOD SCRUB

By R. H. SMITH
Conservator, South-East England

Summary

Hardwood scrub which, in previous years, had been regarded as weed-growth is now widely accepted as a valuable asset and used, by treatment, to form a suitable canopy under which a wide range of species can be planted. The benefits of the system, both silvicultural, ecological and financial are enumerated. The species which can be planted as well as those used for shelter are stated.

The method of treatment described has been standard practice in Commission Forests in the most heavily wooded parts of England for years and is now being adopted by private owners in ever increasing numbers.

The practice of using a light cover of birch had, for many years, been known to have some beneficial effects on shade-bearing and frost-tender species such as beech but in general all hardwood regrowth of whatever type was, until recent times, regarded as weedgrowth and something to be eliminated before any good use could be made of the ground. However, in the natural forest the young seedling develops under the shade and protection of the older trees, and the practice described below is only the artificial application of this principle in hardwood areas by the careful selection and judicious use of the regrowth, either in the form of coppice or maiden stems, which nature so readily provides. Thus evolved a system which has so many benefits both ecological, silvicultural and financial that an ever increasing number of forest owners in the most heavily wooded parts of England are adopting it to their own benefit and to the speeding up of their re-forestation programmes. What had previously been looked on as useless rubbish to be got rid of in the cheapest way possible has now become one of the most valuable assets of the woodland owner.

Almost all woody species can be used effectively. It is fortunate that the age or size which is the most economic from the revenue point of view is also the easiest to deal with and that which provides the best cover. It may often be wise to leave a young regrowth another few years until it is 15 or 20 feet high or more, rather than cut it young when it can bring in little or no revenue, and after treatment is incapable of leaving adequate shade. Later it is often possible to sell the largest poles while leaving the lighter stems to form the overhead cover.

The procedure is to go through the area clearing out heavy or coarse branched trees of all types, retaining as far as possible all light foliaged species such as birch and ash, while at the same time cleaning out the ground cover and brashing up all stems left to about 6 feet to make it possible for planters to move through without difficulty. Planting is then done at normal spacing regardless of the overhead crop. It is not possible to suggest any specific number of stems to be left per acre because this varies at every age or height and for different species and so it is much better to work on the basis of direct light intensity. It is necessary to give only about 30% of direct light for the first one or two growing seasons—to some extent depending on the species to be planted—thereafter opening out at appropriate intervals as described below according to requirements. After some experience the correct light intensity can be gauged by eye, or if necessary there are photographic appliances which

can be used. The heavier the shade-bearing capacity of the species to be planted the less light intensity it needs and, of course, conversely with the light demander. Thus a considerable measure of judgment is necessary making the whole operation one of special interest to the forester. To assess the position accurately it is better if possible to do the work when the leaf is still on the trees since this is the time when the light intensity counts. It has to be remembered, that while the young tree is establishing itself, the canopy is also expanding annually and reducing the amount of direct light getting through. A careful watch is therefore needed, particularly in the early years.

The benefits to be obtained by the use of "dappled shade" in this way can be enumerated as follows:—

(1) Shelter from excessive sun, wind, and frost, thus permitting the use of more frost-tender species on sites otherwise not suitable for them.

(2) Humidity is retained at a natural level.

(3) The movement of the earth ensures that no tree is wholly shaded or wholly exposed to direct sunlight all the day.

(4) There is a gradual breakdown of the litter, maintaining suitable conditions for microfauna.

(5) It avoids the erosion risks attaching to clear fellings on hillsides.

(6) Soils are maintained at a more even temperature by day and by night.

(7) It greatly reduces the cracking open of clays in long dry spells.

(8) The gradual removal of the overhead cover by fellings over a period of years ensures that the brushwood breaks down slowly into the soil and is not destroyed by preparation fires.

(9) It is possible to plant one-year-old and two-year-old seedlings successfully, thus effecting substantial economy.

(10) Planting can be safely done later in spring or earlier in autumn than in open ground.

(11) As the soil does not so readily freeze, planting can be done when conditions make it impossible in open areas. The heavier the shade the more this applies.

(12) In comparison with open ground planting, losses are normally much lower. In consequence beating up costs are proportionately reduced.

(13) Reduction of weeding, weed growth being suppressed by the shade.

(14) Bird life is preserved.

(15) Sporting values are enhanced.

(16) Amenity considerations, which rank so high in many places, are adequately met. Conifer crops can gradually emerge from a hardwood shelter without any sudden change.

Perhaps the most striking visible benefit from this method is the prevention of frost damage under cover, while open areas adjoining are frequently severely cut back by late spring frosts.

Generally it is found that trees do not make much move in the first season after planting and if they are allowed a year or two to establish themselves in such very hospitable conditions, without intensive weed competition, they are then ready to grow away with the advent of more light after the first opening up of the shade.

The fellings on each occasion when cover is removed, or partially removed, can, without difficulty, be spread along the lines of the planted trees leaving

at least every other row free for access. In this way every tree is readily accessible on at least one side for weeding while the volume of brushwood tends to suppress the weed growth on the other side.

Successful planting has been done under the cover of the following species usually in profuse mixture (in addition to birch and ash already mentioned):— Common oak, Durmast oak, sycamore, Norway maple, Sweet chestnut, hazel, Field maple, aspen, alder, gean (*Prunus avium*), rowan (*Sorbus aucuparia*), sallow (*Salix caprea*). In using hazel, which is often growing pure and dense, it is necessary to cut off the outside shoots of all stools to prevent them falling over on the young plants, and this process should be repeated each time the shade is lightened. Hazel makes a very good cover but owing to its form it is usually essential to remove it rather earlier than more upright species which do not cause physical damage to young plants so soon.

It is desirable to eliminate all shrubs including Common privet (*Ligustrum vulgare*), dogwood (*Cornus sanguinea*), elder (*Sambucus nigra*), Guelder rose (*Viburnum opulus*), hawthorn (*Crataegus monogyna*), holly (*Ilex aquifolium*), Spindle tree (*Euonymus europaeus*), and Wayfaring tree (*Viburnum lantana*).

The rate of opening out and final removal depends on the species planted as well as the species comprising the overhead cover.

The following trees have been successfully planted by this method:— Scots pine, Corsican pine, European larch, Japanese larch, Hybrid larch, Norway spruce, Douglas fir, Western hemlock, Western red cedar, Lawson cypress, *Abies grandis*, beech, oak and Norway maple.

The more light-demanding the tree the sooner it needs access to fuller light and therefore complete removal may be necessary for larches after 3 or 4 years following fairly heavy opening (after the first or second year), whereas beech may retain its cover in ever-decreasing intensity for up to about 12 years provided there is no mechanical damage. A careful watch needs to be kept for signs of etiolation, small bud formation, thin weak shoots and drooping needles. All these imply too much shade and indicate urgent attention to be necessary. In practice it is found suitable to remove 50% of the canopy at each stage thus preparing the young trees for ultimate complete exposure. Over Norway spruce or Douglas fir there will be a removal at the second, fourth, and sixth year, the latter being the final. Over beech it is likely to take place at three or four year intervals, depending on circumstances. Forest labourers get so well accustomed to the work that they can do it without any marking by a forester.

Over a wide range of sites, covering a period of years, it is now possible to get some idea of the financial benefits to be obtained although this must, of necessity, be only part of the picture since much of it cannot be directly assessed in this way.

The use of 2-year-old seedlings instead of transplants can show a saving of 53% in the initial purchase price of trees. In the case of beech even 1-year seedlings of good quality have been used with complete success while 2-year seedlings of Douglas fir and Western hemlock have been found satisfactory.

Beating up varies widely but it is not uncommon to find no appreciable loss at all under cover, with 20 to 25 per cent deaths in adjoining open ground without cover. There is a saving in weeding through the normal period of establishment (particularly prominent in the first year) averaging 28%.

The retention of overhead shade brings about an initial average saving in cutting and burning costs of 32% but on the other hand spreading the total removal over a period of years instead of doing it at one operation increases the gross cost ultimately. However figures from sales show that where turnery

or pulpwood markets are available there is nothing to choose financially between the two methods since poles which were small and unsaleable in the beginning have developed through the years to a useful size, thus increasing the revenue above the figure which would have been attainable to start with. Other benefits due to reduced losses and greater flexibility of time for planting are not easy to assess financially.

Perhaps the hesitation with which this practice was first accepted was due to the fact that it needs a much greater measure of skill than straightforward planting after clearing and burning. However, when the principles are understood there is nothing at all difficult about it and workmen soon learn to carry out the operation on their own without constant supervision. Woodland owners, who are adopting it in increasing numbers, are not only reaping the evident financial savings but at the same time gaining the many less tangible benefits to amenity and the preservation of game.

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TREATMENT OF DEGRADED HARDWOOD AREAS FOR SHELTERWOOD RESTOCKING

By J. B. STOCKS

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Until recently the re-establishment of new woodland on poor hardwood sites was almost invariably preceded by clear felling. Poor hardwoods can serve a useful purpose in the establishment of the newly planted crop. This shelterwood system is now being used very largely in the re-afforestation of derelict hardwood sites of many types. The type of cover, the species which are planted, the procedure, the silvicultural, financial and management aspects are considered together with the amenity value of such a system.

(1) The types of poor woodland under consideration are those which are unlikely to develop into marketable high forest or coppice. They are generally hardwood or broadleaf crops and can be divided broadly into species which provide a high cover and those which are only capable of producing a low cover.

(2) The most commonly found species in the former or high cover classes are birch, ash, Common oak, Durmast oak, sycamore, wych elm, lime and Sweet chestnut.

(3) The low cover species are mainly of coppice origin such as hazel, oak, Sweet chestnut and hornbeam or of shrub-like species among which the most common are Field maple, sallow, hawthorn, blackthorn, dogwood, elder, holly and privet.

(4) Those species which develop the higher cover are capable of growing to tree heights but the lower cover species are in general less than twenty feet (6 metres) in height.

(5) Many different species are usually found on the same area except when the previous crop has been worked on a coppice rotation in which case the coppice species predominates.

(6) There is often a great variation in the height and density of the cover crop. Under these circumstances it is advisable, if possible on management grounds, to leave the crop untreated for a few years until the taller, clean growing species have suppressed much of the lower cover and thus made it easier to penetrate the area with men and tools and to select the desirable shade trees.

Density of Canopy to be Opened out Prior to Planting

(7) The taller cover has been found to be more beneficial to the new crop. It is therefore desirable during the selection of the cover crop to retain those trees with a light-foliaged crown which is high above the ground: the stems should be sturdy to obviate falling over.

(8) It is, however, desirable to remove initially all trees larger than eight inches diameter at five feet from the ground and also trees with heavy spreading crowns. Such trees should always be removed before planting takes place as it is not possible except by girdling to remove them subsequently without incurring damage to the new crop.

(9) It is also desirable to remove all dense shade-bearing low shrubs such as privet (*Ligustrum vulgare*), dogwood (*Cornus sanguinea*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*) and holly (*Ilex aquifolium*), prior to planting, except on the most shallow soils overlying chalk or limestone or where frost is severe. In such cases any form of controlled cover in the early stages of the new crop is beneficial.

(10) It is advisable to tend the cover to form a single canopy rather than to allow the over-shade to remain at different levels.

(11) The amount of overhead cover to be retained at the time of planting the new crop should not form a complete canopy, especially where it is low.

(12) Recent experience of planting under too dense a canopy has proved this by heavy mortality. During the wet summer of 1958 the losses were due to the new crop having insufficient light and remaining permanently wet and cold, particularly on the clay soils.

(13) Heavy losses during the extremely dry summer of 1959 were also encountered and this was attributed not only to insufficient light but to the excessive removal of soil moisure by the overcrop down to a considerable depth and the consequent complete drying out of the top soil late in the season. This has been particularly disastrous in cases where an over-wood of ash was used in too dense or even a complete canopy.

(14) The amount of canopy to be retained at the time of planting varies with the species, the height of the cover crop and the light intensity of the locality. There is need for more drastic opening up where the light intensity is low, especially in industrial sites with polluted atmosphere.

(15) The ideal canopy to be retained would appear to be approximately 60% to 70% when the cover is tall, but as the height of the cover decreases so the opening of the canopy should be greater, so that with a low type of such species as hazel coppice the cover should provide approximately a 40% to 50% canopy.

(16) The species most preferred are birch, oak and elm. These species have a type of crown which permits a certain penetration of light which is favourable to the newly planted crop. Ash provides a similar type of cover but it removes very large quantities of moisture and nutrients from the soil.

(17) Sycamore, lime, sweet chestnut and hornbeam cast considerable shade and the large leaves of sycamore and chestnut which provide such an excellent leaf mould free from weeds prior to planting can cover up, at the time of leaf fall, those plants which are too small.

(18) If pure, these last species must have the canopy reduced to about 40% if the cover is tall, and if the cover is low it should be reduced to no more than 25% to 30%.

(19) Where mixtures occur the overcrop should be treated on its merits according to the species present.

New Crop Species

(20) This system is essentially most suited to the use of the more shade tolerant trees and those species which would suffer from frost and exposure if planted without cover.

(21) It should be emphasised that the use of overhead cover is a means to the establishment of the most desirable species in relation to the permanent site factors and the cover should be manipulated accordingly.

(22) The species which have been successfully used are beech, Western hemlock, Western red cedar, Lawson cypress, Douglas fir, Norway spruce, Grand fir and occasionally Noble fir, *Abies veitchii* and *Cryptomeria japonica.*

(23) All these species appear to thrive under similar light conditions initially.

(24) These facts are based on the assumption that the choice of species for the site is correct for it is quite clear that the shade-tolerant quality of any species is dependent on all other conditions for growth being suitable and that if a species is planted on an unsuitable soil or with inadequate rainfall or in a polluted atmosphere it is far less tolerant of shade than the same species growing in its ideal environment.

(25) The type of plant to be used is preferably a well grown transplant of fifteen inches to eighteen inches.

(26) Use of seedlings is seldom advisable.

(27) There are also certain weeds such as Dog's mercury (*Mercurialis perennis*) and blackberry (*Rubus spp.*) which grow profusely under denser shade than many trees can ever tolerate and transplants are essential if such dense weed growth is to be overcome.

Rate of Opening Out of the Overwood

(28) The rate at which the removal of the overwood should take place after planting varies according to the species which have been planted and to the weed and new coppice growth which is encountered and particularly to the rate at which the original crop has closed up.

(29) Where frosts, especially late spring frosts, are likely to occur, the removal of the shelterwood will be governed accordingly.

(30) Thus no hard and fast rules can be given as to the rate of removal of the overstorey: one of the major considerations is that it shall be done in such a way that while the new crop never becomes weakened by too much shade the weed growth of the more light-demanding weed species is kept in control.

(31) One of the major advantages of the system is that whilst accepting some weed growth it is possible to prevent undesirable weeds, such as the coarse grasses, from dominating as they would if the area were clear felled.

(32) Signs of the planted crop becoming suppressed by excess shade are the small bud formation, loss of colour, drooping of the leaves or needles, weak shoots and flattening of the crowns.

(33) The usual procedure for the removal of the overhead cover is for the work to be completed in three operations, in the first two of which a half of the canopy which remains is removed. The first removal takes place when the new crop is about three feet to four feet in height, which is usually three years after planting. The second removal is when the new crop is six feet to eight feet in height or six years after planting, and the third and final removal takes place when the new crop is ten feet to twelve feet in height, which is usually nine to ten years after planting.

(34) It is, however, always advisable to remove the cover completely before the new crop has entered its crown, otherwise the branches of the overcrop will cause mechanical damage.

(35) There is no appreciable difference in the rate of removal of the cover for the species which are most commonly used, except earlier removal for Douglas fir and Norway spruce for which the first removal is usually after two years rather than after three years which is safe for the more shade-tolerant species.

(36) Where hardwoods are planted it is now the accepted procedure to plant a conifer crop with the hardwood either in alternate lines or three rows of each alternating with each other. Douglas fir and beech have been mixed in this way and where such line mixtures have been planted under cover it is sometimes the practice to thin the cover off the more light-demanding Douglas fir before taking any cover from over the more shade-tolerant beech.

(37) This provides overhead light and side shelter, which is very important to the more light-demanding species, and overhead cover and side light to the more shade-tolerant species.

(38) These times at which the removal of the overcrop should take place are general guides only and much will depend upon the rate at which the canopy of the overcrop closes and on the amount of weed growth which appears.

(39) The timely removal of the overhead cover is important not only for the reasons already mentioned but it also enables an even crop to be established and prevents the development of large coarse trees in the new crop. The final cutting of the shade trees is often combined with a "wolf thinning" of the new crop.

Financial Considerations

(40) Apart from the silvicultural and management advantages of the shelterwood system over the complete clearance, the total costs of the two methods are very similar; generally with a slight advantage in favour of the shelterwood system. There are however no spectacular monetary savings, as is sometimes claimed, by using overhead cover rather than clear felling.

(41) The weeding costs are often much less under the overhead cover but this may be offset by the extra care which has to be taken later in the removal of the overhead cover to avoid causing damage to the young crop.

(42) In general very little revenue is obtained from produce derived from the type of cover available. If there is a market then both systems benefit

accordingly and if anything the clear felling system is likely to benefit more due to the difficulty and extra expense of removing any material left as a cover crop.

(43) Apart from a very small saving in the number of plants used under cover, the costs to be considered and compared under the two systems are the felling of the overwood and the weeding until the new crop is established.

(44) Of the many examples of costs which have actually been incurred, typical averages where the poor hardwood yields no revenue are as follows:—

Labour charges per acre

(1) *Clear felling system*		(2) *Overhead cover system*	
(a) Complete clearance and burning lop and top ..	£35	(a) Preparation of overhead cover and stacking in drifts	£17
(b) Total weedings during 5 or 6 years	£24	(b) Total weedings during 4 or 5 years	£9
		(c) Removal of overhead cover in 3 stages together with the stacking and final cleaning	£26
Total ..	£59	*Total* ..	£52

(45) The costs of cover removal can be reduced considerably in those forests where local markets are available and in such areas the total operation has been carried out at a profit; but such markets are only to be found in a few localities. Nevertheless by a careful study of available markets it is often possible to remove at the initial cutting that material which is then saleable and to retain as cover those stems which may develop to become saleable during the time they are retained.

(46) The felling and removal of the poor hardwood under either system is the major part of the cost and the only possibility of reducing this is by ring-barking, which is often undesirable on amenity grounds.

(47) In the extreme South West of the country where there are extensive areas of poor oak coppice it has been possible to do the entire work by a complete ring-barking of all stems, either at the time of planting or shortly afterwards, at a total cost of about £5 per acre.

The crowns and stems of the ring-barked trees disintegrate slowly and the total cost of weeding has been £6 per acre.

Since no felling has been done there has been no trouble from coppice regrowth and no expense in stacking unwanted waste wood.

(48) In many parts of Britain the need to preserve public amenities totally precludes the methods of ring-barking or girdling.

(49) **Summing Up**

The *silvicultural advantages* of the shelterwood system as opposed to the system of clear felling are as follows:—

(i) Many species which are capable of the highest volume production can be more readily established.

(ii) The forest soil conditions are preserved.

(iii) The water table does not fluctuate to the same extent. (The system is particularly valuable on intractable heavy clays where considerable variations in the water table arise and where bad herbage types tend to dominate.)

(iv) There is a greater survival of those trees which have been recently planted.

(v) More protection is provided from frost and wind exposure.

(vi) Less weed growth is present under cover.

(vii) The brushwood is more evenly returned, after decomposition, to the soil rather than being burned unevenly over the area. This is because the waste, being cut over a period of several years, can generally be left to rot whereas by clear felling there is too large a bulk which has in consequence to be burned.

(50) The *management advantages* are as follows:—

(i) There is less weeding which has, of necessity, to be done within a short period during the summer. Such weeding as may be needed can be conducted over a longer season.

(ii) The removal of the overhead cover can be done at any convenient time and when other work is not available. It is very suitable work for the winter months, for there is more shelter for the men, and since the leaf is off the cover at this time of the year less damage is done to the young crop.

(iii) Sporting values are enhanced.

(iv) The transformation of a hardwood scrub crop to a coniferous crop is effected under a system which has higher amenity value than if the whole woodland were clear felled.

(51) In conclusion it must be emphasised that in such a system as that described it is quite impracticable to explain all the various conditions with which the forester will be faced.

(52) Flexibility is therefore essential in the application of the system and once the broad principles have been explained and understood the local staff must be given full scope to obtain the best silvicultural, management and financial results possible.

FORESTRY IN THE DUMFRIES DISTRICT

By WILLIAM J. BLAIR

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The Royal Scottish Forestry Society held their 63rd Annual Excursion in the South-West Area, excursionists being based on Dumfries.

An attractive programme had been arranged which provided ample opportunity for each member to choose daily outings which would be of interest to him. I have laid out the visits of my choice in diary form and I have attempted to describe points which held my own interest and which I think will be of general interest too and in addition I have tried to provide a general picture of each place of visitation.

Tuesday, 3rd May, 1960 (a.m.):

Chipboard Factory, Annan—Airscrew Co. & Jicwood Ltd.

The purpose of this factory is to convert thinnings and waste timber, in various forms, into boards of 12, 15 and 18 millimetres thicknesses with dimensions of 8 × 4 feet for use in furniture, building and allied industries.

Thinnings are purchased by piled volume which is calculated, to the satisfaction of both the Forestry Commission and the buyers, *by taking the total volume of the load and halving it to give the hoppus measurement.* The cut length required is 6½ ft. to 8 ft. with a top diameter of 3½ ins. to 12 ins. for which they pay an average of 4/– per hoppus foot. All timber must be peeled in the forest and any conifer is acceptable. It is interesting to note that they now use the waste from both the veneer and matchbox industries.

A brief outline of the process involved in the production of chipboard is as follows:

Logs are deposited in the yard where the stock is rotated every two months. The more twisted logs are crosscut to lengths of between 12 and 13 inches which is a suitable size for the Bezner *chipping machines.* The straight logs are fed to the chipping machines in their standard lengths. It is worth noting that a great deal of man-handling is necessary in the yard while internally the accent is almost completely on automation.

When the logs reach the chipping section they are chipped or shaved into two grades of uniform size and thickness. The finer grade (product of two Bezner *chippers* and one Guilliet *chipper*) are broken down into "needle" shape by milling in *disintegrators*, then passed through *air separators* to segregate the heavier and coarser pieces. The fine "needle" shaped chips are used to form the surface of the board while the core of the board is formed from the coarser chips and the chips obtained from a Hambak and a Guilliet *chipper* (also coarse) as well as from the aforesaid veneer and matchbox waste.

The chips (fine and coarse now being continually segregated) are conveyed from the *air separators* to *storage bunkers* prior to entry into the *driers.* Contained in the *driers* are *mesh band conveyors* on which the chips are spread in a thin even layer. The drying is done by means of the forced movement of air through banks of steam-heated pipes on to the chips—saturated air escaping to the atmosphere. When the chips have been dried to the correct moisture content (5%) they are transferred to the *resin gallery* to be mixed with resin, electrically controlled devices ensuring that accurate proportions are kept. The treated chips are now transferred to another pair of *storage bunkers.*

Up to this point almost all of the movement of chips is by forced air driving them through pipes to the appropriate compartments.

The final stages in the board making are completely automatic, treated chips being transferred by conveyor belts—all machinery being electrically controlled.

From the *storage bunkers* the chips are conveyed to the *spreading station* where specific weights of core and surface chips are spread evenly on moving aluminium plates. A *mattress* is formed of one layer of surface chips, then two layers of coarse chips, topped by another layer of surface chips. The *mattress* is cut into evenly sized sections by travelling saws and each section is weighed, pre-pressed to consolidate, then trimmed. The sections then move to the *press loader* until fifteen are in position. The next move is to the *hot press* which automatically releases fifteen sections already there. On their release the awaiting sections enter the *press* (also automatically) where they are pressed to the required thickness. The pressing time is approximately ten minutes. Steam heated pipes in this press cure the thermo-setting synthetic resin.

The sections, now boards, are separated from the plates and the plates return through a *cooling station* to the original *spreading station*. The boards are removed by fork-lift and stored for one week for curing and cooling. They are then trimmed to size and sanded to an accurate thickness. Finally they are inspected and tested before being transferred to the despatch area.

The average output is 10,000 boards per week or 320,000 square feet—approximately 300 tons of boarding.

Tuesday, 3rd May, 1960 (p.m.):

Castletown Estate—Major R. H. G. Mounsey-Heysham

This Estate is situated in the north-west corner of Cumberland, adjoining the Solway Firth and in close proximity to the Scottish Border.

It has a woodland area of 362 acres, all dedicated, and is extremely flat, being below the 50-ft. contour, thus making drainage very difficult. The prevailing winds (South-West) are severe and when this is coupled with the unavoidably high water table, the danger of windblow is extreme. In keeping with the flat nature of the ground, frost hollows are prevalent and Scots pine seems to be the only conifer able to survive in the worst areas.

The annual average rainfall is 35 inches.

Besides those natural hazards there is also an extremely high risk of fire. Both the main railway line North/South and the main Glasgow to Carlisle Road pass through the estate. Evidence of fire damage can be seen in many areas.

Nothing was done to the woods until 1912 and fellings made in the two World Wars have played havoc with what plans were made thereafter. An area equivalent to that felled in the first World War has been replanted. In the last war 88 acres were felled and 117 acres of land have been planted and replanted since.

There was a nursery until quite recently but this has now been turned over to the growing of Christmas trees since a local nursery can supply all the plants required.

The first area to be visited was a strip of land some 20 acres in extent which is sterilized by the presence of overhead electricity cables and their pylons. There are a total of 88 pylons for which the owner receives compensation for loss of land of 3/6 per pylon on woodland areas and 30/- per pylon on agricultural areas. In addition 5/- per acre is paid for the land sterilized by the cables. The cutting of this strip caused some windblow but this has not extended. The ground sterilized by the cables has been turned over to the growing of Christmas trees. Everyone was in agreement that the ground had been utilized to its fullest extent, under the circumstances.

Our next stopping point was at an area of 2·96 acres which was planted in 1929 with a mixture of Hybrid larch (40%), Scots pine (20%) and Sitka spruce (40%). The larch was obviously growing well while the Scots pine and spruce showed poor form. The area seemed ideally suited to larch and all thinnings were being directed in their favour.

Adjoining this area was approximately 22 acres of hardwoods, the chief species being oak with some sycamore, beech, elm and ash scattered throughout. The age of the crop was given as 100 years. Some Norway spruce had been removed in earlier thinnings and had been found to have heartrot. Proper thinnings had been neglected in earlier years and consequently the crop had suffered so that many of the trees bore very small crowns and carried little girth. In an endeavour to rectify this, the area was fairly heavily thinned in

1950 leaving 70 stems per acre, 1,700 hoppus feet per acre being removed. Unfortunately no figures were on hand to show whether the trees had actually put on girth but by the general appearance of the crop it was agreed that the number of trees per acre could be reduced even farther to favour the better stems as the crowns were still too small. It was thought that the crowns should be freed completely and where natural regeneration was occurring (and there was ample evidence of this) to encourage it and to supplement it by planting suitable shade-bearing species.

At this point we were shown an area adjoining the railway which had been repeatedly damaged by fire although the forest staff burned a safety strip alongside the lines each year. It was suggested that a possible solution might be found in the use of a rotovator which could be used to completely remove the surface vegetation and that this treatment could be continued for some distance into the wood. The breaking up of the soil might also encourage natural regeneration of the hardwoods around.

This burnt area was typical of many plantations which had been damaged by fire from both road and rail and the enormity of the forester's task in preventing such fires was driven home to all. Seemingly adequate precautions such as forming a triple barrier strip of birch then Japanese larch and finally a fire break at high danger points had proved of no avail. Natural water which might be used for suppressing fires at their onset was something of a rarity and I think that the introduction of water tanks in danger areas would be a distinct asset.

Our next stop was at an area of 16·7 acres appropriately called Hell's Hole. The area had been felled in the first world war (a Scots pine crop) and then neglected. Scrub birch had grown quickly and thickly until the whole area was completely covered. It was decided to clear the area in 1959 and two rather remarkably opportune contracts were secured by the estate. The first was for 11,000 birch brushwood fascines, in bundles of 1 cwt. and measuring 16 ft. by 36 ins. diameter, for road-making on an atomic rocket site in Cumberland. The second was for small birch in the round, of 4-ft. lengths and 4 to 8 inches diameter (no necessity for straightness), for a colliery in West Cumberland. These two contracts have already disposed of 12 acres of the birch scrub on this area. The comparisons of Incomes and Expenditures of these two contracts are rather interesting:

Cost of felling, bundling, extraction and haulage of birch fascines	5/9
Selling Price (per bundle)	6/9
Cost of felling, extraction and haulage of birch in round	72/6 per ton
Selling price	85/– per ton

(196 tons sold to date)

After rather unsuccessful attempts at drainage by ploughing (due to stumps and bog areas) the area was redrained by hand and planted with Scots pine.

We moved on to an area of 9 acres which was planted with Scots pine in 1934. Throughout the crop, at intervals of 30 ft., are groups of nine Sessile oak. The pine had received two thinnings, one in 1951 and the other in 1956. In the first thinning 1,850 hoppus feet were removed and converted into fencing stakes for estate use. In 1956, 1,624 hoppus feet were removed and put to the same use. The oak groups had not been touched. The groups had been planted in order to give some stability to the pine crop as the area is extremely vulnerable to windblow. The stand is due for another thinning and there was some conflict of opinion as to the correct way to thin this stand in view

of the danger of windblow. One party favoured leaving the outside edge untouched but the majority were in favour of giving the stand a normal thinning throughout as the ground appeared suited to Scots pine and it was felt that under such conditions the trees would be windfirm enough especially as the oak group were obviously going to produce one worthwhile tree and these trees were easily keeping pace with the main crop.

On our way back to the mansion we saw some very promising Scots pine regeneration which was receiving every encouragement and we also noted an extremely fine stand of Sessile oak which was in the process of being thinned and under-planted with species designed to uphold the amenity of the house surround.

Our visit ended with the very stirring spectacle of a piper in full Highland dress playing for us before the mansion—a most encouraging sign for our relations with forestry on "the other side of the Border!"

Wednesday, 4th May, 1960:

Castlemilk Estate—Sir John Buchanan-Jardine, Bart.

This estate is situated on the south side of Lockerbie. It has an average annual rainfall of 50—60 inches.

Until quite recently Scots and lodgepole pines had been planted extensively. Following the particularly cold and wet winter of 1953 it was seen that large areas of Scots pine were suffering from almost complete defoliation and over a period of years windblow had been prevalent amongst the lodgepole pine.

Both these factors caused concern and in 1955 Professor Anderson was called in to advise on methods to be used to remedy this state of affairs.

He expressed his opinion that pines had been used on too large a scale and in the case of the lodgepole pine being subject to extensive windblow, he pointed out that it had been planted on heavy land resulting in too rapid growth which eventually led to windblow.

As a solution he suggested the introduction by groups of Norway spruce, some *Abies* species and hemlock with some hardwoods of which oak and sycamore should be the major species. Throughout our morning tour we were to see some of the pine areas in question and the methods which had been used to restock those areas with the suggested species.

Our first stopping point was at an area where Scots pine had been planted in 1933. In the Spring of 1954, 90% of the crop were dead, the only surviving trees being found on the drain sides.

It appeared that the original ground preparation had been inadequate and that the choice of species had been wrong as the area is now ploughed and is bearing a very good crop of three-year-old Japanese larch and Norway spruce.

We moved on to another rather similar area which had carried a stunted and misshapen crop of Scots pine. The ground had originally borne a surface vegetation of *Calluna* and *Erica* and this had probably prompted the original choice of species. The site, however, was wet and since clear felling and ploughing all trace of heather has gone. The ground has dried out considerably and now carries a crop of two year old Hybrid larch which is putting on normal growth.

Our next stop was at an area of twenty-seven years old lodgepole pine. The crop had grown very quickly and the trees that remained after a particularly bad windblow in 1955 were of very poor form and extremely coarsely branched. The blown areas had been cleared and hand drained, then replanted with

sycamore in an effort to give stability to the area. The sycamore was not growing well and there seemed little hope of it ever making a crop. An interesting point, however, was the very good regeneration of Scots and lodgepole pines. It is now intended to encourage this regeneration and to form a mixed stand by interplanting with Japanese larch and Sitka spruce. After seeing the result of a similar mixture at Castletown Estate I doubt the advisability of this decision and I would treat the regeneration of lodgepole pine with caution as the parent trees seemed to be of a very poor strain.

We moved to another part of this area which had also suffered badly from windblow but which was receiving a different treatment. In the large gaps Sessile oak groups were being planted with Norway spruce to act as a nurse. The oak are doing extremely well and I would like to have seen this particular system given a wider trial as I felt that this particular soil would grow a very good type of Sessile oak.

At our next stop we saw another area which had suffered from severe defoliation and yet another system had been tried in an endeavour to establish a successful crop. Lanes had been cut through the pine to allow the entry of a tractor and draining plough and thereby a deep drainage system had been introduced. The area was replanted with Norway spruce and Sitka spruce together with oak groups and, under the more heavily shaded spots *Abies grandis* and Lawson cypress had been planted. A small area had been completely restocked with Hybrid larch. The intention is to gradually remove the original crop of Scots pine. The deep draining had certainly improved the area and all species were doing extremely well. The Sitka spruce being especially attractive.

We also saw an area of particularly rough lodgepole pine in which groups had been clear felled. A variety of underplants was being used in the groups which will be gradually enlarged until the whole area is restocked. The groups have no particular dimensions.

Our morning tour was completed by a visit to a stand of Scots pine which had been very heavily thinned and then underplanted with Western hemlock. Much discussion ensued as to the advisability of planting hemlock on a mineral type soil such as this when it was known to be particularly vulnerable to attack by heart rot. Many felt that the correct thing had been done and that (despite some opinions to the contrary) the timber produced would be very valuable for estate work. It was thought that the danger from heart rot was being exaggerated in this particular case. The stand was certainly looking very attractive.

Although one would expect the weeding costs to be high on an estate being managed in the way described we were informed that to date very little weeding had been necessary although as the overhead crops were being gradually removed so the weeding costs were expected to rise.

It is rather interesting to note that all of the estate seedlings are grown under glass and then lined out in a walled garden used as a nursery.

Taken as a whole the various treatments we saw appear to be having the desired effect and although the management of the woods is now a little more complicated than it would have been had the large areas of pine survived there is little doubt that the land is being utilised in a much more beneficial fashion and will, I feel sure, produce some very fine stands of mixed timber.

The Policies at Castlemilk

In the afternoon we were treated to an exceptionally interesting tour of specimen trees and collections which included many trees of lesser known

species. The tour was conducted by Sir John Buchanan-Jardine who displayed an astonishingly intimate knowledge of the names, origins and habits of all the trees in his extensive collections.

In the many less common specimens seen the following are perhaps worthy of note as trees which appear, on their present showing at Castlemilk, to have distinct possibilities should they be grown on a larger scale in this country. It should be borne in mind, of course, that the trees are not growing under plantation conditions.

Quercus—The Oaks

Quercus conferta—a native of South-East Europe. This tree shows a very good form and has a good persisting stem. It produces a good quality of timber and is reputed to be frost hardy.

Quercus palustris—a native of South-East U.S.A. It is a fairly vigorous grower. Is immune to spring frosts—comes into leaf late.

Quercus macranthera—a native of the Caucasus. It is a fairly fast grower and produces a good quality of timber.

For those who wish to consider amenity—*Q. rubra* and *Q. coccinea* combine fast growth with excellent autumn colouring.

It is worthy of note that the oak collection seen here is reputed to contain a larger variety of species than any other in Scotland.

Pinus—The Pines

Pinus parviflora (Japanese pine). This is a five-needle pine. There is no evidence of White Pine Blister Rust (*Cronartium ribicola*) on this tree. Could this be crossed with *P. strobus* to any advantage?

Pinus koraiensis (Korean pine). Although this is normally reputed to be a tree of poor form, the specimen here was of good habit and had made fairly fast growth.

Pinus armandi—a native of Central and West China, Formosa. This is a five-needle pine and is showing good form and growth.

In the *Acer* collection a specimen of *A. macrophyllum* aroused interest with its fine form and persisting stem. We were informed that it is also a rapid grower.

The time devoted to the inspection of this wonderful collection of trees was unavoidably too short and it was with some reluctance that we departed from Castlemilk Estate, many of us regretting, no doubt, that our knowledge of tree species was so restricted!

Thursday 5th May, 1960: Blackwood Estate, Auldgirth—T. H. Kennedy, Esq.

The woods of this estate lie in the valley of the Nith, approximately eight miles north west of Dumfries. They consist of two major blocks with a number of smaller plantations and shelter belts. There are 650 acres under trees. The average annual rainfall is 45 inches.

The soils are heavy and very rich in the valley bottoms while the middle slopes, which are steep in parts, have a good depth of stony free-draining soil. The upper slopes are less fertile, having fairly large areas of peat, but they are still capable of growing good coniferous crops.

A considerable acreage of woodland is the result of afforestation, quite large areas of poor grazing land having been planted.

It was interesting to hear Mr. Kennedy remark that since planting up these poor grazing areas he has been able to increase his farming stock. This

he attributes to two factors, the first being the easing of farm management as the reduction of poor ground has allowed greater concentration of work and the second being the well known benefits to stock and crop obtained from sheltering.

The first item on our programme was a visit to the estate sawmill which is powered by electricity. It is well laid out and the timber moves smoothly from one saw to another. There is almost no waste as all slabs are crosscut to 31 inches and passed to a remarkably efficient Swedish Ari saw which trims off very thin slats of set width. The saw has a spring-set feed which allows all widths of slabs to be fed to it, yet still produces to an accurate degree the required width of slat. The slats are used for peat bundling and are produced at the rate of 10,000 per month. The selling price is £5 per thousand. All the timber required on the estate for stobs, gates, etc. is converted in this mill.

Beside the sawmill we were shown an area of sycamore regeneration which was being thinned out to allow the free growth of the better stems. This was being done by one man with a portable Jobu circular saw. These saws weigh 27 lb. and on enquiry the operator said that he could use it for a full day quite comfortably. The maximum diameter of stem that could be sawn appeared to be approximately 3 inches. The saw had originally been brought in order to clear twenty acres of broom, required for planting. It had proved efficient and quick. The saw was detachable and could be replaced by a weeding attachment. This we also saw in action on an area covered by brambles but it seemed to have no advantage over the ordinary long handled hook. It was intended to use this machine for weeding young trees but I believe that the risk of injury to the plants would be too great as there was not sufficient control for accurate work and over and above that it would be impossible to weed those most important areas immediately around the base of the plants. Weed growth, it should be noted, is a major problem being both lush and heavy on these fertile valley soils.

We moved on to an area of 6 acres which had originally carried a crop of hardwoods. Three acres were planted in 1927 with a mixture of Japanese larch, Norway spruce and Sitka spruce. The spruce had died out with the result that no thinning was done until 1958 when 989 hoppus feet of larch were removed. A further 1,197 hoppus feet were removed the following year. The larch is not good, being rather twisted and heavily branched and it is intended to remove it completely, replanting the area with Sitka spruce, Norway spruce and *Abies grandis*.

Our next stop was at an area of 5 acres which had been planted in 1927 with yet another mixture, this time one of Japanese larch, Sitka spruce and Douglas fir. The plantation had been neglected and did not receive its first thinning until 1953, when 615 hoppus feet were removed. There have been two further thinnings totalling 1,143 hoppus feet. The crop has suffered badly because of the delay in thinning and the intention is to thin really heavily within the next two years and underplant with a suitable species.

It is interesting to note that no mention has yet been made of hardwoods although this valley soil is very fertile and would be ideal for their growth. The estate policy is to plant mainly conifers with a view to producing, as quickly as possible, timber suitable for pulp wood and estate use. Occasional hardwoods will be planted for soil enrichment and naturally regenerated hardwoods will be encouraged where possible. This trend struck me as rather unusual for a private estate and (though the idea is probably economically sound for the immediate future) it saddened me a little to think that an area so suited to the growth of hardwoods should be turned over to conifers.

We completed our morning tour with a visit to a mixed stand of Japanese larch and Douglas fir planted in 1927. It was first thinned in 1953 when 1,814 hoppus feet of timber was removed. There have been two further thinnings which yielded 2,270 hoppus feet. Here, again, the Japanese larch was not of particularly good form and was well overshadowed by a very fine strain of Douglas fir. Indeed the Genetical Section of the Forestry Commission had thought it worthwhile to choose a "plus tree" here—a fine specimen over 80 feet tall. All previous thinnings have favoured the Douglas fir and this will be the practice throughout the rotation. It is intended to restock the area with Douglas fir.

I was disappointed by the large amount of Japanese larch which had been planted on these fertile soils and I felt how much more profitably the ground might have been utilised. The owner explained that much of the estate had been planted with little thought of silvicultural correctness but rather with the intent to provide good ground cover and nesting areas for the game.

In the afternoon we left the richness of the valley bottom and climbed to the more infertile soils of the upper slopes via a beautiful smooth concrete roadway!

Our first stop was at a large shelter belt which had been planted on ground found unsuitable for grazing. It contained a mixture of conifers which were growing very well. There is a fence around the area but we were told that this is to be removed when the crop is mature enough to allow cattle to enter from the surrounding hill. This remark aroused a great deal of discussion and three separate instances were given where complete plantations had been lost by allowing cattle to enter there. The reasons given were: the exposing of the roots of the trees; the constant churning up of wet ground causing a quagmire which resulted in windblow; and the adverse effect of cattle urine on tree growth.

We moved on through a very much larger area which had also been poor grazing land until two years ago. Here, however, the mixed conifers were not growing well. The ground preparation seemed to be inadequate having been confined to screefing. We were informed that the bedrock was very close to the surface in many places but I feel that a much more successful plantation might have been established had the land been ploughed as far as was possible.

As we walked down the hill we saw an area of 60 acres which had been planted in 1947 with Japanese larch and Norway spruce. The crop was thinned last year, 1,000 hoppus feet being removed. Viewed as a whole the trees looked rather poor but on closer inspection it was felt that there was a sufficient number of good stems to give a good final crop if the area were to be thinned judiciously.

I was intrigued by small areas of ploughing which appeared in the crop. These, I was told, are used for the growing of kale and corn which is left as attractive fodder for the pheasants!

Down at the botton of the slope we again found evidence of the better types of soil. There was a really excellent plantation of Norway spruce, not yet due for thinning, the form and growth of which was admired by all. Here too were seen first class stands of European larch and Scots pine planted in 1938.

We completed our day at Blackwood with a visit to the nursery which is just being established and from which it is hoped to obtain all of the plants required by the estate, followed by a walk through a stretch of lovely, mixed, mature, woodland adjoining the main road, which is being preserved for amenity.

On the completion of this most interesting tour there was little doubt left in our minds that Mr. Kennedy and his forester have some refreshingly original ideas on how an estate should be managed in order to knit as closely as possible agriculture, economical forestry, game preservation and amenity.

Friday, 6th May, 1960: Eskdale Estate—His Grace The Duke of Buccleuch

This estate is situated between Langholm and Canonbie and has a woodland area of 4,112 acres, all of which is dedicated. The elevation ranges between 160 and 1,250 feet above sea-level. There is an average annual rainfall of between 44 and 58 inches and the prevailing wind is south-west although gale damage comes mainly from the north-west and north-east. The soil is very variable but it is mainly suitable for tree growth especially on the slopes of the main valley where it overlies sandstone and where there is good natural drainage.

The chief species to be found are oak, ash and sycamore with beech, elm, alder and birch. Among the older mixed woods Norway spruce, Scots pine, European larch and *Abies* species have been planted. In the younger plantations of pure conifers there are also Sitka spruce, Hybrid larch, Japanese larch, Douglas fir, hemlock and various *Abies* species.

The woods have been under systematic management based on volume and increment control of fellings since 1910. The working plan is revised every ten years.

The objects of management are:

(1) To obtain on every area a continuous yield of the largest volume of good timber, while maintaining and improving the fertility of the soil.

(2) To secure and maintain conditions of restocking from which to select good quality trees to grow to maturity.

Mixed hardwood and conifer areas where access and extraction are good are managed on a selection felling, natural regeneration being supplemented by planting. Areas not suitable for this treatment are clear-felled when mature and replanted either with mixed hardwoods and conifers or with pure conifers.

Pure conifer areas are either clear-felled when mature or else converted to mixed crops by group-felling and underplanting.

Some ground of low agricultural value is resumed for planting.

The annual production is about 300,000 hoppus feet. Rather less than one third of this goes into the estate sawmills and the rest is sold standing or felled. Thinnings produce about 66% of the total yield and clear felling 10%, the remainder being derived from selection fellings.

The first place of interest to be visited was Hallowell Bogs, which is principally a hardwood area about 150 years old. Conifers appear in mixture here and there; and in the centre, on some level ground, there is a pure stand of conifers. It is managed on a selection felling system and heavy fellings were carried out in 1955, 1956 and 1957.

Planting was done in 1957 and 1958. There has been a vast quantity of natural regeneration representing many species of both hardwoods and conifers and throughout one gets the impression of fertility and rapid growth wherever this regeneration occurs. Although there is a strong surface vegetation of *Luzula*, the dragging and felling have broken this up considerably and consequently the natural seedlings have been given the chance to develop.

In the areas which had not stocked themselves naturally a wide variety of underplants had been used, one particularly attractive corner being underplanted with maple which was growing extremely well. Since the advent of

myxomatosis the regeneration has increased enormously and although a few rabbits still remain they are no longer a problem. The damage inflicted by hares and deer, especially the former, is now of much greater importance.

Of special interest were some very fine natural Sitka spruce stemming from two very large parent trees which are 90 years old. One of the parents (the largest Sitka on the estate) is an exceptionally good specimen which has been marked by the Geneticists. Its present height is 110 feet and it has a girth at breast height of 11 feet 8 inches. Its estimated volume is 367 hoppus feet.

We moved on from the Hallowell Bogs area to a plantation aptly called Wendyhill, which was agricultural land until 1870. The first crop, Scots pine, was felled in the first world war and it was replanted in 1918 with Sitka spruce. It suffered severe windblow in 1954 which resulted in the area being clear-felled the following year. It yielded approximately 7,000 hoppus feet per acre. The ground has since been replanted with Japanese larch, hardwood groups being inserted throughout, in an endeavour to obtain some stability on the area.

We completed our morning tour by visiting a very fine stand of pure Western hemlock which had not had the benefit of any overhead shade.

In the afternoon the tour was unavoidably curtailed as many of the excursionists had to leave rather early.

I was able to visit an area called Glencartholm which consisted of old hardwoods planted in 1808. A selection felling had taken place in 1959 leaving twenty trees per acre. A total of 743 hoppus feet per acre was removed in this felling, the timber being sold at 5/- per hoppus foot.

Among the parent trees left were some very fine specimens of oak which had been selected by the Geneticists as quality trees. Natural regeneration was growing well and had been supplemented with a variety of species. A great deal of discussion ensued as to the advisability of the extensive selection fellings which we had seen on our tour through the estate. Many members thought that the expense incurred in planting and weeding would be very high and that difficulties would arise in future management. The same school considered that the future fellings and the extraction of mature trees would play havoc with the young crop. It was admitted that the latter point had in fact provided difficulties in the early days, but in all the more recent plantings extraction routes were planned beforehand and left unplanted. The other points were considered to be outweighed by the fact that a very good continuous yield was being obtained, with little or no planting in many cases.

At the end of my visit to this estate I found myself thinking how well managed and controlled were the woodlands and how lucky the forester was to be able to tackle so interesting a form of management such as selection fellings provide, all the while knowing that the soil he was working on was fertile enough to produce, in many cases, adequate quantities of first class natural seedlings.

The conclusion of this excursion brought to a close a week which had been full of interest and which had proved a mine of information to me. It was refreshingly new to meet, at first hand, problems which arise on estates and to note the methods which are used to solve them. To one used to the more infertile peat soils and to the struggle which trees have for survival on them, one found it very satisfying to walk over ground which was really fertile and to see it producing first class conifers and hardwoods and to note the dense, strong natural regeneration which appeared in many areas.

These and many other points served to make the Royal Scottish Forestry Society's tour of 1960 a most absorbing and memorable excursion.

ESTATE WOODLANDS AROUND CHELTENHAM

By A. R. MADDOCKS
Forester, South Wales

The Royal Forestry Society of England and Wales held its annual Summer Meeting at Cheltenham from 3rd to 7th October, 1960, and visits were paid to three private estates.

Tour of Huntley Manor Estate on 4th October

On the first day a visit was made to Huntley Manor Estate, owned by C. P. Ackers, Esq., O.B.E.

The Estate lies on the borders of the Forest of Dean and is of about 2,000 acres, of which about two-thirds is woodland. A forest nursery of about 10 acres and a sawmill are also maintained by the estate.

The day's programme commenced with a tour of Newent Wood, an area of about 650 acres divided by a public road, to the west of which the geological foundations are mainly of Llandovery Beds and to the east practically all Devonian (Old Red Sandstone).

The area was formerly worked on a 15-year coppice rotation of hardwood poles over hazel coppice, the poles going to the Forest of Dean mines. Acquired in 1910 by Mr. Ackers, the area was later cleared for planting and the first planting of conifers took place in 1917. This planting was apparently done by Austrian internees of little or no experience and there was lack of proper supervision with the result that about 50% of the planted crop failed and were replaced by hardwood coppice shoots from the old stools. Failure of crop probably due to:—

(1) Bad planting.

(2) Lack of proper maintenance, e.g. weeding in early stages.

(3) No beating-up carried out to maintain full stocking.

Several different plots in this wood were visited:—

Plot 1.—P.17 European and Japanese larches with oak and ash

Area was in process of being thinned. The larger conifers being converted to mill timber and the remainder for pitwood. The hardwood poles converted to Sudbrook pulpwood.

The stand was not very uniform for in some parts the planted crop had completely failed with the result that they have become almost scrub and the question is whether the yield of pulpwood and firewood, etc., from these areas is more economical in the long run than a complete gradual clearance to replace them with a more uniform conifer crop, such as the *Abies grandis* seen in the next plot.

Plot 2.—P.27 Abies grandis and P.22 Norway spruce

This was an excellent stand with the *grandis* being particularly fine specimens with a volume of about 3,000 hoppus feet per acre indicating that probably much more of this species should have been planted in this wood. The spruce by comparison here seemed to be struggling and were dwarfed by the *grandis*.

The whole of this plot was originally planted with spruce in 1922 for the Christmas tree market and five years later, when these were ready, they were replaced by the *grandis*, although some of the original spruce remain in the crop.

Plot 3.—Poplar with hardwood scrub

This was a very wet unproductive area which presented the owner with quite a problem. Drainage was difficult owing to the lay of the ground. The few poplar which were there were growing fairly well and the best method of improving the potential yield from this plot seemed to be based on over-hauling the drainage system and introducing more poplar after cleaning-up the scrub, leaving the best stems to grow on. A full clearance of the plot for replanting would be far too expensive and in any case would be of little benefit in ground of this type.

Plot 4.—P.17 Douglas fir with P.17 European and Japanese larches

This plot was just out of the last plot of very wet ground. Originally it carried about 50% Douglas fir but these were attacked by *Adelges* and the larches gained the ascendancy and, in places, have completely suppressed the Douglas fir. A little farther up the hill, however, both larches and Douglas fir seem to be doing equally well.

Plot 5.—P.17 European larch

This area was scheduled to be heavily thinned with a view to under-planting with spruce at close spacing for future Christmas trees and redwood, some spruce being kept in the final crop. The overwood of larch to be about 20 stems per acre. (This method of treatment had already been carried out in Plot 7). It is doubtful whether this overhead cover is sufficient to really assist the undercrop by giving sufficient shade to keep down the weed growth.

Plot 6.—P.12 European larch with few P.12 Douglas fir and hardwood poles

Here the larch had been gradually removed to favour any good oak poles which were then high pruned. The larch giving a fairly quick return in good mill timber while, at the same time, improving the quality of the oak. Some beech and Sweet chestnut throughout the area but damage by grey squirrels had ruined many of these.

Plot 7.—P.12 European larch/P.14 Japanese larch

This mixture resulted from the original European larch failures being beaten-up with Japanese larch two years later and the two species had grown to a good average stand.

Recently this plot had been heavily thinned to about 20 stems per acre and underplanted with Norway spruce at 2-foot × 2-foot spacing interspaced with redwood at 8-foot spacing which, it is hoped, will be the final crop eventually.

The larch "nurse" to be left to grow on to make high quality timber.

The 20 stems per acre seemed too thin a cover to be really effective as a deterrent for weed growth. It was interesting to note that there was a considerable amount of larch regeneration interspersed with the planted crop and it seemed that with say 50 larch left per acre the natural regeneration would have been evenly spread over the whole area.

After a picnic lunch the tour continued with a visit to Huntley Hill Wood. This wood of about 600 acres is situated between 400/600 feet above sea level and geologically composed of the Llandovery series, giving medium loam with some stone outcrops near the top of the fairly steep banks.

The area was acquired in 1905 and at that time consisted of derelict hill grazing land of low agricultural value. This was adjoined at that time by

about 4½ acres of P.1850 larch and Sweet chestnut planted in alternate lines at 6-foot spacing. The larch became the dominant species and at 45 years were about 10 hoppus feet each, average volume.

These were heavily thinned and the proceeds used to plant up all the acquired new area.

A small nursery was established in this area in 1905 with 2 year seedlings of Douglas fir and Sitka spruce purchased from Germany. Forestry was so far in advance of Britain in that country that the cost of these seedlings was less than one-tenth of the price quoted by British nurseries.

The first planting took place in 1906/7 and consisted of an area of Douglas fir/European larch mixture with a border of Corsican pine and sycamore on the exposed south-west side which are excellent shelter for the main crop but of poor quality in themselves as could be expected. The Douglas fir/larch mixture was of average quality for this fairly exposed site.

Over the brow of the hill, where it was somewhat less exposed, there was an excellent stand of Douglas fir/Sitka spruce, the final crop trees of which had been pruned to a height of 40 feet. The owner was particularly and rightly proud of this very good stand of timber which he had tended from the initial establishment to achieve its present excellence.

Lower down the slope of the hill an experiment was carried out by the planting of Corsican pine and Japanese larch in two adjoining areas, one of which had been ploughed. It is interesting to note that on the ploughed area the Corsican pine were a complete failure, whereas in the unploughed area this species was dominant. After a very hot dry summer in 1911 it was feared that most of the Japanese larch would be lost but these recovered and eventually a full crop was obtained.

Further down the hill there were areas of European larch/Douglas fir mixture with an area of pure larch in between. It is interesting to note that, whereas the larch in the pure block was badly attacked by canker, those in the mixture were practically unaffected. Douglas fir is the dominant species here although sufficient of the larch recovered to form a good quality mixed stand. The Douglas fir were free of chermes attacks which did not become widespread until a few years later.

Before finally taking leave of this estate a brief visit was made to the present nursery of about 10 acres. Excellent "beds" of several species of seedlings were established and a start had been made on transplanting these into "lines". However, it was interesting to note that the method of "lining-out" was apparently "single board" by one man in contrast to the general strip "lining-out" normally practised in Forestry Commission Nurseries. Advantages of this single board method would be:—

(1) Area could be split up more easily as each man takes over his own section of the bed.

(2) Easier to work down the slope than across it.

(3) Makes for easier mechanical weed control by spraying as machine could work much better travelling up and down the slope rather than across it where there is always danger of "sliding".

(4) Does away with necessity for aligning of rows across the beds which takes some time for continual adjustments.

Unfortunately, the weather (not unusual last summer) had stopped work in progress and we could not have an actual demonstration of this method of working.

Tour of Ebworth Park and Kingscote Estate on 5th October

The Ebworth Park Estate consisting of about 750 acres of woodland. About a third of the total area has been afforested or replanted since the present owner Mr. F. G. Workman became interested in forestry. The woods consist mainly of beech of very good quality with some ash and small areas of conifers, and tend towards an uneven age structure. There are at present about:—

260 acres of 35 years or under.
70 acres of 35-70 years.
120 acres of 70-105 years.
300 acres of 105 years and over.

Almost all the woods are devoted to cultivation of good quality beech and a flexible policy is pursued with this prime object in mind.

Annual output is around 50,000 hoppus feet per annum. The large timber generally being sold standing, the smaller being "worked" by the estate and sold locally to mills and merchant.

This estate made a fine contribution during the war years—400,000 hoppus feet being felled. Another 280,000 hoppus feet were felled in the immediate post war years from 1946-50, but in spite of this the whole woods are now 100% productive again.

Rabbits were wiped out in these woods by 1935 and planting could be done without wiring against these pests. This made the group method of working much more economical to carry out.

Squirrels on the other hand are very destructive, especially in young beech plantations and the cost of control of this pest is about £1 per acre over the whole estate.

As these woods are situated on the slopes of a valley extraction was always a problem and was proving quite expensive. In 1937 a system of rough road making was commenced which culminated in nearly 30 miles of road suitable for normal extraction being completed by 1959. This roadmaking was achieved by the hiring of one bulldozer working under the direct supervision of Mr. Workman who himself pegged-out the routes. Fortunately a plentiful supply of suitable stone was readily available a few feet below ground level in most cases and so after removal of the topsoil it became a comparatively simple matter to level the stone. Very little attempt was made to camber the roads and very little culverting was necessary but the porous nature of the ground allows for good natural drainage.

These roads have turned what used to be a very difficult extraction area into a comparatively easy one. The money was obviously well spent and will be recovered in a reasonably short space of time.

This system of road linkage will, no doubt, have the effect of modifying the group system which will no doubt now be revised gradually to fit into the new framework.

Frith Wood

This is a newly acquired area of pure beech about 170 years old, obviously neglected for some considerable time. The result is an excessive number of stems per acre with low crown ratio. It is a fairly exposed area and therefore thinning will have to be carefully done to gradually reduce the number of stems to something near normal, favouring the dominant trees which were sufficiently scattered throughout the area to eventually form a fairly good final crop.

Extraction here presented no problem as only a little improvement of existing tracks is required.

Kingscote Estate

This estate was acquired in 1932 and consisted of a total of 1,400 acres which included most of the village of Kingscote and three farms. There were 200 acres of fully stocked woodland.

Capital from sales of timber from these woods resulted in considerable improvement in the farms and cottages. The resultant increases in rents then in turn assisted in the improvement of the woods.

The main block of woods originally consisted of first quality beech of 150 years, believed to be of Belgian origin. Of this about 30 acres now remain containing about 60 stems per acre which are still growing on at an increment of 2% per annum and have a volume of about 3,600 hoppus feet per acre. This is in spite of the fact that many of the best trees were felled during the last world war for veneers for gliders and planes.

50 acres of the wood was felled in the first world war and was partly replanted with Douglas fir, beech and ash. This block is of only moderate quality whereas the area of naturally regenerated beech is of good quality, conclusive evidence that this is essentially an area where beech should be cultivated.

An area of 10 acres was clear-felled in 1949. The resultant natural regeneration covering the area is now growing on well.

A further 10 acres recently clear-felled in 1957/58 have been replanted with larch and beech (Kingscote) with a 3-foot × 3-foot row mixture. In this case it is intended to take out the larch gradually in the pole stage, aiming at a final crop of beech.

Kingscote Wood is listed for seed collection and many tons of good quality seed has been collected.

The whole of the Estate was one of which the owner has reason to be justifiably proud, particularly of the effort to maintain the high quality standard of timber which can be produced from these woods.

Tour of Cirencester Park on 6th October

This park consists of an area of about 3,000 acres of dedicated woodlands made up of ancient forest areas laid out originally by the first Earl Bathurst in the eighteenth century. A wonderful system of rides traverse the whole forest with a "main" ride, broad and straight for 5 miles. A total staff of about 28 woodmen under a forester are employed.

The estate supplied approximately 1½ million hoppus feet of timber during World War II, consisting mainly of oak, beech, ash and larch, when all trees over 12 inches breast-height quarter-girth were felled in Oakley and Overley Woods, an area of about 1,200 acres in all.

A further 300 acres in Hailey Woods were clear-felled.

Rehabilitation of the forest began in 1946 under Mr. J. E. Garfitt, the estate forestry advisor. This was to be financed by making improvement fellings, commencing with all trees damaged during the wartime fellings and including any large trees which had reached maximum increment level but were still remaining.

The main objects of management were:—

(1) To restore the woods to full productivity as quickly and as economically as possible.

(2) Preserving the general broadleaved character of the woods while, at the same time, introducing another high proportion of European larch and Scots pine for which the woods were noted in the past.

(3) Preservation of game cover and the general appearance of the woods during the period of conversion.

The policy was pursued of utilising all suitable natural seedling growth and coppice, so reducing cleaning of ground for planting to a minimum. A form of group selection has been adapted as the basis of rehabilitation. Retained overwood being kept in pure group and any planting being done in pure groups.

The following three methods were used to achieve the above objectives:—

(1) *Treatment of areas fully stocked*

(a) Cut back all underwood.

(b) Thin out all groups of advanced growth.

(c) Reduce coppice stools to single stems per stool.

(d) Fell all trees in overwood not putting on increment which were not required for seed or shelter.

(2) *Treatment of areas incompletely stocked*

(a) Clear all blanks for planting.

(b) Stocked parts of area treated as in 1(a).

After extraction of all resultant produce the area is rabbit fenced. Planting then done in pure groups of about a chain width. Larger planting areas planted in the checkerboard style.

(3) *Partial advance treatment*

This treatment consisted of assisting the young regeneration under overstorey by a general cleaning. Later Method 1 or 2 above will be applied as necessary.

A method of "scuffling" over the ground to prepare it for seed fall in mature beech plots was demonstrated. This was simply the tushing through the area of several yew logs, with several "spikes" left on each log, by light tractor. This is done before and immediately after a fall of seed.

On an area nearby where this simple but effective treatment had been carried out a thick carpet of regenerated beech covered the whole area—ample evidence of the effectiveness of this treatment.

The chief hazards to young growth are:—

(a) *Rabbits*—these are still quite plentiful in the area, necessitating wiring of new plantations. Natural regenerated areas, on the other hand, are left unprotected but do well.

(b) *Grey Squirrels*—This pest caused damage, particularly to beech and sycamore, and must be kept down as much as possible.

(c) *Pigeons*—which damage beech mast.

(d) *Fallow Deer*—these cause some damage to ash and planted pine and beech but there is no special deer fencing erected.

Visit to Wild Fowl Trust at Slimbridge on 7th October

This Trust was formed in 1946, sponsored by Mr. Peter Scott the world-famous naturalist. Its objects are:—

(1) To maintain the stocks of wild ducks, geese and swans in all parts of the world.

(2) To learn more about these birds.

(3) To interest other people in them.

(4) To help prevent their extermination.

The location at Slimbridge was selected by the Trust to assist in this work because:—

(1) It was already the winter home of a great flock of wild geese.

(2) There was a duck decoy already situated nearby which had been in existence for about a hundred years.

(3) The marshy ground was ideal for the purpose and could easily be fenced.

Since 1946 the collection of birds has grown until over 1,000 birds of about 140 varieties are established in the area. This probably is the most comprehensive collection in the world and is of great scientific value.

Observation huts have been built so that these birds can be watched arriving on the marshes which is their traditional winter feeding ground and upwards of 4,000 can be observed during this time.

With this and other bases to work from, the Trust and their associates can follow the movements and habits of these birds all over the world and a considerable data has been gathered which now enables them to arrive at a measure of population of most of these wildfowl species.

A DAY IN NORTH HOLLAND

By J. M. B. BROWN

District Officer, Research Branch

In July 1960 I had the opportunity of visiting the Forest Research Station in Wageningen (Bosbouwproef-station "de Dorschkamp") and, for the following day, Dr. H. van Vloten, the Director, kindly arranged for me an excursion to various pine plantations in the northern provinces of Drenthe and Friesland. I was mainly interested in the incidence of disease in Dutch stands of *Pinus nigra*: this, as I was informed, is restricted to North Holland; the plantations of Corsican pine which I visited on the following day in the south, in the neighbourhood of Nijmegen, looked healthy and vigorous.

We were a party of 6: Mr. C. P. van Goor, in charge of the section of forest soil fertility and soil amendment, and his field assistant, Mr. Roesch; Mr. J. Gremmen, the Mycologist, with his student assistant, Mr. Kriek; Mr. Das, an Indian forest officer studying problems of dune afforestation at Wageningen; and myself. The journey of about 100 miles to Emmen, the first halt, took us through Deventer, Raalte and Ommen and I was agreeably surprised to see a great deal of woodland, broadleaved and coniferous, on the first half, or more, of the journey. Actually the return journey, via Zwolle and Apeldoorn, traversed more densely forested land, including the principal woodland areas of Holland in the vicinity of Apeldoorn.

At Emmen we were met by District Officer Kuhn, who conducted us first to Emmerveld, a heath afforestation site such as is found in many parts of the province of Drenth. The soil is a humus podsol, developed in aeolian sand overlying sandy boulder till at variable depth (about 4 feet in the place inspected). The terrain is hummocky, reminiscent of our Purbeck Forest and

like it a product of former dune formation. In the 30 years old *Pinus nigra* stand where this first stop was made, many trees had died in 1941 and succeeding years and the removal of these dead trees had thinned the canopy to such a degree as to allow underplanting with Douglas fir a few years ago. The few dead and dying pines which remain did not show the characteristic die-back symptoms such as one associates with upland sites in Britain, having more the appearance of victims of *Armillaria* or *Fomes*, but a cursory examination of a few trees disclosed no honey fungus mycelium, or other decisive symptom. Clearly the original disease, almost 20 years ago, must have broken out in very different conditions and it may have closely resembled what is observed in many thicket stage Corsican pine plantations in Britain.

Like most other heath sites in Holland Emmerveld was ploughed before planting and the humus B horizon broken up thereby. The mean height was 28 feet in 1958 (our Quality class IV+).

The other Emmerveld *Pinus nigra* stand inspected was planted in 1932, contemporaneously with the sowing of red oak, *Quercus borealis*, as soil improver. This practice, much in favour 20—30 years ago, is now discouraged: the vigour of the red oak is often inconvenient and its consumption of water is regarded as harmful to some of the associated conifers. Some groups of dead pines were seen and in one of them Gremmen found mycelium of *Armillaria*: but it was considered unlikely that honey fungus accounted for all the deaths which had occurred.

In appearance this stand would have passed for genuine Corsican pine, though (probably due to the impaired vigour) it was not quite typical. The stand first seen was, on the other hand, what we should call "Ursuline" pine and it is interesting that it was established in 1931 with 3-year-old plants. The seed was, therefore, probably bought in 1927/28, the year in which our first and largest acquisition of "Ursuline" pine seed was received: but there is no record of provenance.

On this tour I saw relatively little *Pinus nigra* to which a Corsican origin might be confidently ascribed, while some was avowedly Austrian. A few years ago the Dutch Forest Service purchased a large quantity of Corsican pine seed, of which the resulting plants were so abnormal as to excite the adverse comments of the field staff. The affair was looked into and microscopic examination of the needles showed beyond reasonable doubt that the seed could not have been collected in Corsica. As a result strong representations were made to the Corsican vendor. It is very likely that some spurious Corsican pine seed found its way into Holland 30 years ago.

Exloo Forest lies some 7 miles NNW of Emmen and is somewhat younger. The two stands of Corsican pine examined were planted—or, in part of the area, sown—in 1940, on ploughed heath. Dieback set in about 1947, dead trees were subsequently removed and the stands are now generally open and practically free from disease. The height is about 15 feet, current increment is poor and needle retention unsatisfactory. Mr. van Goor drew my attention to the short 1957 increments on most of the trees and said that they lent support to his hypothesis that winter cold has a disturbing physiological influence, which results in feeble increment in the growing season next but one. One of the immediate effects of cold weather is a loss of potassium from the foliage and van Goor believes that in some way this impairs the development of the root system in the following spring. The tree accumulates scanty reserves during the growing season, because of the inadequate root system, and the length of the shoot in the following year is reduced. It is worth noting here that the 1957 increment of P.28 Corsican pine in Mogshade Hill (New Forest) was also relatively poor.

In Britain the severe weather of February 1956 was remarkable, more for the wide area affected by low temperatures than for the minimal readings in the coldest parts, which were surpassed in the early part of 1955. In Holland however, the minimum temperature of —27°C. (—16°F.) recorded on one night in February 1956 was much lower than any British record that month, and lower than any Dutch record in the winter of 1947. Another feature of the 1956 winter was its sudden onset: January was mild and rainy until the last day, when a very large fall of temperature occurred in 24 hours. It is widely held that an abrupt drop in temperature of this sort is much more damaging to plant life than a gradual drop.

A brief note on climate will not be out of place here. In a country the size of Holland, with a latitudinal span of just over 2 degrees and only a few scattered hills of 300 feet, the climatic differences are clearly a great deal smaller than those in Britain. The annual rainfall of about 750 mm. (30 inches) in the north is much the same as in the south, but in the north atmospheric humidity is higher and rainy days somewhat more frequent. Between north and south there is a significant difference in mean temperature, averaging about 4 deg. F., more than is accounted for by the small difference in latitude. This difference is important for growers, whether of trees, field crops, or horticultural produce.

After lunch we travelled west to the forest of Dwingeloo through the little town of Beilen, where a large part of the butter and cheese is made. Formerly much cheese was made direct on the farms, but this home industry has been steadily declining. Gouda lies much further south between Utrecht and Rotterdam; but Gouda cheese is produced in many places.

Dwingeloo is only one of many villages with a name ending in -loo, signifying, like the English lea, a clearing in the forest and usually a token of antiquity. As in Emmerveld we found a more or less hummocky terrain, with soils developed in blown sand overlying boulder till. This boulder till, locally a sandy clay, was deposited by Riss ice and much eroded by streams in the ensuing interglacial period. The Wurm ice did not spread so far south, but, in the tundra climate, aeolian fine sand was distributed over the boulder till. In this material soil development took place. A few centuries ago, following deforestation and perhaps also in association with a period of increased storminess of the climate (of which there is some independent evidence), wind erosion occurred, producing the existing dunes, on which only immature soils occur.

The *Pinus nigra* stands seen in Dwingeloo Forest were nearly 35 years old and included a good deal of Ursuline or Austrian pine. They had been generally less affected by deaths and dieback than those in Emmerveld and Exloo forests and were now stabilised, though isolated diseased trees were observed.

Dwingeloo is in Drenthe province, close to the Friesland border, on the other side of which is Appelsga Forest, the last to be inspected on this tour. In both provinces serious phosphate deficiency was a feature of the soils in past times and the crop yields were mostly very low. Because of this fact and the acute agricultural depression between the wars, land was worth little and large tracts were acquired by the state for afforestation. Aided by the application of phosphate and cultivation by plough the plantations thrived and soon the practice of phosphatic manuring spread among the farmers. Agricultural production has vastly increased and so these provinces, formerly the poorest in Holland, are now about the richest. An incidental result of these improvements is that many land owners deplore the loss of land to forestry, which is regarded with disfavour, as in certain parts of Britain. I

was informed that this critical attitude towards State afforestation is widespread in Holland, where the people cherish their forests for their amenity and recreational value (including in some instances game) and are apt to consider the mass production of softwood timber an abuse. It must be stated, however, that the widespread use of *Quercus borealis*, *Prunus serotina* (thoroughly naturalised in most of the new heath forests of Holland and the Belgian Campine) and other broadleaved trees relieves the sombre effect of the young pine plantations. On the return journey we traversed, near Otterlo, an extensive forest maintained primarily for the enjoyment of the public and I was given to understand that recreation and natural history studies are adequately catered for in the Dutch forests.

The two sites visited in Appelsga Forest are flat, without evidence of dune formation in historic times. Partly for this reason and partly because of their slightly lower altitude (about 20 feet above sea level) they appeared a good deal wetter, with *Molinia* and *Erica tetralix* conspicuous, and deep artificial ditches intersecting the plantations. In Compartment 74 Austrian pine was mixed with Scots pine and Norway spruce. *Brunchorstia destruens* had been found on the Austrian pine, but die-back was not serious. The second stand (*Pinus nigra*, of "Ursuline", or possibly Austrian type) was remarkable for its slow rate of growth, less than 20 feet in 25/30 years—presumably a result of unsuitable provenance on a poor soil of gley podsol type.

The people of Friesland, the province in which Appelsga Forest is situated, differ in some respects from the Dutch elsewhere and, like the Welsh, take a pride in their differences. They have a distinct language and the children learn Dutch as second tongue. There are numerous lakes in the western part and many tourists are attracted in the summer, during which an eleven towns' sailing race of 220 km. is organised along the canals. In winter there is a similar skating contest.

The Friesian farms are built on a square plan and Dutch barns are not seen, hay and other produce being stored in lower enclosed barns. The greater part of the land is grass, stocked with Friesian herds: but wheat, oats, potatoes and rape are grown on a considerable acreage. Horses are somewhat more frequent than in England.

Turning south for home, we entered the province of Oberijssel and passed through the fascinating village of Staphorst, where the women, and children and some of the men retain the traditional costume as their everyday wear. This is predominantly dark blue, sometimes with dark green, with a brightly patterned neckerchief. Dark blue and green are also the colours seen in the paintwork of most of the houses. In Staphorst too there is a relic of the former open field system of land usage. Most of the houses are backed by very long, relatively narrow strips of land, collectively forming the open field. As fathers divided their strips equally among their sons without cutting across the strips, these became narrower in each succeeding generation. I think the practice has now broken down.

As in the English countryside, nearly every house in Holland has its garden and the standard of maintenance is very high, even higher than here. Prominent at the time of my visit were the runner beans, which all had cream coloured flowers. In Belgium, where the rows sometimes attained a great and irregular height, both scarlet and white varieties were seen. In many Dutch villages the high pitched roofs of the houses were noteworthy: recent domestic building is more like ours, but original designs were often seen. Dr. van Vloten informed me that the housing shortage in Holland is still acute: my first impression of the country on the train journey between Hook of Holland and Rotterdam was dominated by new ferro-concrete factories and blocks of flats.

OVERSEAS VISITORS

By H. L. EDLIN
Publications Officer, Headquarters

For the past two years my small section has been responsible for the arrangement of study tours for "unattached" overseas visitors—that is, those who come singly or in small groups, rather than in specially organised parties. We have little to show them at Savile Row, and they are naturally keen to get out into the woods where the real work is done, so we rely very largely on the Commission's field staff to look after them and show them what they wish to see. The purpose of this note is to explain why such visits are so valuable to the Commission as a whole.

The first point to make sure of, in a Government organisation, is whether we are empowered to give this sort of assistance. Happily, the Forestry Act of 1919 is quite explicit over this point. Under Section 3 (2), "The Commissioners shall be charged with the general duty of promoting the interests of forestry", and under Section 3 (3) (h) they may make "such inquiries, experiments or research, . . . as they think important for the purpose of promoting forestry . . . and publish or otherwise take steps to make known the results of such inquiries, experiments or research." Under this Act, the spreading of technical knowledge is in fact given equal weight with the planting and management of timber. So when our staff are called away from their more familiar forest work to show round some visiting professor, they are still acting entirely in accordance with the Commission's proper objects.

The second point is whether it is all worth our while, particularly when the visitors come from some unfamiliar foreign land. The answer to this is that our share in showing people our current practice and research is all part of a two-way traffic in knowledge, from which we benefit equally with others. Until quite recent years both our silviculture and management have depended very much on Continental practice, which we have only learnt by sending our own students and officers abroad.

Most of our forest officers have benefited (we hope) from study tours in France, Germany, or Scandinavia, and I think most of them will confess that at the time of their trips they thought all too little of the trouble that their hosts had taken, in order to make their work profitable. At the time, it was all apt to be taken rather for granted, as something that their Universities "laid on". Professor Mobbs, who was concerned with a tour by French forestry students from Nancy to England and Wales in 1960, put the situation very neatly when he said:

"For eighty years we've been sending British students to France to learn *their* forestry. Now for the very first time the French are coming to see how *we* do things". So, if we have the pleasure of receiving French foresters annually until the year 2040, we shall only be repaying the very real debt we owe to their kindness in training our own people in the past.

Inevitably, the subjects our staff go overseas to study are seldom the same as those that visitors come here to see. In the early days of our Genetics Section, and of our Work Study Section, we frequently sent people to Scandinavia, well knowing that the Swedes were streets ahead of us in those fields. By the same token, during those early years, few people from other countries came to look at *our* Genetics or Work Study operations, for they knew that we, like themselves, were still learners. But many overseas foresters came to see, for example, our peat afforestation or our sample plot work,

because they knew that we already had long experience in those spheres, and a great deal to teach. It seemed at the time that certain sections got all the overseas trips, and others all the donkey work of showing people round, but on balance the Commission did very well out of those exchanges.

As a side issue, each of our overseas visitors is, in the eyes of the economists, an "invisible export". Just as our own travellers spend money abroad, so do these visitors bring money *into* the country. More important in the long-term context is the impression they get of our way of life, which may have a considerable effect on their outlook in later years. A forester who has found our methods efficient, and has been well received, is likely to hold a good opinion of Britain for many years thereafter; he may, for example, become an important purchaser of goods we ship abroad, such as tractors or sawmill machinery.

A point that causes misgivings to some of our staff is the very different forest backgrounds of some of their visitors. "What is the use", they ask, "of showing a lot of sprucewoods to a man from Bongo-Bongo-Land, when all he is ever likely to grow is teak or mahogany?".

The answer to this is that good forestry, like good trees, is capable of standing a great deal of transplanting. For the past hundred years European foresters, who had never seen anything more tropical than an aspidistra, have been going out to Asia and Africa, and giving a good account of themselves in the control of jungles and savannahs. They have found that the principles of silviculture, management, surveying, engineering, timber extraction, and timber measuring, and the fundamental data of pathology, entomology, genetics, timber marketing, wood preservation, and so forth, applied just the same in the torrid tropics as they did in the frozen north. The technical details for handling each sort of tree, tackling each particular pest, or meeting each particular market for produce, could soon be picked up on the spot.

Most visitors from the tropics arrive rather better equipped than the men we have sent out there—they already know their own local technical details. What they have come to seek are the principles and the methods we use, and our general approach to each particular problem. How they will sort it all out is their own affair; it is up to us to show them the ways we think best in our own particular circumstances.

It is, perhaps, this very contact with foresters who have different backgrounds to our own that makes these visits worthwhile. Some of their questions may induce us to look afresh at our current methods and ask if there are really sound reasons for them. It we remain satisfied that we have no cause for any change, we do at least know that we have not taken things for granted indefinitely.

Here at Savile Row we always try to find out, as far in advance as possible, what each man wants to see, so we can pick on the best people to show it to him. But we cannot standardise the lines of approach of people whose political and social organisations vary widely. Some, for example, start matters with a formal letter from their country's embassy to the Commission's Secretary. Others drop in quite unheralded and, with a general air of "Home is where I hang my hat", expect us to plan a fortnight's tour for them in the next half-hour. On one occasion we had to scrap plans for train journeys and single rooms for a Frenchman who withheld until the last minute the facts that he was bringing both a car and a wife!

There may be a hint for some of our own wanderers here. If you are asking an overseas forestry department to help with your tour, do please give them all the relevant information you can, and in good time. State your

proposed means of travel, the actual dates and, if possible, hours of arrival and departure, and also the number in your party. It always helps too, to give the organisers an idea of the standard of accommodation you expect and are ready to pay for, whether it be Youth Hostel or Hotel Splendide.

One further hint we can pass on: when your visitor actually arrives, find out how long he is free to stay. This applies equally to his total sojourn in your neighbourhood, and to his present call at your office, for he may—for example—have an appointment to keep at a bank that same morning. By tactfully enquiring "when he has to go", you will also discover when you are free yourself for other duties, and also be able to plan your caller's time to best advantage.

Time, for many of these people, can mean a lot of money—we have estimated that some Australians and New Zealanders carried "overheads" of around £50 a day. This does not mean that we should give up an undue share of our own valued official time for their purposes, but it does give cause for careful organisation of the time we can spare to show them round.

On one particular aspect we have frequently to disappoint our callers. Many hope to find everyone "in place" even during the holiday season. For example, we once had to tell a man who particularly wished to see Director, England, that the latter was on tour in Scotland just then; disappointed, he then asked us to make sure that he contacted Director, Scotland when he reached Edinburgh. We did our best, but on the only dates available the Scottish Director had arranged to go touring in Wales . . . (Possibly foresters, like farmers, learn most about their job by looking over their neighbour's hedges!)

TEMPERATURES AT THE SOIL SURFACE

By J. R. ALDHOUS
District Officer
and H. GLEDHILL
Assistant Forester, Research Branch

In the course of Research branch experiments with the use of polythene for the storage of plants, some waxes with known melting points were obtained. These were in two forms, tablet and stick (the latter the size of a stick of timber chalk). The waxes were used successfully in these experiments and then put away.

In the recent spell of hot weather, we became interested in the temperatures at the soil surface in connection with an experiment involving a polythene sheet over seedbeds, and arranged for some of the tablets to be half buried in the soil at Bramshill. The following report tells what happened.

"On 21st and 22nd June, 1960 the temperatures reached at and near the soil surface at Elvetham Nursery, Bramshill, were investigated using wax tablets which melt at known temperatures.

"These tablets were of three colours, red, grey and orange, melting at 138°F., 125°F. and 113°F. respectively.

"The tablets, which were nearly ½ inch in diameter were cut in two and placed in the soil as shown in Fig. 2.

"The area chosen was fallow and the only special treatment called for was consolidation and levelling. The soil is predominantly sand.

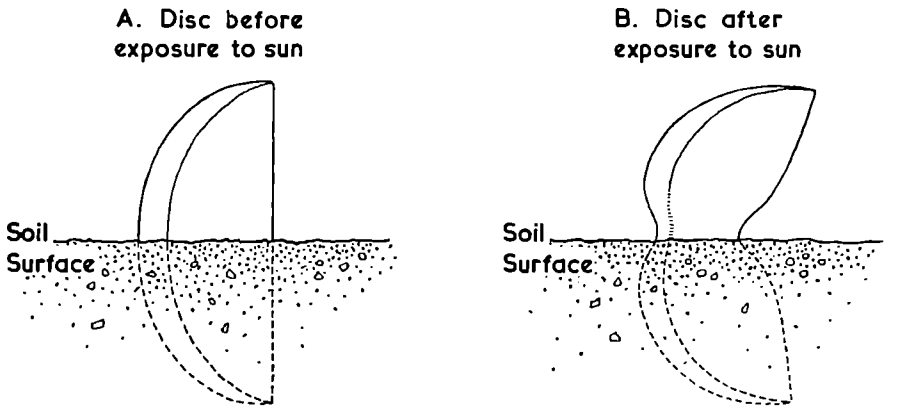

Fig. 2. Wax Tablets Used to Estimate Temperatures at the Soil Surface.

"Results were consistent on both days, although on the 22nd the grey pellet unfortunately fell over during the course of the day. The pellets were inserted at approximately 8 a.m. and observed at 4.15 p.m.

"It was found that the orange pellet had completely melted, the red was unaffected, whilst the grey clearly showed signs of melting at ground level. On the 21st this was evidenced by a tapering at the point of ground level and just above (see Fig. 2).

"On the 22nd owing to the pellet falling over, the pellet (grey) was pitted extensively on the surface next to the soil.

"Thus it seems clear that the temperature at soil level in the open was in the near vicinity of 125°F. and well above 113°F.

"At the same time, since we were also interested in temperatures under polythene in one of our experiments, where scorch had been found to occur under the polythene sheet in certain treatments, a similar trial under polythene was arranged in a nearby area.

"Again results were consistent and on both 21st and 22nd the orange and, in this case, the grey tablets were completely melted and the red tablet melted at ground level, and (on 22nd) throughout the part above ground.

"Thus it can be stated that under polythene sheet on these two days the temperature reached 138°F. at ground level and that up to a depth of ¼ inch in the soil, a temperature of 125°F. was exceeded.

"On 22nd June a maximum shade temperature was recorded in the immediate vicinity of the experiment of 89·5°F."

Summary of Results

	Open	Under polythene	Temp.
Orange	Melted entirely	Melted entirely	113°F.
Grey	Melted at ground level	Melted entirely	125°F.
Red	Unaffected	Melted at and above ground level.	138°F.

These results are not completely unexpected. In other experiments some time ago at Oxford, we had a recording thermograph under white and dark grey seedbed grits (St. Austell and Clee Hill) and in hot weather were recording maximum temperatures of 110°F. approx. just under the white cover and 120°F. under the dark cover. I have no precise knowledge of what is the maximum temperature young plants can withstand at the root collar, but it may be significant that there were far fewer seedlings on plots covered with the dark grey grit than the light grit. This suggests that temperatures much in excess of 120°F. are damaging. The temperatures in the polythene cover experiment suggests that temperatures of 138°F. at the soil surface do some damage, but have not resulted in the complete loss of all the plants under the polythene. Nevertheless the margin of safety must be small as the temperature normally quoted for irreversible and fatal changes in plant protein to take place is just over 50°C. (123°F.). I assume that the cooling caused by evaporation of the plants' transpiration stream keeps them below the danger limit.

If hot weather occurred regularly in mid-June and widespread loss of seedlings was observed, we should have to reconsider our present practice of not using lath shelters for seedbed covers.

SHARP'S LINING-OUT PLOUGH

By G. A. SHARP

Head Forester, North-East England

Introduction

The nurseries of Sand Hutton and Wheldrake lie approximately six miles north and south of York and comprise a small part of the scarplands and vales of Eastern Yorkshire.

The Vale of York lies immediately to the east of the Pennines and is a low plain never rising more than two hundred feet above sea level; it varies in width from over thirty miles in the south to ten miles in the north. The annual rainfall is about twenty-four inches.

The natural centre of the Vale is the city of York which, when known as Eboracum, was the principal Roman military station of northern England. It was also the limit of the tides and was the first point up the River Ouse at which there was firm ground raised above flood level.

The nursery soil is almost pure sand, blows when dry, and is very difficult to work in winter.

The Tractor

The tractor in use for lining out is a normal Ferguson with wheels extended to two inches less than maximum width. Except for shortening by one and a half inches the fixed link on the hydraulic lift the tractor is as supplied. This link shortening, which any blacksmith can do in half an hour, is to match the variable link when screwed to its shortest position, thus ensuring that the plough and stabilisers do not foul the ground when turning on uneven land.

The Lining-Out Plough

The plough is designed to operate behind a Ferguson tractor. A tractor heavier than a standard or "Thirty-Five" model is not really suitable. In operation the tractor is set to straddle the bed to be lined out, which it does in

single rows, the plough only being moved across the slide tubes eight or nine inches each time.

In the model illustrated Ferguson stabilising fins are used but in the later model discs replace the fins. As the plough automatically fills in one row of plants and ploughs out the trench for the next row, a special fitting has been devised to prevent the plough operating when filling in the sixth and last row of every bed.

Ferguson Half-tracks

Where wet or difficult conditions are encountered the fitting of half-tracks is an advantage. These are eighteen inches wide and require a twenty-four inch wide path between beds.

The track bogey-wheel bearers need alteration when the wheels are extended for lining out, and when thus modified the bearers should not be used in rough woodland conditions otherwise the extra strain may cause damage.

Lining-Out Boards

The standard long board of ten feet to twelve feet is used with modifications. These include the use of bolted-on lengths of 1½-inch wide hoop iron to replace the steel pins in common use. The hoop iron rests against the back of the open trench and prevents the board being misaligned on to the trench.

Rubber clips made from worn-out bicycle tyres are used instead of the two-inch spacing board or notched bottom board, and do away with the need for turn clips or buttons on the hinged flap. Specially short hinges are used to prevent fouling of the underside of the tractor.

Method of Working

This is illustrated diagrammatically in Fig. 3, and is also shown in Plates 5 and 6.

Provided the land has been ploughed and cultivated to a lining-out depth of six to eight inches, the tractor should firm down a width of about twenty yards by running up and down the plot. Assuming that one-way lining out is being done, subsequent firming can be done on each return "empty" trip using a different wheel track each time, as in the initial twenty yard width. A line is then laid the length of the bed to be lined out, and is set six feet from the starting edge, leaving a fifteen feet headland at each end of the plot. Two markers are fixed to the tractor front axle, approximately nine inches inside each front wheel. The internal width of the markers is the width of the bed to be lined out, i.e., three feet four inches at eight-inch spacing, or three feet nine inches at nine-inch spacing. This distance should be checked daily, with the driver seated in his normal steering position and an assistant making the actual adjustments.

With the plough in the number one position, the driver ploughs out his first trench, sighting the off-side marker on to the line. On his next run, after the boards have been placed in position, he again uses the line, which is then removed. On the third run the driver, having no line on which to keep straight, transfers his attention to his nearside marker, which runs on his first row of trees and takes the place of the line. He continues to use the first row of plants as a guide until the six rows are completed. In order to fill the last trench without ploughing out another one, the driver makes certain alterations to the machine which bring into operation a small angledozing blade similar to that fixed to the plough and at the same time rendering the plough inoperative.

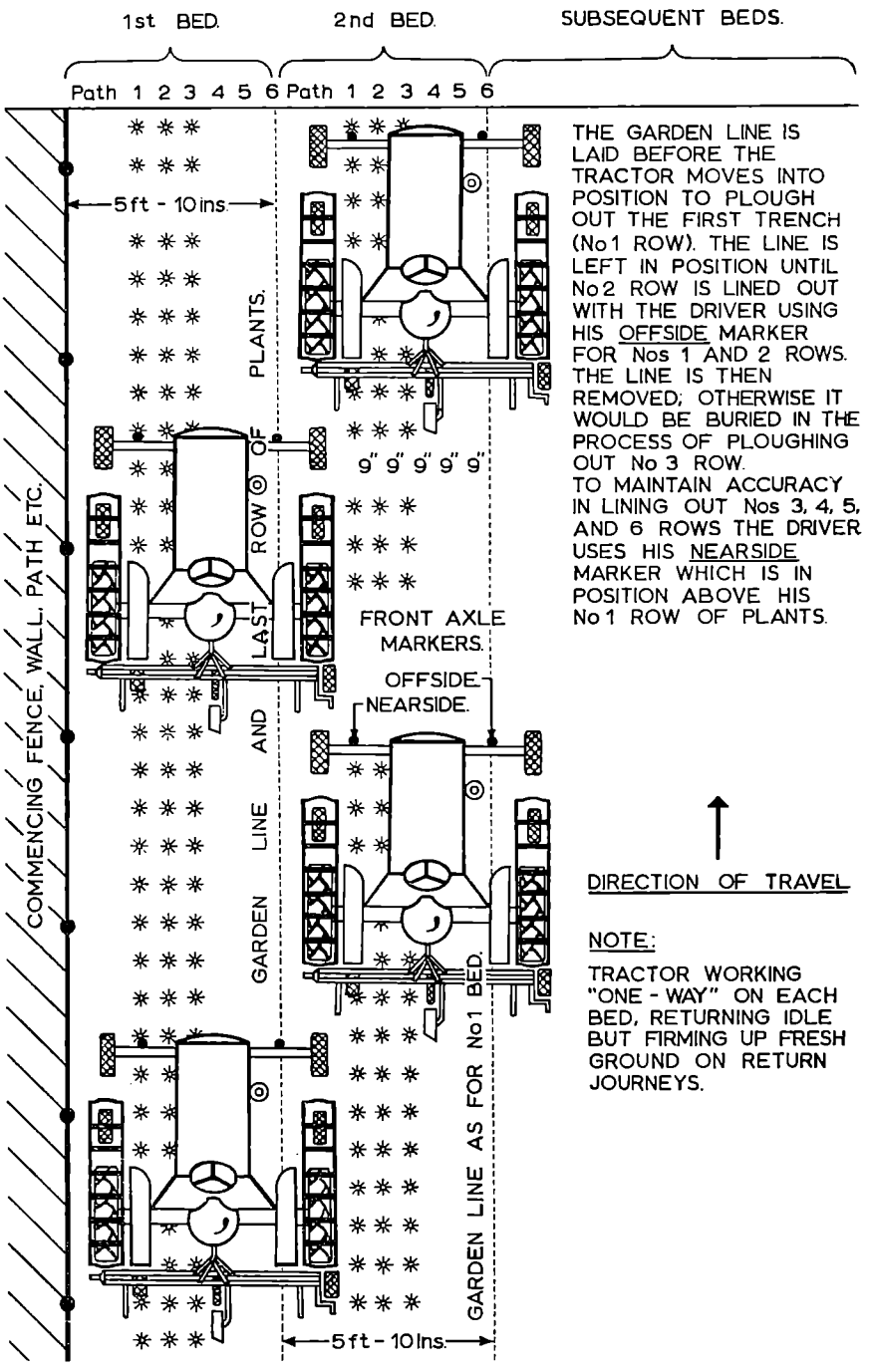

Fig. 3. Method of Operation for Sharp's Lining-Out Plough.

Whilst the driver makes the alterations, the ganger resets the line six feet from the last row of trees, and the driver then uses this line as a guide both for filling in the last row and, on subsequent runs, ploughing out the first and second rows of the new bed. It is not advisable to attempt filling in the last row of trees and ploughing out the first line of the next bed simultaneously.

Capacity

Allowing two or three days to obtain the necessary team-work, it should be possible for a gang of ten or twelve unskilled women or youths to average one hundred thousand plants per day, lined out at eight or nine inch, by two-inch, spacing. This average has in the past often included part days spent transferring to a new plot, boosting up the lifting of seedlings, and tractor or machine breakdowns.

Payment of Workers

Piece-work amongst a group of youths of various ages is not practical because of wage differences, and for this reason a bonus scheme operates at York whereby the older youths are assured of a basic-wage lead over the young ones, who in turn, have the advantage of equal pay for equal effort. Except for the driver and ganger, who also share in the bonus scheme, the bonus does not come into effect until a daily minimum of five thousand per filler has been reached. It is rather important to assess each day's work on completion, rather than on a weekly basis; if the size of a gang fluctuates from day to day, calculation of a weekly total would be difficult.

Further Development

Unlike many nurseries it is practical to line out, with success, in November and December at York, but available fallow restricts the numbers handled to one-quarter of the annual programme. After this the yearly race with the weather commences, with few people outright winners. In 1958 a careful record disclosed that on only twenty-three and a half days was it possible to line out during the period January 1st to May 1st. This included broken days, and a few unsuitable days from both the plant and soil viewpoints, particularly during the drought towards the latter end of April. To meet the possibilities of a recurrence of such a bad year it would be necessary to utilise the labour to progress the programme by pre-filling fifty yard long belts under-cover, in preparation for the daily lining out of at least a quarter of a million plants. A coiled belt of such a length holding approximately one thousand plants is eighteen inches in diameter and, in practice, has been heeled in in the normal way, but nowadays would be stored in polythene bags. Plants thus separated by the thickness of the belt should have a minimum tendency to sweat and, as the exposure of roots to sun and wind during actual lining out would only be for a few seconds, a very high percentage survival could be accomplished.

THE CULTIVATION OF FELLED WOODLAND AND COMPACTED CHALK

By I. R. B. MARSHALL
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and J. WEATHERELL
Head Forester, Research Branch

A major project of the future will be the rehabilitation of crops on poor quality sites. For mineral soils such sites may be classified into two categories, (a) those not intensively disturbed; (b) those given a fair degree of mechanical soil disturbance prior to the initial planting. The former consists of acquired plantations and many of the plantings made from the inception of the Forestry Commission up to the early 1940's. During the 1930's a good deal of medium depth ploughing (maximum depth 8 to 10 inch) was done, but with variable success depending on the compaction of the soil and the presence or absence of boulders. The introduction of the "R.L.R." plough in 1943 commenced an era of deeper (12 to 16 inch) cultivation, even on the more compacted and boulder-strewn soils.

Deep cultivation has become standard practice, and pending the development of better techniques, appears likely to remain so. Advantages of such ploughing have been reduced losses, elimination of weeding and more rapid early growth.

It is on uncultivated, or less intensively cultivated, sites that the older plantings occur, and these, according to ring-width evidence, often slow down in volume increment at about 30 to 35 years. The question likely to be asked will be whether to tolerate slower production pending knowledge on ways and means of lengthening the period of useful production, or whether to fell and replant. The latter course further raises the issue as to whether cultivation of some sort after felling might be possible and beneficial to a future crop.

Felled Conifer Woodland

An example of a "slowed down" stand of Japanese larch at Low Dalby, Allerston Forest in the North Riding of Yorkshire, has provided material for study. The soil type is a podzol, moderately compacted, free of boulders. A discontinuous pan occurs between the leached upper layer of 13 to 15 inches, and the lower orange brown sandy clay; sandstone fragments occur throughout the profile. In addition to carrying out investigations into the causes of slowed down increment, it was decided to clear fell 10 acres, half to be replanted using hand preparation methods, the other half to be ploughed or intensively disturbed before replanting in P.60.

Trial runs were made, using a D.4 tractor with a standard R.L.R. plough, and a Parkgate single tine-plough. The standard R.L.R. plough soon suffered a broken lifting arm, but had given a fairly reasonable furrow and ridge in places; the Parkgate gave a furrow and ridge inferior to that of the R.L.R., both trials being done by an experienced forest ploughman.

The second series of trials using a hired D.4 tractor and an inexperienced forest ploughman were made with an R.L.R. plough mounted in a Parkgate chassis and a standard two-throw Parkgate tine-plough. The former showed some promise, but was abandoned pending a workshop adjustment of mounting for adequate penetration; the latter offered the best all-round performance of all equipment so far tried. The major trouble all the way was, of course, the

larger Japanese larch stumps (10 to 12 inches diameter)—none of the ploughs could move or cut their way through them.

The first plot of one acre, using the D.4 and the two-throw Parkgate tine-plough, took 19 working hours, 75% of which time was devoted to repeated repairs to the plough, mainly to the lifting and disc mechanisms. Whilst a reasonable amount of soil disturbances had been achieved, consistent with conditions, it became obvious that neither man nor machine could satisfactorily operate in such a stump-strewn area, using existing equipment.

The problem of the remaining two plots and headlands scheduled for mechanical cultivation was finally solved by the use of a "Rooter" (see Plates 7, 8 and 9). This tool was originally designed for removing tree roots, but also for assisting in breaking up abandoned concrete runways and loosening gravel for excavators. Drawn by a D.8 or T.D.18 tractor (a D.7 is suggested for future work) the tool is nothing more than a massive and virtually unbreakable subsoiler weighing 3 tons. Provision is made for five evenly spaced subsoiler legs, each capable of penetrating to a theoretical maximum depth of 30 inches, the outer legs being 7 feet apart. The subsoiler frame is axled on to a two-wheeled carriage so that the subsoiler legs effect their own penetration, lifting of the subsoiler being achieved by a simple rope and pulley arrangement. After a series of trial runs it was decided to operate with the two outer legs only, to minimise fouling of the machine by torn-out stumps; each even run straddles the previous outer subsoiler channel, thus giving channels of an average depth of 16 inches every 3½ feet. This relatively shallow depth of subsoiling compared with the theoretical maximum was due to two factors: (1) the passage of a wheel over a stump lifted that side of the rooter; (2) fouling by torn-out roots lifted the carriage. Compaction did not appear to be a contributory factor to shallow running. On a subsoiler leg encountering a tree stump—these varied from about 7 to 12 inches in diameter—one of three things happened, the stump was ripped apart, or the entire root was moved, or the tractor spun on its tracks in which case the subsoiler was lifted (leaving the tractor in forward gear) until the root was cleared and then dropped. One stump came out with a root estimated to have broken off 46 inches below the surface. There were no breakages to the subsoiler, the only breakdown being a tractor track displacement. The operating time for 3 acres was 6½ hours; this does not include time spent on adjustments, trial runs outside the area, etc. The hire charge for a D.8 is 76/- per hour and for a D.7 60/- per hour.

The shelf adjacent to the subsoiler channel provided reasonable planting conditions with a not too rigid spacing technique.

Chalk Afforestation

Shortly before the rooter was tried out at Dalby it was used for cultivating P.60 areas on the Chalk Wolds at Scardale, Wolds Forest, East Yorkshire. Hitherto the methods of cultivating this hard compact chalk had been R.L.R. partial or complete ploughing, shallow two-throw with subsoiling, or shallow complete ploughing. The most effective method appeared to be R.L.R. complete ploughing but this had the disadvantage of high cost, the rate of working being approx. 1 acre per day assuming no major breakdown. Another suspected demerit of ploughing on chalk is that the bringing up of chalk fragments to the surface is harmful, and that there are good reasons for keeping what organic matter there is in the soil within easy reach of the planted tree.

The rooter and D.8 were accordingly tested on treeless slopes of grass sward on chalk. Five subsoiler legs, instead of two at Dalby, were used and performance has been spectacular. On good going, with subsoiling in two

directions, 6 to 8 acres per day have been achieved, and although no conventional furrows have been made, the whole area of land was disturbed and loosened down to an average of 16 inches. The reason for this complete coverage, in spite of the legs being 18 inches apart, is that all the soil is displaced upwards by sheer bulk of the legs, giving an 8 feet cultivated strip. This is wider than the distance between the outer legs.

While it is very satisfying to observe cultivation taking place without loss of time by breakdown, there is one operating snag. This is the tendency for the turf to roll along between the legs, gathering more and more turf until the legs are forced out of the ground. At intervals the driver lifts the legs above the ground for the debris to drop off, the fact that the legs swivel slightly rendering this process easier. This "balling-up" causes the depth of cultivation to vary between the full leg length of 30 inches to occasional patches of "no cultivation" where the rolled-up turf was deposited, but even here the small heap of turf and soil is available as a planting medium. The balling-up can be minimised by burning off the grass, or by hard grazing, beforehand.

Felled Hardwood on Chalk

A felled hardwood area requiring cultivation is a formidable problem, and this is fortunately an infrequent occurrence. The rooter tackled 16 acres of elm and sycamore stumps at Scardale on consolidated chalk. On the section with most stumps, where diameters were up to 24 inches, the rate of working with three legs was down to 4 acres per day. Hardwood roots are immensely tough and instead of severing, as in the case of conifer roots, tend to come out in strings 15 to 20 feet long. With three legs there is some piling up of roots against the legs, and it is probable that a sounder arrangement would have been to have two legs only, 7 feet apart, as later used at Dalby, with the second run straddling the previous outer channel.

The rooter can operate on slopes with a gradient as steep as 1 in 2½. Both on the grass sward and felled hardwood area where soils were consolidated, there has been a considerable improvement in the "take" and first-year height growth of beech, sycamore, larch and pine, as compared with uncultivated controls. The grass was noticeably checked after the rooter, and did not require weeding in the summer following planting, though it was admittedly very dry up to the end of June.

The rooter has operated successfully on felled coniferous woodland and on compacted chalk where stumps and soil conditions precluded the use of conventional ploughing equipment. The tearing-out and ripping apart of coniferous roots might well encourage the incidence of *Fomes*; this must be a calculated risk against the expected advantages of disturbing compacted soils prior to replanting. For those who are interested in this method of cultivation it might be added that Messrs. Caterpillar produce a hydraulically-mounted model which should offer considerable operational advantages.

Plate 1. Refilling the Helicopter's Tanks for Whin Spraying at Speymouth Forest, Morayshire.

Plate 2. Wood Carvings by a Breton Sculptor.

Plate 3. The Great Scots Pine at Guisachan, Inverness-shire.

Plate 4. The Newland Oak in the Forest of Dean.

Plate 5. Sharp's Lining-out Plough in Action.

Plate 6. Sideways Adjustment of Implements on the Tool-bar of Sharp's Lining-out Plough.

Plate 7. The Rooter in Action at Allerston Forest, Yorkshire.

Plate 8. Detail of the Rooter; only two legs are shown; more can be used if desired.

Plate 9. Old woodland ploughed by the Rooter at Allerston.

Plate 10. General Andrews' Nursery, Willow River, Minnesota, U.S.A. Rising 1 0 white spruce (*Picea glauca*) seedlings. Note the shallow side-boards to the seedbeds, supporting lath shelters which are used to prevent sun scorch. Boards are erected at the time of seedbed formation and all mechanical operations are carried out with boards in position.

Plate 11. General Andrews' Nursery, Willow River, Minnesota, U.S.A. Rising 2 0 Red pine (*Pinus resinosa*). Almost all sowings are made in drills with the object of producing 2 + 0 or 3 0 root-pruned seedlings for forest planting. Note the overhead irrigation lines which are in general use during the growing season for water addition and application of nitrogen in solution.

Plate 13. The Stone Recording the Bridge-building.

HELICOPTER SPRAYING TO KILL WHINS AT SPEYMOUTH FOREST

By G. STEWART
Forester, East Scotland

In the autumn of 1960, the spraying of whins by helicopter was carried out at Speymouth Forest in Morayshire, with the intention of reducing the high annual expenditure on weeding. The full effects of this spraying cannot yet be assessed but such information as is available may be of interest to anyone faced with a similar problem.

After ploughing certain areas for planting, the growth of whin or gorse appeared profusely where it had not been seen before, or was only in isolated clumps. This growth may be as much as 20 inches annually and can be so dense that it appears like a solid green carpet on the ground.

Two or three hundred acres of whin-weeding had to be undertaken annually by hand methods. This was a very costly and tedious operation which had to be repeated for up to 5 years after planting at a total cost of £16 to £18 per acre over the whole period.

Recently two new methods of whin control became available. The first was a mechanical scrub cutting machine, which was certainly quicker than hand methods, but did nothing to control the whin re-growth. The second was a chemical spraying of "Hormone Brush Killers" which, it was hoped, would kill the whin and leave the trees.

This brush killer consists mainly of two chemical compounds known as 2.4D and 2.4.5T. Commercially this liquid may be obtained as "Brush Weed Killer" made by Shell Mex, and "Spontox" made by May & Baker, Ltd. These brush killers are primarily produced for killing scrub growth, whin, broom, brambles and (unfortunately) also trees, in fact, almost any woody growth.

The best and quickest kill in scrub and whin is obtained during the months of May to August when growth is at its maximum; the emulsion is then more readily absorbed.

Where no trees are involved, e.g. roadside whin and in the preparation of ground, 4% of paraffin or diesel may be added to the brush killer water. Paraffin is preferable as it mixes more readily. This helps the emulsion to "stick" to the brush being sprayed and so a greater quantity of liquid is absorbed. A complete wetting of the foliage must be aimed at, or only a partial kill will be obtained; the most susceptible scrub species are birch and broom. Whin is harder to kill and may require a stronger dose. The first effects of whin spraying, during the summer, may be noticed several days after spraying by a wilting and softening of the terminal growth.

Whin does not appear to stop growing at the end of the normal growing season, like other shrubs and trees, and may be seen in full bloom during the month of January. Because of this, experimental spraying was carried out in some 3-year-old plantations with constant pressure knapsack sprays.

Spraying commenced when it was ascertained that growth in the planted trees had ended for the season and some hardening off had taken place. This spraying was done mostly in Scots and lodgepole pines. The result of this work was most encouraging, and it was observed that whins could be killed without doing any permanent damage to the planted trees.

In the autumn no immediate results can be seen, and a month to six weeks may pass before any signs of dying off are noticed. It is essential that this

spraying should be done at the latter end of the year as applying in the early spring would certainly kill the whins but might also have disastrous results on the trees.

With the experience gained from the knapsack spraying operation, it was decided to undertake a large-scale spraying by contract.

Offers were received and it was found that spraying by helicopter was cheaper on the very rough ground left after ploughing. Wheeled tractors could only work from rides and tracks and therefore the chemical could only be applied by spray jets fixed to hoses. A helicopter, fitted with a 30-foot boom could apply the spray easily on open areas, provided there were no obstacles such as power lines or standing trees.

This type of work is generally undertaken by the acre and to a certain degree the greater the acreage sprayed the less the cost per acre.

The contract was undertaken by a representative of the Chemical Spraying Co. Ltd., who, in turn, made arrangements for a helicopter.

The first company contacted was a French one which was to supply a helicopter with a 60-foot spray boom; this machine was used largely for agricultural spraying. However, this company withdrew at the last moment and a substitute was found in "Helicopter Services Ltd.", Luton Airport. The spray boom on this machine was only 30 feet. This shorter spray boom was much the better of the two, for the following reasons:—

Less space was required for landing. Small areas could be sprayed and the machine was much more manoeuvreable where large standing trees were adjacent to the area being sprayed.

Broadly—the following were the Forestry Commission's requirements of the Contractor:—

That he undertake to spray a specified acreage with "Shell Brush Killer" and water in areas marked green on the map provided. Also to spray "Shell Brush Killer", water and T.V.O. (paraffin) on areas marked brown on the map—no trees being involved in the areas marked brown.

The Contractor to supply the spray materials.

That he free the Forestry Commission from all claims for damage from third parties.

That he should accept liability for damage caused to Forestry Commission and other property by spraying operations.

The Forestry Commission would agree to pay the Contractor an agreed price per acre. One half payable on completion of spraying, the second half payable when efficiency of spraying appeared to be adequate.

That the Contractor would supply all pumps and equipment necessary for mixing and loading the helicopter with spray.

In turn the Contractor required of the Forestry Commission the following:—

That a number of single birch and Scots pine scrub trees should be felled on the spraying areas to allow a clear run for the helicopter.

That the Forestry Commission provide markers to show the extent of the areas to be sprayed.

A 6-inch map be supplied with the areas to be sprayed, marked in green where there were trees amongst the whin, and marked in

brown where spraying was for preparation of ground; the area of each block to be also shown on the map.

All relative water points where water could be obtained to load the tanker were to be marked in blue.

Power lines to be shown as a thick black line and telephone lines to be drawn in purple.

Suitable landing places to be negotiated with local farmers adjacent to areas being sprayed. These areas to be accessible by water tanker. (Any flat area, free from surrounding trees and clear of fences would do, only a small area being necessary and no runway being required.)

After all preparatory work had been completed by both parties a date was fixed for the arrival of the helicopter. This date was Monday the 10th of October, 1960 and the helicopter was scheduled to arrive at approximately 1 p.m.

A white sheet, as a marker, was spread out in a small field in front of the Forest Office.

Arrival was very sudden. The helicopter appeared over the trees, turned in a tight circle, and landed very gently in the field near the sheet.

It was hoped that spraying might commence Tuesday, the 11th of October. On Monday afternoon the pilot was shown part of the area to be sprayed and given some idea what the whin areas actually looked like in comparison to surrounding vegetation.

Unfortunately the weather was completely against spraying during most of the week.

Friday morning arrived. The day was rather dull but there was only a very light breeze. The rush was on. The tanker was loaded with water and tins of brush killer and a start was made.

Spraying commenced at 9 a.m. and finished at approximately 4.30 p.m. This was to give the mechanic time for maintenance. In this period of time an area of 120 acres had been sprayed with a solution of "Brush Killer" and water, mixed to a strength of 1 in 25. The solution was applied at a rate of approximately 12 gallons per acre, which is stronger than normal but was applied at this strength owing to the low rate of application.

The method of application was as follows:—

The water tanker was placed in the field beside the selected landing area. Two 40-gallon drums were used with an end cut out of each to mix the chemical and water. The helicopter's capacity was 60 gallons which allowed a small reserve to be carried so that no "run" had to be abandoned in the middle.

"Brush Killer" was poured into the drum which was then filled with water. A small portable pump was used (a Hathaway fire pump would do) to fill the helicopter from the drum. The pump was fitted with 50 feet of delivery hose and a by-pass back to the container. On the approach of the helicopter the pump was started up and the by-pass used to agitate the mixture.

When the helicopter landed, the hose was run out, the delivery end put into the helicopter's tank, the stop-cock opened and the by-pass closed, allowing the 40 gallons to be pumped into the helicopter's tank. (See Plate 1.)

Particular care was necessary at all times to avoid spilling the mixture in case it should be driven against the perspex bubble by the action of the helicopter blades.

After about two runs, the pilot had the filling time counted out and was actually revving up his engine in anticipation of the remainder of the 40 gallons being put into the tank.

On the spray area two markers only were used. One at approximately each end of the area, or if the ground was undulating, at vantage points so that, on commencing his run, the pilot could see both men.

Spraying was carried out in such a way that the helicopter sprayed across wind, and started spraying on the down-wind side of the area to be sprayed. In this way the two markers were moving up-wind all the time and so away from spray drift.

The markers had a flag each and, as already stated, stood at the perimeter of the area, one at each end. When the helicopter arrived and it could be seen by the markers that it was on the proper line of flight, the first man then moved ten yards forward, ready for the next run. The helicopter proceeded down the spray line and as it approached, the second man advanced ten yards. This was carried out by both men in turn, each time a run was made. In this way, the markers never came in contact with the spray emulsion and marked in advance of the machine during the whole operation.

Markers were issued with Wellington boots and protective leggings to assist their moving about in the whins.

The marking system requested by the French Helicopter Company was much more complicated and required lanes to be marked in advance with different coloured flags. These flags to be inserted into the ground every few chains and in parallel lines. Spraying for a whole day to be marked in advance. If the wind changed during the day all these flags would then have to be moved. The lanes also had to be marked on the spray map.

Spraying again commenced on the Saturday morning at 9 a.m. and was completed by 1-15 p.m., 67 acres being sprayed.

Total acreage sprayed was 187 acres in approximately 11¾ hours.

Height of spraying above ground was from 4 to 8 feet.

Cost per acre, by Contractor, was £6 10s. 0d.

Cost of preparing ground, including scrub clearance, markers and vehicles was calculated at 16/6 per acre. This gave a total cost of £7 6s. 6d. per acre. A table giving comparative costs with hand weeding is given below.

The preparing ground cost could be lowered. A lot of extra work had to be carried out which was not required by Helicopter Services. If no scrub had to be cut the total cost per acre could be lowered to approximately £6 16s. 6d. per acre.

The helicopter is the costly item in this work. Everything must be planned in advance so that there is no hold-up to the machine once spraying actually commences. If a number of small areas are to be sprayed a van is necessary to move the markers from one site to another. Two sets of markers would also be required so that one set could always be ready in advance.

No trouble was encountered in gaining permission from farmers to land on their ground when it was explained that the spray was non-toxic to animals.

There should be great scope for this type of work as more selective sprays become available. Large areas of bracken and grass weeding may also be done by this method in the near future.

Inspections in the Spring of 1961 indicated that the spraying had been sufficiently successful to justify the contractor being paid the balance of his fee. The whin is now dying down and no more weeding will be needed.

Cost Comparison of Whin-Spraying by Helicopter at Speymouth, 187 acres.

Aerial Spraying		*Estimate of Equivalent Hand Cutting and Weeding*	
Item	*Cost* £ s. d.	*Item*	*Cost* £ s. d.
(1) F.C. Labour—Surveying and marking lanes	64 5 2	Area for burning—15 acres	
(2) „ „ Scrub clearance	61 4 2	(a) Burning @ £1	15 0 0
(3) „ „ Spraying markers	12 17 10	(b) Three weedings @ Total cost £12 per acre	180 0 0
(4) Supervision — District Officer 6 hrs. @ 12/6	3 15 0		
Head Forester 8 „ @ 9/-	3 12 0	Other areas	
Forester 2 „ @ 7/2	14 4	(a) Two weedings, 130 acres @ £9 ..	1,170 0 0
		(b) Three weedings, 23 „ @ £13 ..	299 0 0
(5) Vehicles, Machinery:			
Van .. .. 98 miles @ 5d. ..	2 0 10		
L/Rover .. 36 „ @ 7½d.	1 2 6	Final weeding: (a) 7 acres @ £8 ..	56 0 0
Private car .. 16 „ @ 7½d.	10 0	(b) 12 „ @ £5 ..	60 0 0
Jo-Bu Saw .. 20 hrs. @ 4/-	4 0 0		
(6) Payment to Contractor	1,215 10 0	Supervision: Forester 160 hours @ 7/2 ..	57 6 8
Labour overheads included at (1) to (3) ..		Van Mileage: 600 miles @ 5d.	12 10 0
		Labour overheads @ 35%	623 0 0
187 acres **Total Cost**	£1,369 11 10	187 acres **Total Cost** ..	£2,472 16 8
Cost per acre	£7 6 6	**Cost per acre**	£13 4 6

BRASHING COSTS

By G. IVISON
Assistant Forester, North Wales

Varying climatic and silvicultural reasons make it impossible to give an overall price to brashing. Quality Classes are a better indication to a reasonable economic price of payment. Brashing is an operation which is rather forced upon British Forestry by the shortness of rotation necessary to make our crops economical. Larch and pine are fairly easy to brash, but with the Forestry Commission having made such large plantings of Sitka and Norway spruce since the war, a much more difficult task is set before us.

Several factors decide how quickly and economically the work can be done, as set out below:—

(1) *Choice of Species.* The right tree in the right place will ensure good growth particular to the situation. Brashing habits vary and also type of needles. Sitka spruce are difficult to approach and very wearing on clothes.

(2) *Age* and *rate of growth* are complementary from brashing point of view and are both indicated in *Revised Yield Tables for Conifers* (Forest Record 24).

(3) *Spacing, Number of Deaths and Mixtures.* These three factors in the final number of trees per acre at the time of brashing can make a difference of perhaps 700 trees in extreme cases. Many deaths give more room to those trees left and consequently thicker branching from ground level, especially in pine and spruce.

(4) *Altitude and Exposure* are two natural factors that affect the rate of growth and are probably the two greatest factors in determining the Quality Class of your stand. Genetics may finally prove the answer to our problem, but it is certain that if two identical seedlings from the same nursery are planted on different sites, i.e., a sheltered valley, or an exposed high altitude slope, that two vastly different trees would be seen at 50 years of age.

(5) *Angle of Slope.* This is purely a physical factor from the workman's point of view. Obviously a man working on a slope cannot work as fast as a man on the flat. In extreme cases the man may have to pull himself up from tree to tree, thus cutting his speed by over half.

(6) *Hours worked* per day vary from forest to forest—the many variations result in different working days, i.e.:

(a) Reporting to the job and leaving on time, using his own transport.

(b) Reporting to the job and leaving on time, using Commission transport.

(c) Being given a set travelling allowance and reporting to the job anywhere.

(d) Being given varying travelling times according to distance travelled.

(e) Reporting to a certain spot on time and being transported to work.

(f) Reporting to a certain spot on time and walking to the job.

Thus a normal nine-hour working day can in extreme cases be reduced to seven or even six hours.

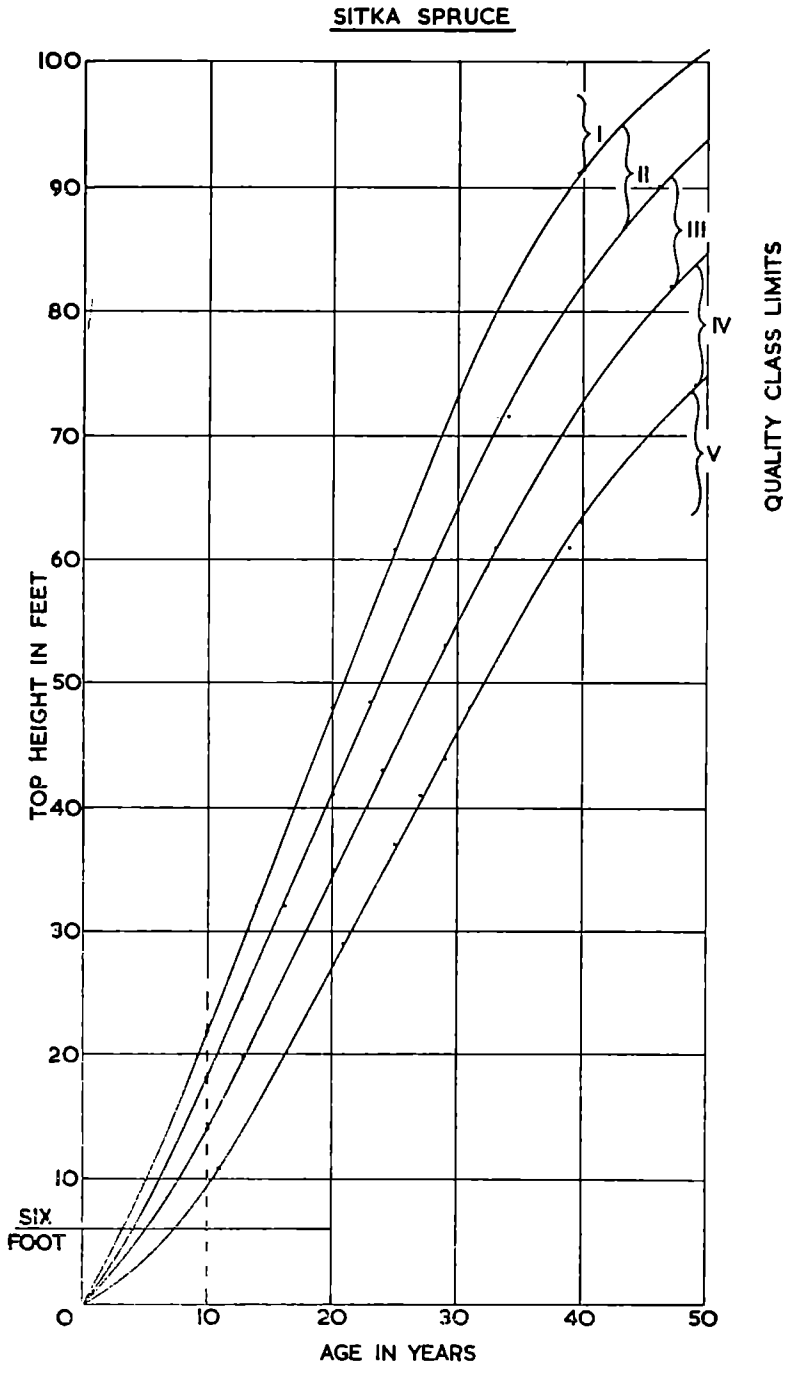

Fig. 4. Age-height Curves for Sitka Spruce of Five Quality Classes, Carried Back to Zero.

Assessment of Spruce Crops for Brashing

Sample No.	*Species*	*Ht. Ft.*	*Age*	*Q.C.*	*Trees per Acre*	*No. Checked*	*Branches per Tree*	*Whorls per Tree*	*Branches per Whorl*	*Area sawn per Tree sq. ins.*	*Area sawn per Acre sq. ins.*	*Notes*
1	S.S.	80	—	1	—	20	22	4	5·2	1·1	—	
2	N.S.	35	P31	4	1000	50	46	8·3	5·5	4·05	4050	
3	S.S./S.P.	40	P30	4	810	55	32	6	5	5·5	4450	Pines Suppressed—S.S. only counted
4	N.S.	20/30	P31	5	700	50	44	7·5	6	4·97	3483	Open N.S.
5	N.S./S.S.	30	P31	5	1080	50	43	8	5	3·5	3780	
6	N.S./S.S.	35	P31	5	1120	50	42	5·7	7·4	3·4	3715	N.S. Suppressed
7	S.S.	25	P32	5	1250	24	42	—	—	2·6	3250	
8	S.S.	35	P32	5	1150	36	34	—	—	3·5	4025	

(7) "*Doubles*". Attacks by sheep, hares, and also bad planting, can result in many "doubles" (and more than two stems) on each tree. If these are above a certain percentage they greatly reduce the acreage brashable per day because both leaders have to be brashed to achieve the object in view.

(8) *Age when Brashed.* Regardless of Quality Class, trees can be brashed as soon as the canopy has closed or a few years later. If the former, even though there be no needles aboard, the branch is still virtually green, which means harder sawing, and a certain amount of tearing of bark results. If brashed after the canopy has been closed a few years, the branches are dead, much easier to saw, and no damage is done to the stem. Smaller branches break off and the tree can be brashed in half the time.

Pages 3 to 9 of Forest Record No. 24 gives us the AGE/HEIGHT graphs of the main planted species, but the value of the graphs do not start till 10 years of age. Our brashing height is formed before this, but if the lines are carried back to zero we can get a general idea of the situation. Thus we get a representative graph for Sitka spruce (Fig. 4).

From this we see that the Quality Classes reach the height of six feet at various ages.

Q.C. 1 at ages up to 4
Q.C. 2 at ages up to 4
Q.C. 3 at ages 4 to 5
Q.C. 4 at ages 5 to 7
Q.C. 5 at ages over 7

Generally speaking each year will produce one major whorl of branches. Quality Classes 1, 2 and 3 can be regarded as the same, and Q.C. 4 will be slightly harder. Q.C. 5 however, can have any number of whorls above 6, and in fact we usually find that the best have 6 to 9 whorls. Lesser and/or distorted trees can have more, and I have seen 13 whorls on a 27-year-old brashable tree. An actual physical assessment gave me the figures set out in tabular form opposite. The method used was rather tedious and the results show that a lot more samples would be needed before an accurate graph of results could be made. All the branches on each tree, to a height of six feet, were counted, and the diameter noted. They can then be grouped into diameters, e.g., 0—½-inch: ½-inch—1-inch: 1-inch—1½-inch, etc., and areas worked out by taking a mean value for each diameter, ¼-inch: ¾-inch: 1¼-inch etc. Only sawable branches were counted, so called "whiskers" being disregarded.

Larger trees, being more vigorous, have slightly larger branches; but as these have been dead longer they are easier to cut. No outside trees were measured; if any long edges to compartments are done they may have to be taken into account. The practice in some forests of brashing these on day work does not give a true picture of costs.

The figures show the varying degrees of work needed even on the same Quality Class of trees, and point to the fact that a rigid table of prices need not always work.

Samples No's. 7 and 8 were the first, and I hadn't then realised all the information that could be collected.

It is interesting to note that the number of branches requiring brashing and their diameters give no indication to the size of tree, as the following table shows:

Relationship between Number of Branches and Volume per Tree

Number of Branches by Diameters				*Number of Whorls*	*Estimated Volume hoppus feet*
0—½″	½″—1″	1″—1½″	1½″—2″		
46				6	6
37				6	4
37	3			6	2½
41				7	4
39				7	1½
49				8	2
48				8	5
52				8	2½
40	7			8	2½
34	13			8	4
53				8	4
52				9	½
39	11	1		9	2
50				10	¼
48				10	1

Much research is being done on the development of new tools for brashing, and even machines are being developed and tried. However, the fact remains that the condition of the trees at brashing cannot be altered, and could probably only be partially altered at the time of planting. The Work Study Section is working on the produce angle and have probably come across the problem of different Quality Classes of trees, and so must make adjustments to prices. Brashing is an overall job and we tend to find an overall price for a forest or area. The fairest way is to pay a price according to the work done. Reference to the trees age/height ratio will give us a quality class which can be taken as a suitable division but, even within Quality Classes, some adjustment may have to be made.

Figure 5 is a graph of prices that I think will fit to a Quality Class scale. £12 10s. 0d. may be rather high on bad Sitka spruce, especially when working the full nine-hour-day, but I have coupled this to No. 5 Quality Class. These prices can be taken on a nine-hour day in fairly even conditions. If the working day is shorter or working conditions very bad, then a percentage must be added on to the normal price.

Brashing prices vary from Forest to Forest, and this is an attempt to try and find a range of prices that will work in all areas and be fair to workers and their employers. My study took place in North Wales and this article relates to that area, but the figures may be applicable to other areas.

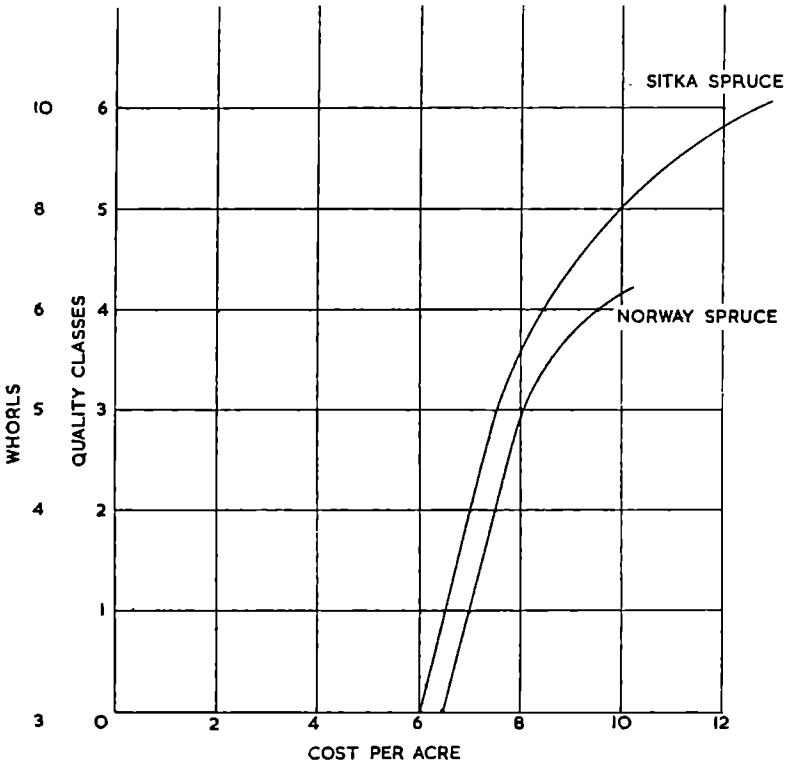

Fig. 5. Brashing Costs per Acre for Sitka Spruce and Norway Spruce, Showing Variation with Quality Class and Average Number of Branch Whorls per Tree.

PLANNING IN THE COUNTRYSIDE

By E. M. CONDER
Divisional Officer, North-West England

This is a report of a week-end course for Planning Officers, Councillors, Architects, Farmers, Industrial Executives, and others concerned with the English country scene, which was held at Westham House College, Barford, near Warwick, in May 1960. *The course was arranged by the University of Birmingham and the Association of Agriculture.*

It was perhaps unfortunate that a week-end course on this subject should have been conducted in such conditions of crowding as to be more reminiscent of the city at rush hour; opportunities for quiet study and contemplation were themselves squashed into quick walks in the garden, or else infringed on short bouts of indigestion after congested cafeteria meals.

This unfortunate background should in no way be taken to detract from the layout of the talks and the performance of the speakers, which were of a high order. Professor Dudley Stamp opened the proceedings with a compelling discourse on the increasing demands of a growing population on a dwindling countryside. Not unnaturally he drew our attention first to the prediction of Malthus some 150 years ago, at a time when much of the world was virtually unknown and almost entirely uninhabited. Since that time, progress in so many directions had inevitably worked along the same lines, so that increasing longevity, decreasing mortality, and the vast improvements in medicine and techniques had produced a form of death control which had so far been quite unmatched by the practice of birth control.

To drive home this point he drew attention to the available space on earth—a fixed quantity which had not so far been seriously affected by even the most ambitious reclamation schemes. Of the 12½ acres of land surface per man now available, only 30% is actually of use, the rest being desert, mountain, swamp, or tundra. But in fact only 1·1 acres per person was actually used, and it was interesting to find that, in comparison with this global figure, the U.S.A. required 3·5 acres per person, as opposed to the comparable figure of 1·55 acres in Great Britain, and 0·17 in Japan. Such figures must, of course, be taken in conjunction with the known surpluses in some countries, and the fact that the heavily industrialised countries depend to a great extent on imported food, and in no small measure on fish. It was further shown that the present increase in population would, in 600 years, leave us each with exactly 1 square yard on which to stand.

From this background the Professor narrowed his attentions to England and Wales, whose availability per person is revealed as 0·8 acres. Of this,

Agriculture and grazing demands	0·55	acres per person
Forests demands ..	0·05	,, ,, ,,
Parks and recreation demands ..	0·01	,, ,, ,,
leaving for all other purposes	0·01	,, ,, ,,

This figure spotlights the difficulty of the planner, and is really the hub of the whole problem under discussion.

Having quelled his audience with these ghastly figures, the Professor explained that this country must, in order to survive, give paramount place to the siting and development of industry. Said with such assurance and by

such an eminent man, this solution took on the air of an assumption, in much the same way that the world is accepted as spherical in shape. And in fact no member of the audience was bold enough to raise a feeble protest, or point to the reasonably happy example of Switzerland, whose economy has been sustained for long enough on a rich and varied fare of tourists, recreation, precision tools, guide books, papal guards and waiters. Heavy industries were to a great extent demons which could not be channelled or controlled, and certain extractive industries were located by the very nature of their products. But to some extent the demands of housing, transport, light industry, recreation, and the defence services could be guided and rationalised by the wise and timely action of planning. The alarming fact remained that 9/10ths of the population lives in 1/10th of the country, and the continued drift of population and development is towards the south and east, where our best agricultural land lies. The utmost importance must be placed on the classification of land, so that within a broad framework, the correct type of land shall be put to the correct use.

Continuing next morning on the Professor's theme, Mr. Robin Best concentrated his attention on some of the more important results of recent changes. He observed that the Industrial Revolution of the last century had not significantly changed the pattern of land use; such changes as were obvious had centred on the coal mining areas, where industries had necessarily concentrated around this source of power, and where the lack of mobility had compelled large populations to swarm round Britain's dark satanic mills. Their low standard of living had conditioned them to a squalor of overcrowding whose effects have for years presented some of the planners' worst problems.

The emergence of the internal combustion engine, the development of oil as a fuel, and later the use of electricity for industrial power had effected far greater changes, which were continuing and accelerating in our present day. The motor car had reduced considerations of distance to comparative unimportance, so that town workers could now comfortably live far from their work, whilst an increasingly affluent society demanded more and better houses set in suburban environments. This drift from the land, the concentration of populations into huge conurbations, and the growth of vast new mobile suburban populations was putting a pressure on green belts around cities, and causing road congestion to an extent to exercise planners at every level. The familiar pattern of a growing town leading to peripheral expansion and then to overspill continues, and to such an extent that the old concept of the city is changing, giving place to the rather vague and formless pattern of the Urban Region.

To complicate the planners' task there has been a strange lack of reliable data on land use not yet fully resolved, and discrepancies of over 1 million acres are known to have been involved in statistics used in planning reports and decisions made in post-war years. Sharp conflict has persisted amongst those considering these problems, as between those who peg their determination on the retention of agricultural land, and those who base their priorities on the "national need", in its broadest sense.

Mr. Best dwelt at some length on the various solutions found in green belts, motorways, and new towns, but the general impression presented was of an irresistable Juggernaut whose career was no more than irritated by small obstructions thrown in its way; whilst no firm hand had appeared ready to take the beast by the halter and lead it along some convenient route to its appropriate stable.

Switching abruptly to the more human aspect of this problem, Doctor Bracey next gave a stimulating and provocative impression of the newcomer

to the countryside, and though most of his experience had evidently been concerned with the south and south-west, there were many points to his credit which could apply equally well over much of the country. Doctor Bracey's theme mostly concentrated on two points; the stuffy conservatism of the old village community; and the lack of welcome accorded to the newcomer. In both cases, he made his points, but in so doing he entered upon some generalisations which are certainly not true in many parts of the country, and in many respects he did less than justice to the traditional reserve and dignity of the old villager. From Doctor Bracey's thesis, the sun appeared to radiate from the countenance of every newcomer, whilst the cloven hoof was barely concealed under the squire's tweeds and the rustic smock.

Doctor Bracey was the more interesting on less controversial ground when he traced the evolution of the village and its community from earliest times, through the stresses and tensions of the first industrial revolution to the present century, and the almost final disruption of the community spirit. This was the result of failing leadership consequent upon the decline in the influence, first of the church and then of the landowners. There is little doubt that this change is absolute in much of the south country, and in villages in the neighbourhood of large and expanding urban areas.

Turning to the newcomer and his reception in the countryside, Doctor Bracey had some hard words to say about the lack of welcome and friendliness which greeted him. He excepted from his strictures the Women's Institute which invariably made the first approach, generally through the woman of the household, who was usually more prone to loneliness than other members of her family. His point was taken, but unfortunately he proceeded to compare the situation with communities in America, where the spirit of aggressive welcome and compulsory camaraderie makes it absolutely certain that no one shall ever be lonely anywhere; his description of reception committees and booster groups made the flesh creep, until happily Professor Stamp rose to enquire if the speaker had ever heard of the P.L.U.A. society—Please Leave Us Alone.

Doctor Bracey was at pains to stress the social revolution that has taken place in the countryside during recent years—a revolution which is continuing, bringing with it changes which are barely understood before even more change has taken place. He might have pointed out that much of the unrest and bewilderment of our modern society stems from an inability to adjust itself to continuous changes. Hitherto changes in our social structure have been viewed against an ample background of stability, but in recent years change has been superimposed on a structure already crumbling, where the accepted sense of values, responsibility, community spirit, leadership, and stability have shrunk, leaving a vacuum in their place.

It was a delight to listen to Mr. James, who completed the day's discussions and talks with a masterly summing up of much of what had already been said, though he never appeared to repeat anything we had already heard. The delight was somewhat tempered by the substance of his talk, but the problems of planning for an overpopulated island sounded less stark against the background of light with which Mr. James illuminated them, and his clear and human approach picked out rays of hope in several directions.

First and foremost he underlined the futility of resisting social changes, and the pressure of populations. At our present rate of increase in these islands—and for all practical purposes that means the Midlands and South-east of England—the next 15 years would require a plan *now* for the extra 3 million arrivals. This plan would need to envisage some very acute changes in the interpretation and enforcement of the Planning Acts—failing which some very

drastic changes would inevitably follow. By and large the public are gloriously indifferent to long term plans for development, but much could be done to awaken their interest by more forceful and active public relations work.

Two points were frequently under discussion and criticism, and Mr. James explained his views first on Green Belts, whose proper place he saw as a means of preventing the ever-present tendency of large towns to coalesce, forming one endless sprawling conurbation. In its proper function the Green Belt should not, however, be confused with a mere stricture which could frequently surround an expanding town; such expansion should be allowed, but parts of the Green Belt might properly stretch far into the heart of the city in certain directions. Location of industry has played an enormous part in shaping the size and nature of our new towns; but Mr. James was insistent that direction and siting of industry had, within realistic possibilities, made a very appreciable effect on the present shape of things—a shape which H. G. Wells had largely foretold 50 years ago.

The difficulties were many and the problem baffling and many sided, but the Planner had the matter under very good control, provided (or so we got the impression) the demographers got their figures correct, and human behaviour remained predictable. A lady visitor from Moscow University appeared somewhat mystified by our troubles, and in reply to my question, assured me that Moscow had no planning problems whatsoever.

With this wide background, and the problem writ large upon it, the three speakers on Sunday presented their case studies and proceeded to describe certain aspects of planning in the countryside which had been attempted or proposed. Mr. Ginsberg opened with an illustrated talk on the reclaimed lands of the Netherlands, as an outstanding example of man's contribution, however local, towards expanding his living room. Holland has, in comparatively recent times, reclaimed 1/5th of its own area, a feat which has no parallel in this country, where our main efforts have been devoted to population distribution and the preservation of remaining amenities; and where the only comparable approach might be found in the rationalisation of the Common Lands by new legislation. The settlement of the new lands in Holland, the planning of new villages and towns, and the social problems arising from the formation of a new countryside, were the result of a very carefully planned combined operation by a number of agencies concerned, and the successful outcome of the several extensive schemes completed over the course of the last 40 years presents a startling example of planning in the countryside.

On a very different theme, Doctor Pritchard first discussed in general terms the principles of conservation and the ecological approach in rural planning. The close study of man's behaviour in his natural surroundings, and of the beneficial and harmful results of his activities, was a prime necessity, without which no proper planning could be started. To illustrate this point it was possible to point to many examples—the mountain deserts of our Scottish highlands, where indiscriminate tree felling and relentless grazing have reduced an ancient culture to a depopulated waste land; in the new world the cultivation of the huge tracts of land used since time immemorial for grazing created a dust bowl on such a serious scale that remedial measures had to be taken as a matter of national emergency. More recent and perhaps more insidious has been the advent of chemical farming, and the wholesale application of chemicals to manurial treatment, weed killing, and pest destruction; spectacular and quick results have created huge vested interests which spare no pains in channelling criticism into quiet back waters, and bludgeoning the wavering and unthinking with lush and compelling advertisement.

As an outstanding example of the full and proper use of the environment to meet all the demands placed upon it, Doctor Pritchard dwelt at some length

on the Muskingam Valley conservation scheme in Ohio, where drastic and repeated floods had virtually forced co-operative action on the valley dwellers. Over the course of forty years or so, flood control had been reasserted after the construction of several extensive reservoirs. Afforestation of the steep slopes and lake sides had been successful in arresting run-off and silting, whilst strip cropping and contour ploughing had built up a tilth and fertility in the hill country quite beyond the hopes of the hill-billy farmers of former years, whose tumble-down shacks and derelict land signified a rural community on its beam ends.

Settlement of the watershed had followed the improvement in conditions, local industry had followed the quickening pulse of the economy, and gradually a valuable tourist and recreational trade had grown up on the boating, bathing and camping facilites provided by the Reservoirs and their scenic setting.

Such instances as these are hard to find, and in this country one of the main difficulties is the lack of any administrative machinery to sponsor and carry out the work. Local Authorities are notoriously parochial, if not positively quarrelsome with their neighbours and resentful of federal interference. As in many other aspects of planning, some form of Regional or Provincial machinery is found to be missing.

In the final talk, Professor Bowen had no difficulty in holding the full attention of his audience. As a Welsh-speaking countryman, and a trained geographer and anthropologist, the Professor added a rare gift of fluency and humour to a subject which had clearly occupied his interest and energy for many years; even without the full text of the Mid-Wales Report fresh in their memories, his listeners were swiftly absorbed in the special problems of the hill farming community of the central mountain core of Wales. This problem had its origin in many particulars seldom found elsewhere; but whereas formerly the central mountains and peripheral foothills had for centuries enjoyed a similar economy and a common way of life, sharp changes had emerged in recent years, when the turn-over to dairying and the facilities for mechanisation had brought prosperity to the lowlands and foothills, but made virtually no impression on the central uplands, from where the young people had restlessly drifted to industries and occupations far afield.

In studying the problem, Professor Bowen repeatedly stressed the need to understand the psychology and social background of the community affected. Refusal to admit such factors had so often in the past stultified efforts to change the order of things; to base plans on clear-cut logic and realism was to miss the point—or to invite a last resort to compulsion. The mountain Welsh have always been poor, and their whole aspirations have necessarily been deflected from things material to the treasures of the mind. Added to this it should be observed that the pattern of settlement in the countryside is based very largely on the homestead as opposed to the village; these and many other considerations have gone to make up an individual intensely self-sufficient, and emotional in his approach to problems. Successive changes in the economy of the uplands have unfortunately all tended in the direction of progressive depopulation. It is difficult to escape the conclusion that the best have gone, leaving what we find to-day, a land of subsidies, with marginal farmers subsisting on marginal farms.

A compassionate understanding of this unhappy situation provides the correct context—but no solution; and only new and fairly drastic remedies will be adequate to stem this decline, and later rejuvenate this rural economy on a sounder footing. The recommendations are fully set out in the Mid-Wales Investigation Report, for which Professor Bowen provided evidence. But essentially the recommendations lie, first in the amalgamation of the better

farms and a change over to a ranching system; secondly in a considerable development of afforestation; thirdly in a big increase in Reservoir capacity for the sale of one of the few plentiful commodities in this austere land; and fourthly in a sensible re-organisation of village communities and services to the benefit of all concerned.

As a practical problem and a planning solution, it would be hard to find a more realistic illustration of the theme developed on the course. On the other hand one was left with the disturbing thought that these and similar rural development schemes (cf. Fraser Darling and the Western Highland Survey) merely touched on the fringe of a more vast and forbidding problem—the ordering and planning of the other half of the country adjacent to the expanding cities, where the land is gnawed away each year, and with it goes the old order, the village communities, and the English countryside immortalised by generations of poets and painters. Planning there must be, and planning on an increasing scale and of a more compelling nature but, to have any decisive influence on the problems of our present social revolution, this planning should have started some 50 years ago.

OPERATOR TRAINING

By M. E. S. DICKENSON

District Officer, Education Branch.

Introduction

This paper has been written following attendance at a one-day course on Operator Training held at Harrogate on the 7th October, 1960, by the Institute of Personnel Management. The main speaker was W. Douglas Seymour, a Consultant in Industrial Training. For part of the course he was assisted by a panel consisting of:

Miss E. M. Gentles, Senior Training Supervisor, Joseph Lucas (Electrical) Ltd.

T. A. Rose, Production Director, Taylor Woods Ltd., and

E. D. Simmons, Training Manager, Guest, Keen & Nettlefolds (Midlands) Ltd.

While the course was concerned with industrial machine operator training, the principles involved apply equally to the training of forest workers, and this paper will endeavour to relate them to the foresty industry.

Objects of Operator Training

Before a scheme of training can effectively be put into operation it must be accepted by both management and workers, so that there must be anticipated benefits for both. These are:—

(A) for management:

(i) increased output per man, resulting in lower unit costs;

(ii) an acceptable level of production achieved more quickly by new entrants;

(iii) increased job satisfaction, resulting in decreased labour turnover, and therefore a uniformly higher rate of productivity;

(iv) easier recruitment of labour—a number of personnel managers confirmed that training schemes definitely attracted labour to firms where they were available;

(B) for labour:
- (i) increased earnings where piecework, bonus, or merit rating schemes are in operation;
- (ii) an acceptable level of earnings achieved more quickly;
- (iii) increased job satisfaction, resulting from increased confidence in the worker's own ability.

Provided that these benefits can be obtained at a reasonable cost, the introduction of a training scheme is obviously advantageous. Unfortunately, it is difficult to say what is a reasonable cost, since it is virtually impossible to evaluate the benefits in terms of cash. They are only reflected over a comparatively long period, so that to some extent the institution of a training scheme must be an act of faith on the part of management. However, there is sufficient evidence available from industries which have taken this step, e.g., the cotton industry, to make the risk a small one.

If industry finds it advantageous to provide training for operators of a single machine, how much more benefit should be obtained with forest workers, who may be called on to carry out any one of about thirty operations, many involving the use of three or four skills?

Organisation

Before any scheme of operator training can be instituted top management must make two policy decisions:

(a) who is to be responsible executively for the organisation and running of the scheme, and

(b) who is to be responsible for functional guidance, i.e., seeing that the right instruction is given in the best way.

Industry finds several alternative solutions to these two points, but generally speaking the answer to the first one is either a Director, or the head of either the Personnel or Work Study Departments.

The responsibility for functional guidance may lie with either a special Training Department, or the Training Section of the Personnel Department, or the Work Study Department, or line management, i.e., the various production departments. Which it is depends to some extent on the number of specialist staff employed—the degree of functional sophistication.

The position within the Forestry Commission has been that the training of forest workers (not Foresters, which is a separate matter coming into the category of technician training) has been in the hands of line management; each territorial Conservator, through his Foresters, has been responsible for the training of the workers within his Conservancy. Functional guidance has been absent except, in recent years, in the case of tool maintenance for which specialist instructors have been available, and, also in recent years, the inclusion of some instruction in worker training in the man management syllabus at Forester Training Schools. This has resulted in the adoption of the technique, known in industry as "sitting next to Nellie", or perhaps "working with Charlie", which is admitted, even by many who still use it, to be little better than showing the worker the job and leaving him to find out how to do it as best he can. This method of instruction is unsatisfactory because—

(a) Many, probably most, experienced operators adopt some undesirable practises. Familiarity breeds contempt, in particular with regard to safety.

(b) Few experienced operators are able clearly to explain what they are doing, and why.

(c) Conditions for instruction are at their worst—bad position for pupil, insufficient room, noise, speed of operation, distractions, and a sense of being different.

(d) Interference with production, and probably with "instructor's" earnings.

New developments in worker training to be put into operation in the near future are, in fact, merely an extension of this. The executive responsibility remains with Conservators, i.e., decentralised, and the functional guidance, at least as to "what?" and "how?" will come from the Chief Education Officer, i.e., centralised. Whether the different conditions which apply in the forestry industry are such as to justify a complete reversal of the policy, adopted generally in other industries, of centralised executive control and decentralized functional guidance can only be resolved by experience.

Where should Training be Given?

Training may be given in a separate establishment or section, or on the job.

The use of a special training centre has certain very definite advantages:

(a) All the necessary facilities can be concentrated and be readily available;

(b) no distractions;

(c) a better learning atmosphere can be achieved—all present are learning and are not conscious of being "different";

(d) no interference with production.

In forestry the surrounding or near-by forest must, of course, be considered as part of the training centre.

On-job training is more difficult for the instructor, since apart from distractions and lower receptivity of the learner, he may well have to contend with noise, and unsatisfactory lay-out for demonstration, both of individual machines and general lay-out. These objections however do not normally apply in a forest unless the learner is put in with the gang, i.e., working with Charlie. It is always possible to take a group of learners to a part of the plantation away from the gang and there, automatically, is a separate training centre. Ideal lay-out can only be achieved by long-term design of a training forest, but since only one operation is normally taught at one time, layout is not important.

Most industries find that a compromise between training centre and on-job training is most suitable, it being necessary to introduce the learner increasingly to shop-floor conditions, and this may well be the case in forestry too. Some training, in such jobs as tool maintenance, tool use techniques, and preparation of produce could, with advantage, first be given at some central place for a District or group of Districts before moving to the forest for practical application. This should be a room or small hall of normally accepted standards for successful instruction, and *not* a wet weather shelter, or corner of a workshop. The fact that the worker is away from his normal surroundings, and in company with others in a similar position to himself, would undoubtedly increase his initial interest; to maintain it is the job of the instructor.

Instructors

The success or failure of any training scheme rests with the instructors; no-one with any experience of training will deny that a poor instructor would be better employed on some other job, and only serves to bring training schemes into disrepute.

This means that selection of instructors must be careful, and they themselves must be given some training to do this new job. With these provisos, it is usually found that the number of people able and willing to undertake this job of helping their fellows to be efficient workers is much greater than is generally supposed.

Industry draws its operator training instructors for the most part from charge hands (gangers), occasionally from the assistant foreman (assistant forester) or foreman (forester) levels. In view of the general shortage of gangers, suitable assistant foresters may well form the main source of supply in forestry, perhaps about four years after leaving Training Schools.

The criteria set by industry in the selection of instructors are:

(1) He should be capable of doing the job in which he is to instruct at least at experienced worker level.

(2) He must have the right attitude, i.e., be keen to pass on his knowledge.

(3) He should be above average charge-hand's intelligence, particularly with regard to verbal expression.

(4) He should be a model operator, not only in technique, but also in dress and habits, since students tend to accept the standards set by instructors.

The training of instructors after selection remains the biggest problem in industrial training. Most are sent on Ministry of Labour Training-Within-Industry courses, particularly Job Instruction and Job Relations, and these are generally felt to be a good grounding, but insufficient in themselves. Courses at the Ministry of Labour Training Centre at Letchworth are in such demand that there is a nine-month waiting list. Some industries, or groups of firms in a certain area, have arrangements with local teacher training colleges. Government Departments have an advantage here in that the Treasury courses for Departmental Instructors are available to teach the technique of instruction.

Cost

As already stated, costs must be kept within reason so that a general economic advantage results. The major part of training costs lies in the salaries of instructors, but equipment and space may also contribute appreciably.

It is normal practice to pay instructors a lead over their normal payment as charge-hand or foreman, since they have an extra skill at the service of the company. Equipment, even standard tools and machines, is non-productive and therefore fully chargeable to the training. Special equipment for demonstration purposes, or for practice of a particular skill involved in an operation is often useful, but care must be taken that it does in fact aid training; that as a result of its use the trainees either learn more quickly, or to a higher standard. A useful test for a piece of special equipment is whether or not an experienced worker can use it more efficiently than a trainee; if not, then it is not teaching the trainee a skill that he requires for doing the job for which he is being trained. Special equipment costs should be viewed in this light.

Training Forest Workers

The application of the principles of operator training as evolved in industry to forestry can be summarised as:

(1) A clear allocation of executive and functional responsibilities must be made.

(2) A decision whether training is to be at a special training centre, at the place of work, or both, must be taken, and the necessary facilities provided.

(3) The selection and training of instructors is the crux of the whole matter. This is particularly so in forestry where the task is largely one of re-training, since most men, even new entrants, believe they know how to use an axe and a saw.

(4) Any scheme must show results in improved production; if it does not, management is wasting its money, and the scheme will get no support from workers. Some industries do not include new entrants on the production side until they are capable of working on piecework. If this could be achieved in say two weeks for each forest operation, the loss of production during that two weeks would be more than offset by a greatly increased initial level of production thereafter.

(5) Training should be applied first where it will do most good, and therefore show greatest results. Each unit must decide which operation would benefit the Forest most from increased productivity—is planting held up by slow ground preparation; is conversion held up by slow extraction? This principle will ensure not only greater efficiency at the Forest (which is the basic reason for training), but also more ready acceptance of training.

HAPPY RETURNS

By K. W. WILSON

District Officer, North-East England

At a Northerwood Study Group, I was asked to prepare a paper on "The use of Routine Returns in effecting Control of Operations". The paper lead to considerable discussion and I have been encouraged since then to give the subject wider publicity.

"Returns" in the popular imagination has become almost a naughty word—the hallmark of bureaucracy, the playthings of those who appear to rule our lives. Only last week, I overheard in a locality which shall be nameless: "It was one o' they Government forms, ye ken. A didna' ken a'thing aboot a' the questions they asked, but likely they'll mak' somethin' o' them". An uncommon view? What do you think? Have you burned a few bad forms lately? You have? Good!

Let us, then, consider the role of returns in the practice of management which, for any undertaking including the forest industry, has been defined as "the provision of goods and services required by the community with the most economical and effective use of resources of all kinds, including labour, materials and capital".

The direction and management of an industry calls for the exercise of two distinct functions, the administrative and the technical. The administrative function does not vary much from one industry to another despite differences in techniques peculiar to separate organisations, for it involves the co-ordination and control of those technical functions. The exercise of this managerial co-ordination and control depends upon the judgment and actions of the manager, taken after consideration of technical and other information held as a result of his professional training or as properly received by him. The communication of information in its widest sense—and by that I mean instructions as well as the results of those instructions, hence "returns", must flow effectively through all appropriate channels of the organisation.

We are all aware of the gradual development of management within our own industry, a movement to be found in other industrial and commercial organisations. A common approach in this matter is that of *Production Control*, the principles of which may be applied to forest management.

The principles are, and here I quote from a book (1) prepared on the subject by the British Standards Institution:—

(1) *Scheduling*, which is the means by which the production plan is presented *to all concerned* to provide for the commencement and completion of work in all stages of manufacture;

(2) *Machine and Labour Utilisation* which is the means by which the maximum use of machines and labour is co-ordinated in the production plan;

(3) *Manufacturing Order Control* which is the means by which authority is given to all concerned to produce according to the plan;

(4) *Stock Control* which is the means by which the correct *quantity* and *quality* of material and components are made available, according to the production plan, and

(5) *Progressing* which is the means by which the execution of the plan is co-ordinated, so as to *reveal*, and *as far as possible, to eliminate*, any variations of the plan.

Production Control Diagram

	Production Plan	*Agencies*	*Relevant Forms and Returns*
(1) Scheduling	Forest Working Plan	Parliament } National Forestry Com. } policy H.Q. instructions down through Conservancies	Annual Reports Summary W.P. Controls W.P. 14 to 20
(2) Machine and Labour Utilisation		"Establishments"—recruitment and morale Work Study Engineering Section—provision and maintenance	A47 Vehicle logs Personnel records A6
(3) Manufacturing Order Control		Approval of Programmes and Financial Estimates W.P. 16 and 18	
(4) Stock Control		Financial Estimates Work Study Stores Section—tools and materials estimates	A69 Stocktaking A64 Consumable Stores Returns Produce Records
(5) Progressing		Programme and Financial Estimates	A47 W.P. 14, 16, 18, 19, 20 R0 and R1 NR 1-4 Produce Records

The diagram above indicates how Production Control may be related to Forestry Commission practice. Running throughout, we have the Forest Working Plan which is the prime management document drawn up on the basis of all the national and local administrative and technical information applicable to the Forest. Down the line of communication and control move the policy, technical and procedure instructions for guidance of management at each level and for executive action. Some of the agencies concerned with

this are given in the third column. Finally, a few of the forms for authorisation and returns for control purposes are given in the last column.

Authority for control is delegated to each level of management on an age-old pattern.

Probably at least 3,000 years ago, Jethro set out this principle to his son-in-law, Moses (*Exodus* XVIII):

"The thing that thou doest is not good. Thou wilt surely wear away, both thou, and this people that is with thee: for this thing is too heavy for thee; thou art not able to perform it thyself alone. Hearken now unto my voice. I will give thee counsel and God shall be with thee: Be thou for the people to God-ward, that thou mayest bring the causes unto God; and thou shalt teach them ordinances and laws, and shalt shew them the way wherein they must walk, and the work that they must do.

"Moreover, thou shalt provide out of all the people, able men, such as fear God, men of truth, hating covetousness; and place such over them, to be rulers of thousands, and rulers of hundreds, rulers of fifties, and rulers of tens.

"And let them judge the people at all seasons: and it shall be, that every great matter they shall bring unto thee, but every small matter they shall judge: so shall it be easier for thyself, and they shall bear the burden with thee".

The Bible does not tell us much more except that Moses heeded this advice. We know that his control was generally very effective, and can probably assume with some certainty that his methods of communication and control had at least the merit of simplicity.

This quality is of increasing importance as an objective in the management of complex modern industrial organisations, and a recent paper (3) makes interesting and stimulating comment as follows:—

"In the last few years there has been a growing awareness in industry of the evils of excessive paper work, of wasteful practises and useless statistics. These all accumulate automatically in every organisation unless there is a conscious recognition of the danger, and a positive determination to combat it. Excessive paper-work and wasteful practises are born of inertia. Paper increases because people avoid the effort of personal contact and come to rely on the exchange of correspondence. Wasteful practises arise from the failure to apply commonsense to systems and methods. They are also the outcome of resistance to change. New technologies, new materials and changing needs all demand new ways. Commonsense and flexibility of mind, that is, the willingness to change with changing needs, are rare qualities.

"Perhaps the greatest evil is the growth of statistics, because management too often encourages this growth in the belief that statistics illuminate the business, and that the more there are the better will be the management control. The danger is aggravated by the ease with which statistics can be mass-produced in these days of modern accounting machinery . . . Where lies the danger? It lies in the fact that statistics come to be valued for themselves to the neglect of the people or things they represent. Their growth leads to dependence on paper and remoteness from people and their work. They generate a wrong attitude of mind and, what is worse, they employ valuable human beings on purposeless jobs."

Effective communication between levels of management is paramount for the success of the organisation. "Returns", routine or emergency, generally give the results of action taken and may in some cases form the largest proportion of the information flowing from lower to higher levels of management. The manager must know, with a rapidity appropriate to his level of respon-

sibility, such information as is necessary for his control of production. He must know that a job is *being done right*, at the *right time* and at the *right cost*. At certain and generally middle and higher levels of management, information through the medium of returns is required for the initiation and maintenance of production plans.

It is the job of the "management" to know what information is required for any purpose, at what level(s) only it is needed and to devise the simplest means of recording the information. "Management" should ask of any "return"—does it tell me *what I need to know* in a way that is simply interpreted? Does it tell me too much? If so, staff have been wastefully engaged gathering and presenting this information. Do the staff appreciate why the information is required in this form? If not, their interest and morale will suffer and later returns may be less reliable. What further analysis of the return *have I to make* before it has any value as a control document? Could the return be devised to do this for me—thereby saving time and costs?

It is wise to remember that "the price of perfection is prohibitive", to be sure that what is demanded is really essential and to be prepared to cut or improve the requirements at any management level so that authority properly delegated can be responsibly exercised.

Finally, the manager should ask—am I getting this return in time to make effective use of it?

I have said that the manager's job so far as it relates to "Control" is to check that the job is being done:

right
at the right time
and at the right cost.

First then, he is responsible for *control of quality*.

The specification of the quality required must be made on technical and economic grounds. Avoid "fussiness" which leads to increasing costs without improving efficiency and productivity. Be always aware that changing conditions demand an amended specification. The specification must not be too low—otherwise the process is ineffective and time and money are lost. Neither must it be too high or productivity and profit margins are impaired thereby. Specifications must therefore be clearly described and fully understood at all levels down to the forest worker—it is helpful if the *reason* for the specification is understood also. This promotes interest and morale as well as providing a basis for incentive schemes.

Whilst examples of this come most readily to mind on the timber production side, I am sure that we can do much more to determine specifications for all branches of our work. Work Study and Forest Research are seeking development on these lines but the task should not be left entirely to them.

Once the specification for any work has been determined, *control* rests primarily, in our case, with the Forester and District Officer. The responsibility for *attaining* the quality is that of the Assistant Forester and/or Ganger, but we should always explore the possibility of allowing the worker to do as much inspection as possible—to do otherwise is often to condemn initiative and the application of intelligence to his work.

Secondly, the manager must see that the work proceeds at the *right time*. This embraces the whole of the productive plan from Scheduling to Stock Control. Whilst much of this control is at Forester level, the District Officer must keep this aspect of his responsibilities in mind during visits and inspections and when attending to "Progressing" on the A47.

Finally, the manager must see that the processing is carried out at the *right cost*—in particular at the right cost for the desired quality of work.

We can acknowledge the development of the costing system that has taken place in the Forest Service (4) over the past few years, but would be foolish to assume that it is incapable of improvement. An adequate costing system is capable of being the means of control provided it is designed to that end, that it gives quick results, and can be applied at the lowest levels of management.

The system should give an historical record of the financial results of the operations of a business *as well as a means of controlling expenditure during the time it is being incurred.* It should also provide a basis of comparison of other results over similar periods or by the employment of different methods.

Historical costs are usually produced too late for remedial action. They can indicate the size of a "surplus or deficit" over any period, and so permit broad comparisons to be made. Apart from this system of "actual costs", development is, I think, proceeding in the use of "standard costs", which are estimates of costs based on appraisement of work loads, quality and the conditions under which the process has to be carried out. I believe that we can expect more developments along these lines as work measurement can be applied to more of our operations.

Whilst the design and mechanics of a costing system adequate for the needs of a large organisation such as ours must be somewhat complex whatever form of cost control is employed, the following practical considerations are vital to its success—and here I quote from *Management for Production*, published by the British Institute of Management—

"(1) Operating statements must be presented as promptly as possible so that any remedial action may be correspondingly prompt.

"(2) The contents of operating statements must be appropriate to the departments receiving them. Expenditure outside the control of the head of the department should not be included. The form of statement must be simple, both for ease of compilation and interpretation.

"(3) Information received from primary records must be accurate.

"(4) The make-up of standard costs and of departmental budgets should be discussed with the supervisors concerned, whose advice and assistance in drawing them up should always be taken. The final figures must be capable of acceptance by those who will ultimately be called upon to use them."

The next technique available to the manager is that of inspection. Much could be written on this subject, and I will say no more here than that the control exercised by the manager depends upon the inspection of all facets of his production plan as well as of quality and costs. In office or in the field, the method and focus of his inspection should be appropriate to his level of management.

Let us look briefly at Commission returns which pass through the District Office, i.e., the control returns familiar to the majority of readers. There are other returns, the form and purpose of which may differ from Conservancy to Conservancy, well-designed useful control forms; but there may be forms still going the rounds the original purposes of which have been lost in antiquity, different forms giving similar information going to neighbouring offices, I-can't-be-bothered-to-look-it-up-myself-let-somebody-else-do-it-for-me forms, and I-send-it-in-every-week-but-goodness-knows-why-they-want-it forms, and but-I've-done-it-this-way-for-years forms.

Looking at our returns on a functional basis let us see what use can be made of them for control purposes up to District Office level.

First there are the *Silvicultural Operations* the progressing of which is recorded on A47 Pt.I. The programme of work is summarised on the left-hand side of the form from the WP 15 and 16 of the Working Plan. Against this is set the approved expenditure on that work programme—the expenditure generally being an aggregate of realistically estimated or standard costs. Rather limited provision of space under each Account Head is made for recording the estimated unit cost of any work which the District Officer may wish to have "progressed" in greater detail, e.g., under 101 may be given the various ploughing methods to be used. This detail is useful for control purposes as well as providing information to aid preparation of subsequent "Estimates".

At this point, I would like to express regret at the disappearance of A47(a) which (a) saved time in preparation of the A47 at the Forest Office

and (b) provided for the recording of unit costs in as much detail as necessary.

The later system has some advantages over the one it replaced, but it is still not quite satisfactory. Another fault of the A47 applicable to most, or even all operations which it covers, is that the time taken to reach the District Office and there to be examined is far too great for full use to be made of the return for close control purposes, even in its present form. A costly operation may occur 3-4 *weeks* before record of it comes to the District Officer's notice by this means. Nevertheless, even though this delay has occurred, large variance over estimated costs should be checked by enquiry of the Forester and/or inspection of the job by the District Officer. This inspection may reveal faulty estimating, too high quality of work, justifiable cost in view of difficult terrain or other working conditions, inaccurate quantity recording, poor supervision etc. The aim should be to obtain a satisfactory reason for the variance, and to effect an improvement by whatever method seems most suitable.

The delay in receiving the A47 is relevant to its use as a progressing document—i.e., the job being done at the *right time*. It can tell the District Officer only that work done 3-4 *weeks* ago had been started in time or even making good progress up to that time. It gives no clear indication that proper priorities are being given to operations according to season. The blank weeks without information are obstacles to close control. This return, therefore, like most other returns for that matter, is no substitute for the closest possible contact between District Officers and Foresters—by visit, phone, or minute.

The following suggestion seems worthy of consideration:—

The submission of the A47 to Conservancy Office at monthly intervals for ledger posting of expenditure, may be all that is required. The return in its present form could be retained, with the provision for local use only of a form which would provide a weekly control of quantity, operation and cost for Forester and District Officer.

The form, in duplicate, would be divided vertically by perforations (top copy only) into five groups of columns for Account Number, operation, quantity, total cost and unit cost. Each group of columns would be completed weekly from A6 and other produce records, listing only those operations carried out in the period. After the first week, operations would be shown on the line on which it was first recorded. Top copy would pass weekly to District Office, whilst duplicate would be retained to provide, by cross adding, the totals necessary to complete the A47. Alternatively, if the operations are listed in vertical columns and weekly groups arranged horizontally, vertical addition would be an easier operation.

Fire Protection—A47 Pt. I Acct. No. 160

It is essential for the total expenditure under this head to be detailed on a separate part IV to correspond with the Forest Annual Fire Plan which will normally be the Forester's control document. This enables progress to be checked in relation both with the Annual Fire Plan and with seasonal requirements. The unit costs help to provide more realistic estimates of costs for ensuing year(s).

The Fire Report—Form A74

Generally, the District Officer will have attended the fire on which the report is being submitted. Nevertheless, he should check the accuracy of this report before it is submitted to Conservancy Office, as well as the proper completion of the A74(c) (Efficacy of Fire Protective Measures) as this is a valuable return for the building up of information indicating the factors of importance in fire control.

Vermin

A return of vermin destroyed may be required in all Conservancies and may have originated for the collection of data for Annual Report purposes. Nevertheless, its use for control purposes should be recognised and its design amended when necessary to give that feature. It gives an indication, when coupled with observations made on visits, of the effectiveness of the protection arrangements against each class of vermin, and the priorities being given according to season, e.g., fox control, closed season for deer, proportion of male and female deer killed, spread or decrease of rabbits, hares, woodpigeons, etc. Return might usefully show the number of rounds of ammunition used.

Roads Maintenance

The A47 gives total and unit costs of road maintenance, whilst in some Conservancies a special weekly return is used for each grader to show tractor and grader time in use, the roads and mileage graded. Where the District Officer is responsible for roads maintenance, this return is very helpful, in conjunction with field inspection, towards checking that effective use is being made of the equipment and directing attention to roads in any forest where grading is required.

Nurseries

With similar limitations as mentioned for other operations, the A47 indicates progress and cost in relation to programme, financial estimates and season.

The Nursery Records *NR 1-4* are not really returns designed for control of operations by the District Officer, but to confirm his field observations and reflect the efficiency of nursery management.

The Plant Demand and Advice Notes, *Forms T11 and T12*, are useful returns, whether a District Officer has or has not a Nursery. They should be checked against forms P3 and/or 4 to ensure that demands and delivery of plants for planting, beating-up and lining out are being made at the proper time, according to season, progress expected and recorded (A47). Field inspection is most important during this season of the year to maintain proper control of quality and progress, e.g., that plant grading is adequate, that handling is being done carefully and expeditiously, that clearance of nursery sections is properly in advance of sowing and lining out. Attention to these returns enables the best use to be made of transport by arranging joint demand and delivery of plants from one or more nurseries to one or a group of forests.

The historical costs given by the Nursery account give the value of the surplus or deficit of the year's working, but must be studied together with all the factors affecting nursery management.

Produce

The A47 is useful to the extent already indicated.

The S6 is a good form for *producing* forests though it can indicate extent of unused stocks, at other forests, which may be available for transfer or sale. It does have a major fault for "control" at District level; it is prepared at too long intervals.

The District Officer must therefore maintain close control by field inspection and by the inspection of the primary produce records.

The S6, often merely confirming the position with which the District Officer should already be conversant for control of quality, cost and progress, shows at "*A. Progress of Felling*" the volume marked and measured against programme for F.C. fellings and Standing Sales. In regard to the progressing of Standing Sales or of sales of produce at stump or at roadside, a local return is usually necessary, particularly when a number of contracts are involved. The S6 for this purpose, is of little value; in any event, it was not properly so designed. The District Officer and Forester must be able to inform the Divisional Officer at any time concerning—

(1) Volume felled and removed in relation to instalments paid, and to full period of contract;

(2) Satisfactory fulfilment of all the terms of the contracts.

At "*B. Disposal of Felling*" and "*C. Conversion and despatch*", control must be by inspection and process planning. Stocks in hand, if in excess of known requirements (here check S4's) represent "capital" and steps should be taken to find local markets or to report on form S2(b) for disposal of surplus stocks. Mention has been made of S4's—whilst a copy is held at District Office, only examination of this form at Forest Level can reveal any difficulties which should be resolved.

The "Loss on Conversion" given on S6 is an indication at quarterly intervals of the effectiveness of control during the period of the return. There is a danger that the figure given in the S6 may be misinterpreted by those not conversant with the processes of conversion, which should be regularly inspected to ensure that the loss on conversion is brought to and maintained at a minimum level consistent with the class of material produced,

e.g., (1) measurement by "Tariff" should be kept at a high standard;

(2) check measurement of sample trees;

(3) check cutting of poles to best advantage;

(4) check proper grading of converted produce;

(5) check conversion loss by stands, using S8 and S9;

(6) encourage marketing of produce with low loss on conversion.

It is normal practice in some Conservancies to give on the reverse of the S6 a note of the quantity of timber at stump, roadside and at dump. This usefully indicates the progress of extraction.

Before leaving field inspection of the operations connected with timber production, mention must be made of the need to carry out from time to time a physical stocktaking of all timber stocks, with which should always be associated, I think, a check of the correct processing of the documents S0, S1, S2, S8 and S9.

At this point, the value of the time sheet should be mentioned. The proper completion of the A6 should be checked periodically in the field for security reasons. When the return reaches the District Office, usually together with the A57, further examination can be useful, though the nature of the form forces the District Officer to spend his time making such analysis as he requires. Without analysis, he may detect irregular payments, inaccurate recording, or he may note extended sick leave which may require further enquiry, and in some cases, the examination of the Accident Book. It is helpful, and in fact essential, to analyse piece work earnings in relation to agreed rates—noting anything that may call for enquiry or even field investigation, e.g., in relation to quality control, possibilities of defalcation, changes in piecework rates, or to consider improvements in work methods.

Since the first preparation of this paper, the Work Study team has put out a scheme for labour control which covers these points.

Estate Work

The control of expenditure on "Estate" work is not normally the responsibility of the District Officer, though he should watch work and costs as recorded on Part IV of the A47 and in his field inspections he should not overlook his responsibility towards the welfare of his staff, in so far as it is influenced by the housing and related conditions, and towards the proper care and maintenance of Commission property.

Agency Work

This may be divided into two types:

(1) Labour on loan to farmers etc., requests for which will often be known to the District Officer in advance. He should ensure that official policy is being maintained and that loans are only made without upsetting essential work on his own forests.

(2) Work for outside parties for which "estimates" have been approved after preparation by the District Officer. It is important in this case, to keep a close watch on specifications, costs and quality.

Difficulties may arise if District Officer and Forester do not keep very much in mind the differences between "Agency" and F.C. labour rates. I suggest that it is imperative to keep a costing record of this work at the appropriate rates, as the A47 record of expenditure is quite misleading.

Road Construction

Whilst road construction is the responsibility of the Engineering Staff, this activity is being carried out very often by forest staff. The District Officer has a considerable responsibility in road and programme planning. Hence he has a large interest in the proper co-ordination and control of the road programme, which he exercises in co-operation with the Civil Engineer. Attention to the progressing of this work by field inspection and by attention to Part V of the A47 is essential to the management of his District.

This leads us to consider the summaries recorded on Part VI of the Progress Report. The section devoted to *Weather Report, Fire Conditions and Remarks* is often inadequately used. It has a historical, rather than a control value, but for all that, we should encourage intelligent use of this section to record *useful* information. Remarks, if any, tend to be sketchy. The impression is often given that the Forester thinks he must write something and as little as possible, if only to show that he has seen the space provided. It could be useful for Working Plan and Annual Report purposes.

The Forester's Time Summary is provided for accounting purposes, i.e., the allocation of Local Supervision Overheads. There is nothing of value for control purposes here, as the figures are given as an aggregate for all the non-industrial staff on each forest, and no note is made of time other than that spent in the field. For proper interpretation of the P.V. and M. summary, the District Officer needs to keep a list of machines held at each Forest. Whilst he can check the proportion of "time in use" and make enquiries when "lost time", for any reason, seems to be excessive, he cannot, from this summary, get any indication of the output from any machine. This can only be done by Field and Log inspection.

Overhead charges result from statutory and other obligations to our staff and equipment but it is well to examine certain items, e.g., Driver Maintenance, Wet Time and Transport of Workers, from time to time to satisfy oneself that expenditure has been kept to the minimum level and to consider ways in which reductions might be effected, e.g., are wet time rules being reasonably enforced, can productive work be arranged in wet weather, can contractors be employed on F.C. operations or for transport of workers?

Forms A64 and A69 are the two returns by which, in conjunction with field inspection, the District Officer can effect *Stock Control.* By this means he can control both the quantity and quality of tools and other equipment held at each unit and, by transfer when necessary, ensure that full use is made of available stocks. He should always be on the look-out to see that the correct tool for each job is properly used and maintained, and that "waste" of any kind is cut to the minimum.

Most of the returns routed through District Office have now been considered with the exception of those concerned with the *Private Woodlands* side of his duties. Such returns are usually applications for grants and licences received from Conservancy Office and normally require a field inspection, either by the District Officer or by a Forester to whom he may delegate the job. The "returns" are mainly for accounting and record purposes, but it is important that any remarks or other details following those inspections should be given as clearly and as fully as possible as an aid to further inspections, and to assist the Divisional Officer in his judgment wherever this has to be exercised.

Finally, I repeat that a manager exercises control of work (and this includes people) by seeing that it is done right, at the right time and at the right cost. This has always been a sound objective that has received an impetus by an acknowledgment of the need to manage our business on economically sound lines.

"Returns" are a tool of management that should be effectively employed. I hope this paper will have stimulated interest for all readers and will encourage the initial review of the number, purpose and design of "returns" and their use, together with proper inspection, for good control of our activities. Happy returns!

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SO YOU WANT MORE MONEY!

By W. M. CORMACK
Controller of Finance, Headquarters

I am sitting peacefully at my desk one morning in June waiting for the sun to come round to my side of the building and speculating on the ill-fate which befalls me every time I am trying a small slam or a blasting shot out of a deep bunker guarding the green when in walks Joe. "I want more money" he says, "you chiselling crook" he growls. He is of course a Director.

They call me Controller of Finance but if they ever find out the trouble I am having with my own money, which I never mix with official funds—why should I subsidize the Government?—the promotion avenue will open even wider.

Joe's problem is not uncommon. He asked for £x and was awarded £x—£y. There was a time when I used to explain very carefully how the national cake could only be a certain size which meant that our portion also is limited. But that got me into difficulty when faced with the problem of comparing the value of the M1 to the national economy with the value of afforesting a peat bog in some unpopulated district in the North-West of Scotland. I always had to concede that very few, if any, people died suddenly in a peat bog in the north of Scotland, and no amount of argument that the important point was the number of deaths per 1,000 users could convince the chap that he should not have the money for his afforestation. No—all I could do was to explain in whining apologetic tones that the Treasury had cut us.

"So they are cutting the grant to the Forestry Fund", says Joe, "that's all right; you must cut somebody else, not me." I am beginning to feel weak. Someone with infinite wisdom (I think) will some day be able to make a realistic assessment of the comparative values of peat bog in North Scotland v. scrub woodland in South Wales; a few miles of cheap roads in East England for extraction v. a mile of very expensive pre-planting road in West Scotland and so on.

"Very well, Joe" I says, "I'll see if I can be helping you." He leaves me in reflective mood. I am thinking of my chum Jock the forester at the side of his peat bog. Jock has been going into things very carefully. He reckons that with a Land-Rover, a lorry, 10 men, a few bicycles, the use of a tractor, some nice shining spades and things and so on he would turn this peat bog into the finest forest that anyone could expect from such a wretched site, even if it will only grow to Quality Class IV whatever that means. He forgets that he has 500 mates on the same trail.

I am beginning to wonder whether I am turning into a hardened cynic as I reflect on the difficulties but it is difficult when one is comparing things which are unlike. How can one share out the money?

The Controller of Finance is nicely poised between the Treasury shouting "Less" and the Directors shouting "More". A difference between the two seems to be inevitable because the respective "cakes" are of different sizes, but the size of the difference varies from year to year.

In a commercial enterprise the same factors as we contemplate are taken into account but I would say that in the former more emphasis is given to profit. Let me hastily add that it is not a question of profit or loss in the Commission, it is a question of the size of the profit, or to put it in the way we usually describe it the percentage of interest on capital. Nevertheless,

profitability is not the measure of entitlement to funds—the imposed programme is apparently unshakable and money must be found for the respective programmes or a proportionate share thereof; programmes in this instance covering acquisitions, buildings, vehicles, roads, etc., as well as planting.

It seems then that there is no basis for determining how cuts should be imposed or extra money divided out should the situation ever arise.

Engineers are, if anything, worse than Directors. Every mile of every road is vital to the Directorate economy and a cut of engineers' funds means disaster. That is the argument.

Mr. Parkinson, the author of "Parkinson's Law" which I believe is well-known, perhaps even practised in the Commission, suggests an answer in his new book *The Law and the Profits*; in effect he says that awards should be more readily won by saving money than by spending it—the Government should take on the onus of determining how much money each Department should have and measure its efficiency by reference to how much each department achieves with the money.

No doubt in due course we shall do something like this in the Commission. Out of the surpluses on your produce account, it will be said, you will first pay to Headquarters a certain amount in respect of interest on capital. With the balance you will first maintain the plantations not yet in production; then you will replenish your buildings, your tractor fleet and so on; after that if you have anything left you can consider new investment in forestry. Happy thought—roll on 1975!

But for the moment I am left with the problem of how much to give to each, how to cut the allocation, how in other words to compare unlike with unlike. Comparisons, someone said, are odious.

Never mind, the sun is now round to my side of the building and I must use up that half-day's leave left over from 1952. Forget about estimates. But how to spend the half-day—various possibilities with various attractions; I just cannot make up my mind whether to go to Lord's or Wimbledon or try out that new driver.

SOME RANDOM RECOLLECTIONS

By H. CRUICKSHANK

District Officer, Education Branch

The memory of an intriguing, if infuriating, interview with a stone-deaf applicant for the position of cook prompted me to record other reminiscences, mainly light-hearted, which may amuse others involved in weightier matters.

One is apt to imagine that the life of an instructor in a forester training school might be akin to that in the austere scholarly atmosphere of well-known educational institutions where life flows smoothly on regardless of world events and human frailties. Nothing is further removed from reality. The strange psychology of students, the vagaries of domestic staff members, the unco-operation of the weather, the naïve or possessive approach of the general public and the amenities of forest civilization all contribute to the relief of any monotony which might otherwise encourage stagnation.

While inspecting our sewage plant an officer remarked that this is what a forestry training is for! A horticultural training might have been more appropriate judging by the number of tomato plants which flourished there!

Apart from broken windows, crockery, axe-handles, saw blades, fences, collar bones, ankles, electric cables, locks, and promises the most frequent source of diversion, and often trouble, was usually the domestic staff. One can think of too many instances. One recalls the temporary cook, a female, who couldn't form a sentence without including a swear or two, the assistant-cook who played the piano accordion and kept her room-mate awake at night, since she wasn't stone-deaf, the maid who in her various activities had given three different Christian names, another who had the annoying ability of inventing tales about her work-mates to their detriment and discomfort and the matron who couldn't move from her chair in case the effort involved worsened her migraine.

There was the Polish cook who after a "friendly" meeting with his lady's husband, was brought back, bleeding furiously, by the police during the night. The handyman's wife attributed her two black eyes one morning to neuralgia, in spite of her husband having been a circus boxer. He denied having practised on her even after very audible quarrels and cries of help.

There were applicants for the post of cook who thought they were qualified after having produced tea for a hundred people at a church soiree, and that it would be very easy to feed a small number of lazy students, and there were girls who were keen to work in a school because of the presence of a large number of eligible young men.

One recalls the helpfulness of previous employers when asked on the 'phone for details of applicants' service with them. For example: "All right under supervision, but no use as a waitress." "Definitely worth a trial." "Not up to our standard, but would do very well for a hostel."

One remembers with gratitude innumerable warm-hearted responses by students and domestic staff in emergencies—extra hours when short-staffed, student volunteers for cooking and washing-up when temperamental cooks and maids decided suddenly to leave; typing, sometimes with *two* fingers, when reports were urgent, and night work when trees were blown across roads.

One remembers many amusing incidents in which students distinguished themselves, worthily or notoriously; more amusement than praise may be obvious in the latter.

There was the student, who distinguished himself in several ways, and who, after a long discussion outside the office with the Director, entered and reported that the Chief Education Officer's chauffeur was certainly very knowledgeable about forestry.

A student making bird-boxes, was complimented by an officer on the excellence of his workmanship. The young man was wise enough not to explain that the box being examined was the one sent to be copied.

A number of students rather suddenly realized that the furniture in their hut was very drab—and they were right—and decided to repaint it in much more brilliant colours.

Students in turn are given charge of a squad of other students carrying out operations, and sometimes asked to write a report on the work. One, writing after having been in charge of fence erection, commented that his wife didn't appreciate his i/c complex.

Even early morning breakfasts bring back memories. There was the student who, while at his meal, suddenly stood up and offered a prayer for his fellow students—and possibly the instructors as well. Then there was the jolly Irish student who after having cheeked the warden suddenly found his face immersed in his porridge bowl.

One can compliment the quick-witted student who didn't waken one morning and was discovered still in bed by an instructor after work had started. The student gave the reason as an attack of malaria from which he said he occasionally suffered. The reason was good enough to allow him to avoid practical work for three days.

The rhymes which sometimes appeared on the blackboard were usually humorous but more often caustic. The note slipped under a door warned succinctly: "Beware of pickle pockets."

One remembers the student who used his pillow as a pin-cushion for his fishing flies, and another who pressed his botanical specimens along with his trousers under his mattress.

One thinks of deliberate pranks, such as the broken bathroom porcelain pot on top of the flagpole, the effigy hanged on the cross-bar of the school signpost, the collection of road, bar and tree signs in the dining room, and the historic coach having been pushed along the road to the school.

One doesn't forget the suffering from claustrophobia, kleptomania, hysteria, cold feet, headaches, migraine, mumps, appendicitis, marital diseases, late or slow trains, engine trouble and rugger injuries.

One recalls many members of the public genuinely interested in forestry or an associated subject who were most appreciative of facilities to visit plantations or inspect labelled specimen trees. But there were many others who looked upon the forests as their own property, and when asked to extinguish their picnic primus stoves considered us very brutal and offensive. Others wandered at will through the grounds and round the buildings taking photographs mainly of their companions with what they considered appropriate backgrounds. When they were checked about peering into windows, they would murmur: "Oh, it's all right. We're only passing. And, anyway, isn't this a school?"

Not only forestry students have a sense of humour. Teachers attending a forestry course can have one just as virile. When I mentioned the forester's remark on visiting one of the western isles of Scotland: "What I like about this place—there are no bloody trees", a teacher immediately capped it by replying: "What I like about this place—there are no bloody kids".

I cannot end these few reminiscences without including a very delightful memory, the visit of the late Chairman, just prior to his departure for Canada, to give a short talk to the students. When he arrived the students were singing lustily, which no doubt prompted him, after giving his farewell talk, to request the students to sing a song specially for him. The song he requested was "Alouette", which he said had been chosen by Canada as the signature song of the Forestry Conference. His appreciation of the rendering was very apparent.

THE MYSTERY OF THE WOODEN BOX

By R. LINES

District Officer, Research

Many foresters have become interested in archaeology over the years, and this is not surprising, considering the wealth of ancient burial or habitation sites which lie within Forestry Commission boundaries, quite apart from the "finds" which appear in a regular stream, perhaps turned up by the plough or spotted by an observant forest worker.

These enthusiasts will probably have read newspaper accounts of the unique find of superb Celtic metalwork crushed together in the remains of a wooden box, under a stone slab on St. Ninian's Isle, Shetland, in 1958. Altogether, there were 28 metal pieces, including a silver hanging bowl—the only existing one of its kind in Britain—several other decorated bowls and three Celtic brooches with designs like those in the Lindisfarne Gospel. The style of the articles suggested that they were of Scottish manufacture and probably date from the 8th Century.

One might well ask whether the few remaining fragments of the wooden box had any significance, compared to that of their beautiful contents, but in Professor A. C. O'Dell's account of the treasure, he reported that the rotted remains of the box were *larch*. This seemed to be a fact which did not fit in with our knowledge that larch was not grown in Britain until 1,000 years later, and I wrote to Professor O'Dell asking whether he was certain of the identification of the timber, since if it really was larch, then why should anyone take a plain wooden box all the way from the Alps to Shetland, unless it already contained some valuable objects? And if they took the box, might it not have contained some of these objects, which might then not be of Scottish origin? Professor O'Dell's reply is worth quoting in full.

"Thank you for your letter about the larch box which we found on St. Ninian's Isle. The wood was identified at Princes Risborough, the specimen actually went via the Laboratory at the British Museum, but I saw a copy of the report.

"Unfortunately, while there were the fragments of the timber where it had been jammed against the stone, it was impossible to get any details as to the exact size and structure of the box as the rest had decayed completely.

"While it is tempting to think that the silver material in this box came from Central Europe, I feel that more evidence would have to come forward to make the case. The designs are very much of the "Scottish" type of ornament being made in an area from Northern Ireland through Southern Scotland to Northumbria. The Hoard has a very miscellaneous assemblage of objects and therefore it is more natural to assume that a piece of timber was used to make a box in Scotland rather than that a box was specially made to carry the objects a great distance. The evidence points to the material having been packed and the box turned over in the rush on burying as the objects did not nest naturally the way they were found, but would have been reasonable if the whole thing had been inverted. There is little doubt that the date of burial was early in the 9th century.

"There is reason to think that timber drifted from the Siberian rivers and came southwards after it had travelled through the ice for a season or two. There are such timber movements in the Faroes today and there is a place in Shetland, Woodwick, which is the equivalent of Vedvig in the Faroe Islands, where timber collects even yet. Unfortunately, I do not think this helps us with larch, but you perhaps could tell me whether larch was a Siberian timber which could have drifted down one of the long north-flowing rivers. It is easier to account for movement in this way than to postulate a carrying by man from Central Europe."

I have subsequently checked with the Forest Products Research Laboratory that there is no anatomical difference between the timber of European and Siberian larch, so that there seems no doubt that Professor O'Dell has the correct explanation. What a pity the box cannot speak itself; what a story it would have to tell.

(Two other theories have been suggested to us since this article came in. One is that the larch driftwood may have originated in Switzerland, and have been carried down the Rhine to the North Sea, and thence ultimately to Shetland. The other is that the timber may be an American larch, and have been obtained from a log that had been carried all the way across the Atlantic, by the Gulf Stream.—*Editor.*)

LEGENDS OF SAVILE ROW

By H. L. EDLIN

Publications Officer, Headquarters

Now that plans are being made for the removal of the Headquarters of the Commission to another London address, it is fitting to look back on our long association with the street of high fashion. For those who do not know the spot, it is a narrow, straight, undistinguished looking thoroughfare running parallel to Regent Street, wherein many of London's grandest, and most expensive, shops are situated. Savile Row itself was built early in the eighteenth century as private houses for the upper classes of those days. Later the tailors took over, converting the basement kitchens into work-rooms. But though many survive in the neighbouring streets, few are now left in the Row itself; they have been ousted by leading ladies' fashion houses, and by textile and hosiery firms to whom a "Savile Row" address has a high prestige value. Our other neighbours include Government Offices, a glamorous ladies' hairdressers, and the West End Central Police Station.

The Commission's first Headquarters Office from 1920 onwards was at 22 Grosvenor Gardens, near Victoria Station.

It first came to Savile Row in 1931, when an office was rented at No. 9. Surprisingly, we still get occasional letters from overseas sent to this old address. A move to Number 25 followed in 1939 and this has been our address ever since. The building is owned by a property company and our share of it, as tenants, has varied. We contracted during the War years, when all the staff were evacuated to Bristol; a small nucleus returned even before the war ended, and we have expanded considerably since.

Number 25 is a modern office building without frills. It has three lifts that, over a period of about fifteen years, exhibited a strange perversity. Out of action during the war years, they were restored to fitful activity thereafter, but one or another was *always* under repair, and passengers stood a fair chance of being marooned between floors. Last year they were swept away by the march of science. We now have modern automatic lifts that, as like as not, go UP when you press the button that says DOWN. (Something to do with their electronic brains; we hope our own computers prove more reliable.)

During the war the building was severely damaged by a high explosive bomb that fell just opposite during a night air raid, while it was fortunately unoccupied. Much of the upper stories was blasted away, but our own offices, then on the second floor, survived. The Commissioners' Board Room table was deeply pitted by fragments of flying glass from blown-in windows, and its surface had to be planed off before it could be restored to its present pleasing condition.

Neighbouring buildings suffered more severely. Whatever stood directly opposite was demolished, and the site was used as a mooring point for a barrage balloon. Adjoining property on the other side of New Burlington Street also

vanished, and this site was used for a static water tank. Now and again a pair of London's half-wild ducks would alight on this and swim solemnly round below our windows.

The ruins of buildings next door remained as an undeveloped "bomb site" for many years, and were colonised by ragwort, bracken, and small trees. Lord Robinson, the late Chairman, once drily remarked that the growth rate of birch and willow on the ruins of Savile Row far excelled what he found in most of his conifer forests.

Eventually a feverish spate of new building swept away the last signs of the war-time blitz. The imposing Government building now used as the headquarters of the Ministry of Health was rushed up opposite us, and for a time we could watch "catmen" perilously erecting and rigging the tower crane or "skyhook" at a dizzy height above our windows. One old hand remarked that although all the latest devices of scientific building in reinforced concrete were called into play for this job, the builders were still steadily overtaken by old-fashioned bricklayers putting up a conventional building for Heathcoats, the textile firm, just across the street. The Ministry of Health building bears a small portrait bust of the original Lord Burlington, who gave his name to New and Old Burlington streets nearby, and also to Burlington Gardens, where the Civil Service Commission have their headquarters. Our own Savile Row staff have long enjoyed membership of both the Ministry of Health and the Civil Service Commission Staff Restaurants—otherwise West End prices for meals would have made rather large holes in their weekly budgets.

Proximity to the West End Central Police Station, which often features in reports on the more exotic types of crime, can have its disadvantages. On one occasion a sergeant called in, seeking "volunteers" for an identification parade. Only very senior officers were available, and a certain messenger (no longer with us) tactfully gave a romantic account of their present appearance and past activities. "Those blokes won't do", said the sergeant, defeated. "We can't take anyone with a Previous Criminal Record."

Nowadays there is not a tree in sight at Savile Row, if one excepts an acorn grown in a glass of water by a sentimental exile from the woods. We did once have a rare *Podocarpus* that throve in a pot, although its fellow seedlings at Kew had perished.

A pair of carrion crows once nested on a building close by, and street pigeons come to our window sills for food. A family of half-wild cats and kittens once lived on the bomb site next door, and we still have one of their descendants, a black cat that sometimes takes free rides in the lifts. A gang of rats once ruined a batch of publications by eating the fish glue on their covers and making nests out of the remaining waste paper.

Despite its humdrum character, most of us will be sorry to leave Savile Row. It is true that it is a bad place for practical shopping—everything around us is so de luxe and expensive that most of us are obliged to spend our modest salaries elsewhere. But it is very accessible, both from all parts of London and from terminal stations bringing travellers from all parts of the country, and we have enjoyed having Buckingham Palace, Westminster, Piccadilly Circus, and all the bright lights and fashionable spots of the West End virtually on our doorstep.

LIFE OF A FORESTER

By D. F. MARSHALL
Forester, East England

Young men when choosing the vocation or profession of forestry (and for those of us who love it, it is a most invigorating occupation) conjure up the more pleasant picture, the winding trail, the scent of pine and heather, the beautiful spring and glorious autumn.

The life of the forester is usually but vaguely understood by most people. Whole-hearted interest in forestry is required by the student as the work of a forester is not always the picture it is often made out to be.

Extremes of heat and cold, drought and rain, and also insect pests often make life a misery, and like any other work forestry has its share of drudgery and tedious routine.

Ability to manage labour, the power of observation, and most important common sense applied in practise, are the main factors required of the forester.

Great care should be taken with applicants who wish to take up forestry. Whether or not they prefer jazz to classics, cribbage to bridge or fact to fiction can have little or no bearing on their ability to make foresters. It is often difficult to determine whether or not a student possesses the qualifications essential to success, at least until he has been in school for some time.

Very important traits do not always appear until a man has assumed some responsibility.

This then should be borne in mind by the instructors, students should be given every opportunity to test their ability in the first year; if they fail to have the necessary traits, including self-reliance, it would be kinder to them and better for forestry, if they were not allowed to continue into the second year.

A thorough knowledge of the work from the very bottom, added to scholastic training and a keen sense of perception, form a good foundation from which to build.

Management and Policy, although very important in forestry, should not be of immediate interest to the student. Management, as the word indicates, is the administration of forest properties. A position of this sort is (or should be) given only to the experienced forester. Forest Policy, being the place of forestry in public affairs and the economics of the nation, can only be done by the leaders, men who have become such through experience and recognised ability. It follows then, that the essentials required for practical forestry should be nurtured in the student, such as silviculture, mensuration, protection, nursery work (essential to all foresters), felling, thinning and forest products.

Forestry as a life-work will only satisfy the true outdoor man, with a liking for physical exertion with a small proportion of hardship, able to be cold, and wet, hot and tired and not mind too much.

Men resourceful and ingenious, men who love nature in all her moods, who have eyes that see, minds with which to note, compare and think out, these then are the men who should think of going into forestry.

Those of us who have the job of training and those who have the power of accepting these trainees, should be men of vision, versatility and imagination.

A BRETON SCULPTOR

By R. LINES

District Officer, Research Branch

One cannot travel far in Brittany without being constantly reminded of the predominantly rural nature of the province. This is shown not only in the frequent markets and the well kept farms, but it is also reflected in the rural crafts. Here the horse has not yet been ousted by the tractor, so that smiths have not become motor mechanics; and you may still find the occasional water-mill, such as that at Plozevet, with its huge overshot wheel. Its owner, M. le Guellec-Raphalen, welcomes you like an old friend and conducts you proudly round. He is indeed "a jolly miller". Three generations of le Guellec-Raphalens run the mill, each one enlarging and modernizing his father's work.

One of the most interesting rural crafts is that of M. Job, the *imagier*. You come upon him at his open-air bench in the sunlit square of the little village of Locronan. With his orange trousers, multi-coloured shirt, and beard, he makes an arresting sight, standing there flanked by his delicately carved sculptures.

His main work is that of carving the traditional figures of saints and others carried in the religious processions, or *pardons*, which are such a feature of Brittany. These figures are executed in the historic Breton style, which has not changed throughout hundreds of years and suggests the medieval wall paintings of our own country. His merit as an artist is shown in his more finished, character sculptures of Breton peasants and in his heads of Christ. He successfully combines the old with the new by using recent Colonial timbers, such as Iroko, as well as the traditional woods of his own country, such as beech, oak, and elm. Examples of his work are illustrated in the picture facing page 56.

NOTES FROM HERE AND THERE

Compiled by the Editor

Two New Bridges

The former Bailey Bridge across the North Tyne at Plashetts in the heart of Kielder Forest, has recently been replaced by a permanent steel and concrete structure, with three spans totalling 140 feet. This was designed and built on our behalf by the 48th Field Squadron of the Royal Engineers and opened on 18th September by the Chief of the Imperial General Staff, Field Marshal Sir Francis W. Festing, G.C.B., K.B.E., D.S.O. Photos taken at the opening ceremony appear opposite page 57.

Our own engineering staff were responsible for the design and construction of a completely new bridge across the River Cothi in Brechfa Forest, South Wales. This has three spans totalling 160 feet, and gives access to the 500-acre Graig bloch, which has now reached the thinning stage. It was opened in October by Mrs. Lloyd Owen, wife of Mr. Lloyd O. Owen, a Forestry Commissioner and Chairman of the National Committee for Wales, and has been named Pont Rhyd y Gwial, meaning "the bridge of the ford of the hurdles".

The Sawmill at Geychancie

As part of its campaign to promote safety first on farms, the Department of Agriculture for Scotland has published a humorous poem called: *Don't*

take Risks! It's Geychancie. This is set to the tune and measure of the traditional Bothy ballad called: *The Barnyards o' Drumdelgie.* Incidentally, the farm of Drumdelgie, which is a real place, stands close beside The Bin Forest, near Huntly in Aberdeenshire. We give below three verses which show the spirit of the thing:

There's a fairm toun ca'd Geychancie
It's kent baith far and wide
Whaur they made a hash o' the safety
The warst on Deveronside
The fairmer o' this muckle toun
He is a glaikit stot
And a' the sense he disna hae
His servants hinna got.

Oor circular saw is an awesome tool
The blade wabbles roon wi' a zoom
And twa o' the loons that cut the logs
They're baith o' them wantin a thoomb
Nae rivin' knife and nae gaird ava'
And the flair's an awfa soss
If the farmer wad wark the machine himsel,
We'd sune hae a different boss.

Sae fare ye weel Geychancie
For I maun gang awa'
Sae fare ye weel Geychancie
Yer safety measures an' a'
Sae fare ye weel Geychancie
I'll bid ye a' adieu
I leave ye as I got ye—
A richt unchancy crew.

Golden Jubilee of State Forestry in Northern Ireland

This year the Forestry Division of the Ministry of Agriculture, Northern Ireland, celebrated fifty years of progress. Its oldest property, Ballykelly Wood near Limavady in County Londonderry, once belonged to the Fishmongers Company of London. It was taken over on 1st December, 1910, and it is rather startling to find that the first forester in charge, Mr. T. Donovan, then drew a salary of only 3s. 6d. *a day.* As his responsibility extended over 24 hours, it can be reckoned that his rate of pay was little more than 1½d. an hour!

The authority then in charge was the Department of Agriculture and Technical Instruction for Ireland. Subsequently, from 1919 to 1922, our own Forestry Commission was responsible for Irish forestry developments, but in the latter year the woods in the six counties of Ulster were transferred to the care of the Northern Ireland Government.

From that modest beginning with one 200-acre wood, the Northern Irish forests have been expanded to a total estate of 100,000 acres, half of which has already been planted. The current planting programme is 3,000 acres a year, and 1,500 men are employed. The total capital investment is £10½ million and thinnings are already bringing in about £250,000 annually. Nearly all the new woods are of conifers, with Sitka spruce accounting for about 55 per cent of all planting, and Norway spruce for another 10 per cent.

War-time Grenade Starts Fire at Kielder

An unusual fire occurred at Tarset in Kielder Forest on 21st June 1960, involving a loss of four acres of seven-year-old Norway spruce, and financial damage, including costs of extinguishing, estimated at £686. The area involved, part of Dodd Farm, had been used as a practice range during the 1939-45 war, and a week after the blaze the smoking relic of a phosphorus grenade was discovered. Enquiries were made of the military authorities, who identified the remains as those of an obsolete type containing white phosphorus, which is liable to ignite spontaneously when exposed to air. Possibly it had lain dormant until corrosion of the case exposed this dangerous substance.

Foresters in charge of other areas that were once used as Army training grounds should be on the look-out for similar sources of risk, even fifteen years or more after the last war ended.

Record Breaking Trees

On the centre pages of this *Journal* you will find photos of two of the largest trees of their kind recorded in recent years in Great Britain. One is the Newland Oak which was 44 feet 6 inches round and held the contemporary girth record for any tree in the country. It stood close to Newland Village in the Forest of Dean, Gloucestershire, and its position is still plotted on the one-inch Ordnance Survey map. A pollard tree, it had long been hollow, and became more and more decrepit, finally collapsing in a great gale a few years ago. Our photo was taken about fifteen years back for Mr. R. C. B. Gardner, then Secretary of the Royal Forestry Society of England and Wales, who may be seen in the picture.

The second view, taken at Guisachan, now a Commission forest in Inverness-shire, shows what was (and indeed may still be) the stoutest recorded Scots pine. It was taken by Mr. R. M. Adam, the well-known nature photographer, who was on the staff of the Royal Botanic Garden, Edinburgh, about thirty years ago. He measured the girth as 24 feet at ground level, and the photo shows so little taper in the butt that the breast-height girth can hardly have been much less. Any information on this giant tree would be welcomed.

The current records for height and girth of Scots pine are 120 feet tall for a tree at Necton Park in Norfolk, and 18 feet round for another tree at Spye Park in Wiltshire. Both these trees are in England and it will be surprising if our Scottish readers cannot report something bigger, even if this Guisachan tree no longer stands.

By Gaelic Names which Ossian Sang

By Gaelic names which Ossian sang
New forests now are known
Though long forgot, henceforth they'll live
As long as trees are grown.

There's music in the saying of them
Recalling long ago,
In Achnashellach, Guisachan
Barcaldine and Glencoe.

Our sires who took a hank of words
To weave and name each scene
Have thus a worthy hansel brought
To Scotland's forests green.

Clashindarroch, Bennachie
Garcrogo and Benmore
Shall yet revive those waving woods
Which Caledon once bore.

And, where the trees bleak moorlands clothe
There men shall come anew
To herald a more glorious age
Than Albyn ever knew.

Alec Mackenzie,
(*District Officer, Research Branch*).

FORESTRY COMMISSION STAFF

At 1st October, 1960

Notes: The stations of individual officers are shown only where they are different to that of their main office. This list should not be read as a seniority list; it has been compiled from returns submitted by the various offices to the Establishment Section.

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CONSERVATORS:	C. A. J. Barrington; S. W. Edwards (Estate).
DIVISIONAL OFFICER:	Garthwaite, P. F.
DISTRICT OFFICER I:	Davidson, J. L. (Sales).
DIRECTORATE ENGINEER:	Granfield, E. F.
MECHANICAL ENGINEERS:	Fitzpatrick, G. (Lightmoor); Richardson, M. C.
WORKSHOP MANAGER:	Gawn, S. (Lightmoor).
SENIOR CHIEF EXECUTIVE OFFICER:	Palmer, A. D., O.B.E.
SENIOR EXECUTIVE OFFICERS:	Barter, L. G.; Brooks, Miss A.
HIGHER EXECUTIVE OFFICERS:	Buck, A.; Henry, H.; Horsham, Miss J.; Manicom, Miss M. E.

EXECUTIVE OFFICERS

Chapman, J.; Coggins, W. E.; Collins, V. M.; Crerar, Miss E.; Critchley, E.; Cuerden, J. E.; Hale, E. F.; Loverock, E. G.; Mitchell, Miss A. S.; Peal, Miss M.; Powell, E. S.; Round, G. L.; Trist, J. D.; Worthington, Mrs. E. E.; Yates, Miss M. D.

DRAUGHTSMAN (HIGHER GRADE): Axtell, R. A.

ENGLAND, NORTH-WEST CONSERVANCY

Upton Grange,
Upton Heath, Chester,
Cheshire.
Telephone: Chester 24006-7-8

CONSERVATOR:	J. S. R. Chard.
DIVISIONAL OFFICERS:	Conder, E. M.; Grant, D.; Raven, W. J. (Estate).
DISTRICT OFFICERS I:	Coulson, T. W. G. (Lichfield); Crosland, J. W. (Kendal); Flynn, A. E. G. (Chester); Jackson, W. V. (Mansfield); Purser, F. B. K. (Shifnal); Roberts, W. G. (Shifnal); Winchester, P. L. (Cockermouth); Winterflood, E. G. (Chester).
DISTRICT OFFICERS II:	Earl, D. E. (Mansfield); Fletcher, J. R. (Bakewell); Malcolm, D. C. (Craven Arms); Michie, E. J. S. (Carlisle); Mitchell, T. C. (Chester); Orrom, M. H. (Kendal); Raban-Williams, R. (Chester).
CONSERVANCY ENGINEER:	Phillips, W. M.
MECHANICAL ENGINEER:	Haynes, W. S.
ASSISTANT ENGINEER:	Tennant, G. V. (Carlisle).
CLERKS OF WORKS:	Adams, C. (Kershope); Clark, J. (Thornthwaite); Cottrell, C. J. (Mortimer); Goodwin, W. A. (Grizedale); White, R. H. (Sherwood).
SENIOR EXECUTIVE OFFICER:	Elliott, J. W.
HIGHER EXECUTIVE OFFICERS:	De Groote, A. M.; Searle, A. J.

EXECUTIVE OFFICERS

Ainsworth, S.; Dominey, C. H.; Johnston, A. M.; Lloyd, H.; Simpson, W. V.; Watts, J. E.

HEAD FORESTERS

Adams, I. (Mortimer); Daglish, T. E. (Sherwood).

FORESTERS

Allcock, M. S. (Hardknott); Anderson, R. D. (Inglewood); Aspinall, E. (Delamere); Atkinson, I. D. (Miterdale); Attenborough, T. J. (Long Mynd); Axtell, D. W. (Cannock); Bennett, H. (Matlock); Bignell, R. A. (Launde); Brandon, J. W. (Mortimer); Brooke, B. L. (Kinver); Brown, D. (Kershope); Close, F. (Grizedale); Davis, P. P. (Delamere); Day, J. (Charnwood); Edwards, K. T. (Arden); Francis, E. R. (Lindale); Fuller, H. (Oakamoor); Garner, W. (Sherwood); Grant, W. (Greystoke); Guthrie, F. H. (Kershope); Hall, D. (Cannock); Hall, W. (Sherwood); Hammond, B. R. G. (Sherwood); Hardy, R. B. (Blengdale); Harvey, K. B. (Longton); Hawkes, D. M. (Grizedale); Hobson, K. A. (Kershope); Jenkins, T. L. (Delamere); Jones, E. (Thornthwaite); Keens, D. W. (Dalton); Macdonald, R. (Mortimer); Mackenzie, J. H. (Causeway Wood); McMillan, J. R. (Swynnerton); Morgan, L. G. (Cannock); Morley, D. S. (Grizedale); Morrill, W. H. (Hope); Morris, J. (Mortimer); Murray, M. (Bowland); Nelson, D. (Ennerdale); Newsom, G. B. (Gisburn); Pemberton, F. (Spadeadam); Power, R. J. (Thornthwaite); Rees, T. J. R. (Walcot); Rowlands, I. G. (Sherwood); Sarsby, O. R. (Sherwood); Shelley, W. R. (Mortimer); Stickland, H. F. (Packington); Stockoe, J. (Habberley); Thick, F. W. (Cotgrave); Thomas, D. R. (Sherwood); Tucker, E. J. (Corvedale); Walsh, D. H. (Thornthwaite); White, S. L. (Arden); Wilson, W. J. (Bagot); Woollard, R. P. C. (Bawtry).

ASSISTANT FORESTERS

Bartholomew, W. (Grizedale); Birch, F. C. (Mortimer); Birch, T. (Mortimer); Bollard, W. A. (Foremark); Bowdler, A. C. F. (Cannock); Brunton, J. (Thornthwaite); Colling, J. B. (Thornthwaite); Collings, P. J. (Sherwood); Corfield, J. S. (Grizedale); Dean, B. G. (Cannock); Hall, J. R. (Kershope); Harpin, J. W. (Sherwood); Hobbs, A. B. (Sherwood); Hutchinson, P. (Mortimer); McKay, H. (Kershope); Moore, T. B. (Kershope); Morris, R. (Sherwood); Parker, J. A. (Mortimer); Patten, B. D. (Kershope); Simpkin, J. R. (Mortimer); Thompson, B. S. (Greystoke); Tyler, W. H. S. (Sherwood); Ward, A. A. (Sherwood); Windle, D. (Lindale); Wood, D. (Grizedale); Yates, H. (Ennerdale).

FOREMAN: Bowes, A. (Kershope).

ENGLAND, NORTH-EAST CONSERVANCY

Briar House,
Fulford Road,
York.

Telephone: York 24684

CONSERVATOR: G. J. L. Batters.

DIVISIONAL OFFICERS: Dent, T. V., M.B.E.; Portlock, W. J. J. (Estate); Smith, W. T. (Hexham).

DISTRICT OFFICERS I: Bell, H. W. (Pickering); Langley, P. J. (Hexham); Maund, J. E. (York); Piper, R. J. (York); Rowan, A. A. (Rothbury); Selby, B. C. (York); Thallon, K. P. (Helmsley); Wilson, K. W. (Kielder).

DISTRICT OFFICERS II: Hurst, R. T. (Helmsley); Macdonald, I. A. D. (York); Marshall, I. R. B. (York); Oakley, J. S. (Kielder); Rix, A. (Durham); Voysey, J. C. (Wakefield).

CONSERVANCY ENGINEER: Preston, Col. G. W.

MECHANICAL ENGINEER: Wortley, A.

ASSISTANT ENGINEERS: Allan, C. S. (Bellingham); Bassey, T. (Bellingham); Bromley, A. R. (York).

CLERKS OF WORKS: Blankenburgs, V. (Kielder); Buller, H. B. (Wark); Cuthbert, T. (Falstone); Kirby, C. (Allerston); Lees, W. R. (Kielder); Morgan, J. F. (Helmsley); Symons, A. J. (Kielder); Whittingham, T. R. (Dalby).

SURVEYORS: Grant, V. (Widehaugh); Jackson, G. S. (Pickering).

SENIOR EXECUTIVE OFFICER: Chaplin, L. A.

HIGHER EXECUTIVE OFFICERS: Blott, J. C.; Fisher, R. H.

EXECUTIVE OFFICERS

Hickleton, G. A.; Mitchell, M.; Palmer, R.; Roscoe, K.; Walker, J. A.; Wallis, Miss B. E.

HEAD FORESTERS

Chisholm, J. D. (Redesdale); Gough, W. R. (Allerston); McCavish, W. L. (Kielder); Sharp, G. A. (York East); Snowdon, L. (Allerston); Stoddart, W. F. (Rothbury).

FORESTERS

Adams, G. (Hambleton); Ainsworth, P. H. (South Pennines); Baird, R. L. (Fountains); Bartlett, R. F. E. (Allerston); Bewick, T. (Slaley); Bolam, T. W. B. (Hambleton); Bowns, A. (Hambleton); Brown, W. C. (Wark); Charlton, E. (Allendale & Widehaugh); Collier, T. E. (Wark); Cumming, J. (Jervaulx); Dawson, K. J. (Selby); Fawcett, E. (Allerston); Featherstone, C. (Helmsley); Fowler, N. L. (Rothbury); Fox, T. F. (Kielder); France, J. (South Yorkshire); Gledson, J. G. (Rothbury); Harbin, W. B. (Wynyard); Hartley, A. (Knaresborough); Heaven, S. F. (York, West); Hird, J. (The Stang); Hislop, J. J. (Harwood); Jane, T. A. (Kielder, East); Johnstone, T. (Hambleton); Marchant, R. E. (Pickering); Marsh, E. W. (Redesdale); Marshall, J. A. (Hamsterley and Weardale); Martindale, J. M. (Hambleton); Mennell, J. (Allerston); Metcalfe, J. E. (Kielder); Parker, G. W. (Chopwell); Salmond, M. P. (South Yorkshire); Scott, G. H. (Allerston); Scott, J. J. O. (Kielder); Simpson, C. N. (Kielder); Stanley, W. E. (Allerston); Stephenson, F. (Hambleton); Stokoe, G. (Slaley); Straughan, J. G. (Wark); Tait, J. (Kielder); Taylor, C. E. (Hambleton); Telford, J. W. (Chillingham); Terry, T. N. (Allerston); Thompson, L. T. J. (Kielder); Turnbull, M. T. (Kielder, West); Woodcock, F. A. (Kidland); Woodward, F. G. (Wolds); Young, J. P. (Wolds).

ASSISTANT FORESTERS

Allen, M. J. J. (Allerston); Bardy, D. A. (Harwood); Barry, G. N. (Kielder); Clark, P. F. (Allerston); Craig, J. M. (York, East); Davison, A. (Fountains); Drewitt, J. O. (Hamsterley); Edes, D. S. (Harwood); Embleton, H. N. (Kielder); Featherstone, P. (Redesdale); Fisher, H. (Allerston); Griffin, C. R. (Kielder, East); Hammond, D. (Wark); Haw, G. (Widehaugh); Hodgson, M. (Hambleton); Holden, R. L. (Rothbury); Johnson, A. (York, East); Lancaster, R. A. (Allerston); Lee, D. R. (Jervaulx); Lewis, D. I. (Wynyard); Long, T. W. (Hamsterley); Maughan, B. (Kidland); Mills, K. (Wolds); Moore, W. (Kielder); Moules, T. R. (Allerston); Powell, D. E. (Allerston); Priestley, T. J. J. (Chopwell); Richardson, I. (Wark); Robinson, P. D. (Hamsterley); Scott, T. I. (Redesdale); Simpson, G. (Allerston); Stockdale, B. R. (Allerston); Stonehouse, F. (Allerston); Straughan, W. (Redesdale); Wade, J. (Wark); Webster, F. (Cawthorne); Weir, A. H. (Kielder); Wilbert, G. N. (Kielder); Williams, K. D. (Allerston).

FOREMEN

Atkinson, J. (Allerston); England, T. (Hambleton); Ruston, R. N. (Allerston).

ENGLAND, EAST CONSERVANCY

Brooklands Avenue,
Cambridge

Telephone: Cambridge 54495

CONSERVATOR: G. W. Backhouse.

DIVISIONAL OFFICERS: Ballance, G. F.; Payne, S. R.; Snook, K. R. (Estate).

DISTRICT OFFICERS I: Chard, R.; Good, F. G. (Estate); Harker, M. G.; Mackay, D. (Aylsham); Chapman, E. S. B. (Hitchin); Kennedy, J. N. (Ipswich).

DISTRICT OFFICERS II: Barrett, F. D. (Cambridge); Christie, A. C. (Princes Risborough); Derrick, R. G. (Grantham); Hughes, H. J. G. (Aylsham); Laurie-Muir, J. (Northampton); Pryce, T. (Cambridge); Small, D. (Thetford); Searle, H. (Lincoln); Stoakley, J. T. (Princes Risborough); Tilney-Bassett, H. A. E. (Thetford); Walker, A. D. (Halstead); Wildash, J. T. (Northampton).

CONSERVANCY ENGINEER:	Green, A. M.
MECHANICAL ENGINEER:	Cook, G. O.
CLERKS OF WORKS:	Holmes, W. (Thetford, Estate); Foote, J. (Fineshade, Estate); Raisborough, R. (Tunstall, Estate).
FOREMAN SURVEYOR:	Elliott, H. (Thetford).
SENIOR EXECUTIVE OFFICER:	Clark, G. H.
HIGHER EXECUTIVE OFFICERS:	Bowman, L. W.; Norton, J. F.

EXECUTIVE OFFICERS

Damerell, A. F.; Folkes, K. A. B.; Kitteridge, K. E.; Merker, P. A.; Threadgill, J. S.; Wild, A. H.

HEAD FORESTERS

Anderson, J. T. (Thetford); Button, G. H. (Swanton); Heavener, C. (Princes Risborough); Lawson, G. E. (Thetford); Redford, C. W. (Thetford); Wellington, C. R. (Aldewood); Wyatt, L. (Hazelborough).

FORESTERS

Acott, E. J. (Rockingham); Adams, H. (Elveden); Axten, G. B. (Wendover); Beard, B. W. (Ampthill); Beverley, E. (Bardney); Belton, G. C. (Bernwood); Birkitt, A. (Aldewood); Bloor, C. A. (Yardley); Booth, E. M. (Aldewood); Burnie, H. W. (Thetford); Clark, J. F. (Fineshade); Dover, A. C. (Downham); Faddy, A. G. (Salcey); Fairman, E. (Wensum); Field, H. C. (Thetford); Gracie, A. (Thetford Hall, V. B. (Wigsley); Harker, A. (Rockingham); Hendrie, J. A. (Thetford); Hinton, F. I. (Bramfield); Hobbs, G. (Bardney); Hutchins, D. R. (Honeywood); Ingram, L. D. (Thetford); Irons, E. R. (Ditton); Johnson, H. (Burwell); Jones, F. B. (King's); Jones, G. (Bardney); Keeler, B. (Latimer); King, S. G. (Thetford); Kirby, P. D. (Wensum); Law, S. J. (Thetford); Leutscher, E. H. (Shouldham); Ling, J. (Laughton); Liddington, G. (Hazelborough); Marshall, D. F. (Swaffam); Marston, W. H. (Santon); Mitchell, A. L. (Kesteven); Morris, A. M. (Rockingham); Moulden, D. J. (Walden); Muggleton, H. G. (Wensum); McLeod, E. (Gaywood); Parker, J. W. (Dunwich); Parlett, H. F. (Hevingham); Patterson, D. T. (Thetford); Platt, F. B. W. (Marlow); Pritchard, R. (Watlington); Pywell, A. C. (Willingham); Roberts, G. (Bernwood); Robinson, D. A. (Thetford); Rogers, E. V. (Huntingdon); Salisbury, E. J. (Thetford); Schofield, R. (Kesteven); Shinn, F. (Tunstall); Smith, W. P. (Mildenhall); Steel, W. H. (Aldewood); Trussell, J. (Beechwood); Waters, C. G. (Ongar); White, J. B. (Lavenham); Wilson, A. L. (Waveney); Williams, J. H. (Thetford); Wood, P. (Whaddon Chase); Woodrow, R. B. (Thetford).

ASSISTANT FORESTERS

Banks, P. A.; Boughton, M. J. (Kesteven); Breed, T. C. (Wensum); Butcher, A. J. (B.C.D.); Carter, D. E. (Rockingham); Cavell, E. W.; Chandler, R. H. (Pytchley); Dampney, C. F. (Wensum); Ellis, D. E. (Ampthill); Gordon, B. S. (Swaffham); Hamstead, E. V. (Wensum); Hellard, P. (Harling); Holmes, N. J. (Honeywood); Howarth, J. (Kings); Hunt, L. (Lavenham); Keeble, P. D. (Beechwood); Kew, F. M.; Lane, P. B. (Rockingham); Marsh, P. (Wensum); Mitchell, W. P. (Waveney); Nichols, A. (B.C.D.); Nicholson, J. H. (Fineshade); Payne, W. C. (Walden); Rayner, D. A. R. (Rendlesham); Roebuck, B. A. (Willingham); Rouse, R. S. (Thetford); Shaw, J. K. (Thetford); Snowdon, J. D. (Wigsley); Southgate, G. J. (Hazelborough); Sturges, B. W. (Kesteven); Wood, P. (Thetford); Woods, A. J. (Bramfield); Wainwright, J. D. F. (Thetford); Wilson, B. (Yardley); Wiseman, J. (Aldewood).

FOREMEN

Basham, T. F. (Thetford); Brown, C. S. (Aldewood); Manels, R. W. (Thetford); Marsh, L. E. (Thetford); Pickwell, H. (Laughton); Rutterford, D. (Thetford).

ENGLAND, SOUTH-EAST CONSERVANCY

"Danesfield,"
Grange Road,
Woking.

Telephone: Woking 2270-1-2

CONSERVATOR:	R. H. Smith.
DIVISIONAL OFFICERS:	Dixon, E. E.; Stocks, J. B.
DISTRICT (ESTATE) OFFICERS I:	Halton, K.; Wilson, J. F.
DISTRICT OFFICERS I:	Begley, C. D. (Guildford); Burton, E. S. V. (Winchester); Keen, J. E. A. (Reading); Mithen, D. A. (Ashford); Sutton, A. R. (Chichester); Troup, L. C. (Guildford); Weston, F. (Winchester).
DISTRICT OFFICERS II:	Cooper, D. J. (Woking); Cuthbert, A. A. (Ashford); Dinning, M. (Uckfield); Joslin, A. (Winchester); Kipling, T. H. (Chichester); Perry, D. J. (Guildford); Savage, G. F. d'A. (Sevenoaks); Verey, J. G. H. (Uckfield).
DISTRICT (ESTATE) OFFICERS II:	Gradwell, J. W. (Woking).
CONSERVANCY ENGINEER:	Crawford, P. C. R.
SENIOR EXECUTIVE OFFICER:	Gulliver, H. W.
HIGHER EXECUTIVE OFFICERS:	Carter, L. W.; Carvosso, L. A.

EXECUTIVE OFFICERS

Beard, G. C.; Brook, P. W.; Carter, K. W.; Godfrey, Mrs. D. M. ; Hansford, E. G.; Rolfe, A. W.

HEAD FORESTERS

Brook, J. W. (Slindon); Davies, D. J. (Hemsted); King, B. H. (Hursley); Lingwood, N. J. (Bramshill).

FORESTERS

Arnott, W. (Andover); Awbery, P. P. (Queen Elizabeth); Barden, J. T. (St. Leonards); Bartling, F. C. (Vinehall); Bashall, J. R. C. (Orlestone); Batt, C. J. (Lyminge); Brinsley, D. A. (Bramshill); Catchpole, R. A. (Micheldever); Cooper, J. (Marden); Cooper, J. H. (Bedgebury); Cordery, E. B. (Maresfield); Cross, L. G. F. (Alice Holt); Davies, W. J. (Bedgebury); Davy, J. H. (Rogate); Devine, R. (Badbury); Drake, F. H. (Alton); Forrest, A. H. (Witley); Francis, R. E. (Chiddingfold); Freeth, A. J. (Southwater); Hann, F. C. (Abinger); Harvey, D. R. (Rogate); Henderson, J. R. (Brightling); Holter, G. E. (Friston); Hyett, S. (Shipbourne); Langford, D. (Charlton); McNamara, N. A. G. (Bramshill); Marples, D. (Abinger); Middleton, W. F. C. (Arundel); Moseley, J. (Hemsted); Percy, D. M. (Hursley); Pyman, A. J. (Micheldever); Rickards, S. W. (Slindon); Smith, H. J. (Arundel); Spiller, G. D. (Challock); Taylor, A. F. (Bramshill); Trodd, K. H. C. (Gravetye); Twallin, R. W. (Shere); Usher, F. (Havant); Vickery, F. J. (Mildmay); Watkins, S. (Lyminge); Watkinson, R. V. (Bucklebury); Watts, F. C. (Bere); Wheeler, R. T. (Bramshill); Woods, W. (Basing).

ASSISTANT FORESTERS

Ballard, B. H. (Queen Elizabeth); Bignell, R. A. (Bere); Budgen, E. (Brightling); Cale, G. F. (Queen Elizabeth); Choules, C. (Friston); Cooper, P. L. (Bucklebury); Cowley, D. A. (Lyminge); Davis, D. E. (Alice Holt); Davys, J. P. (Andover); Dineen, P. J. (Bramshill); Fulcher, D. E. (Mildmay); Green, G. G. (Alice Holt); Griggs, B. (Bishopstoke); Harding, D. (Alton); Hinds, C. H. (Rochester); Hoblin, R. A. (Alice Holt); Howell, W. R. (Hemsted); Kennard, J. T. (Effingham); Lawes, R. F. (Bere); Meek, W. T. (Challock); Monk, R. F. (Orlestone); Newland, R. L. (Bramshill); Oaks, R. (Charlton); Parnall, D. L. (St. Leonards); Pearce, P. H. (Micheldever); Perkins, R. M. (Mildmay); Slemmonds, S. W. (Gravetye); Sutton, B. E. (Hursley); Tyers, J. D. A. (Brightling); Vine, S. V. (Bedgebury); Vines, R. C. B. (Challock); Wainwright, K. (Vinehall); Walker, I. (Maresfield); Wood, I. E. (Chiddingfold).

FOREMAN: Butcher, H. G. (Crawley).

ENGLAND, SOUTH-WEST CONSERVANCY

Flowers Hill,
Brislington,
Bristol, 4.

Telephone: Bristol 78041-5

CONSERVATOR:	C. A. Connell, O.B.E.
DIVISIONAL OFFICERS:	Penistan, M. J.; Rouse, G. D.
DISTRICT OFFICERS I:	Banister, N. (Taunton); Carnell, R. (Bristol); Hughes, B. D. (Bodmin); MacIver, I. F. (Malvern); Moir, D. D. (Bristol); Rogers, S. W. (Exeter); White, A. H. (Bristol).
DISTRICT OFFICERS II:	Blatchford, O. N. (Dorchester); Cameron, J. D. (Salisbury); Chadwick, D. J. (Taunton); Clothier, C. R. G. (Bristol); Oram, A. K. (Launceston); Scott, A. H. A. (Malvern); Shirley, M. C. (Gloucester).
CONSERVANCY ENGINEER:	Perkins, J. S.
MECHANICAL ENGINEER:	Inglis, E. J.
ASSISTANT ENGINEERS:	Martin, D. R.; Hoyle, H. N.; Shillito, P. E.
CLERKS OF WORKS:	Boundy, L. D. (Estate); Inglis, R. E.; Labram, W. J.
SENIOR EXECUTIVE OFFICER:	Coote, R.
HIGHER EXECUTIVE OFFICERS:	Chapman, W. L.; Tinson, E. J. F.

EXECUTIVE OFFICERS

Child, Miss A. V.; Cutcliffe, B. W. J.; Lane, E. C.; Maher, Mrs. B. M.; Musto, A. F.; Wood, J. H.

HEAD FORESTERS

Beasley, G. F. (Halwill); Cameron, A. H. (Bodmin); Gunter, A. T. G. (Hereford); Hollis, G. W. (Tiverton); Lewis, C. J. (Savernake); Parsons, F. G. (Wareham).

FORESTERS

Barber, E. G. (Charmouth); Beard, A. C. (Dymock); Bowdler, T. C. (Exeter); Bowman, P. (Bodmin); Braine, R. G. (Wareham); Bruce, J. M. (Eggesford); Bultitude, R. (Dartmoor); Chapman, S. (Brendon); Clarke, H. F. (Molton Woods); Coles, L. H. (Savernake); Cox, D. J. (Cranborne Chase); Deal, W. (Hartland); Everitt, E. C. W. (Cotswold); Fife, R. G. (Taunton); Fowler, J. (Neroche); Fulford, A. G. (Bodmin); Gould, J. (Wyre); Green, W. J. (Blandford); Hibberd, E. C. (Neroche); Hockaday, C. (Lands End); Humphries, W. J. (Bowerchalke); Jenkinson, G. A. (Quantocks); Judge, J. N. (Bristol); King, R. (Pershore); Law, H. G. (Wyre); Lewis, W. P. (Poorstock); Linder, R. (Bristol); Link, H. H. (Wareham); McIntyre, N. E. (Salisbury); Mills, E. W. (Savernake); Parker, J. (Halwill); Parsons, P. H. (Wilsey Down); Poll, E. A. (Exeter); Scott, M. J. (Quantock); Sherrell, D. A. (Halwill); Skinner, F. C. (Hereford); Snellgrove, D. S. (Mendip); Stott, W. S. (Honiton); Strong, T. G. (Bodmin); Tackney, A. J. (Wareham); Walsh, J. E. (Halwill); Walton, R. (Wareham); Whale, R. S. (Plym); Williams, L. H. (Bovey); Wills, K. G. (Bradon); Wilson, M. J. (Mappowder); Young, R. E. (Cotswold).

ASSISTANT FORESTERS

Amer, D. J. (detached duty); Anderson, J. E. (Wareham); Ayers, D. (Savernake); Barton, E. N. (Mendip); Bibby, W. B. (Cranbourne Chase); Budden, R. C. (Salisbury); Chalmers, J. G. (Dartmoor); Devine, T. D. (Halwill); Dyer, W. F. (Exeter); Flagg, G. D. St. J. B. (Hereford); Fox, F. G. (Selwood); Fruen, C. R. (Mendip); Grenfell, R. G. P. (Bodmin); Hall, M. P. (Bradon); Hambly, J. R. (Bodmin); Houghton, M. A. (Hartland); Humphrey, A. W. (Honiton); James, M. E. H. (Dymock); Lansdown, P. W. (Poorstock); Millman, M. R. (Honiton); Mitchell, G. G. (Dymock); Morrish, F. G. (Blandford); Murphy, B. (Exeter); Niles, J. R. A. (Poorstock); Pedler, D. C. (Dartmoor); Pound, H. L. (Brendon); Rayner, G. L. (Dartmoor); Simkins, G. (Bradon); Sturgess, W. F. (Savernake); Taylor, G. (Plym); Thurlow, F. G. (Brendon); Tilley, J. W. (Wyre); Tisdall, J. C. (Halwill); Trotter, W. (Dartmoor); Whitlock, M. D. (Savernake).

ENGLAND, NEW FOREST

The Queen's House,
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Hants.

Telephone: Lyndhurst 300

DEPUTY SURVEYOR:	W. A. Cadman.
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ASSISTANT FORESTERS

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ENGLAND, FOREST OF DEAN

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ASSISTANT ENGINEER:	Anderson, W. C.
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SENIOR EXECUTIVE OFFICER:	MacKenzie, M. E. W.
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DRAUGHTSMAN (HIGHER GRADE): Williams, V. H.

SCOTLAND, NORTH CONSERVANCY

60 Church Street,
Inverness.
Telephone: Inverness 223, 608-9

CONSERVATOR:	J. A. Dickson.
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DISTRICT OFFICERS II:	Cassels, K. A. H. (Inverness); Drummond, J. A. (Fort Augustus); Grant, I. A. D. (Dornoch); Macrae, F. M. (Leanachan); Massey, J. E. (Glenurquhart); Marnie, R. J. R. (Leanachan); Ogilvie, J. Y. (Culloden); Paterson, D. B. (Dingwall); Ray, A. (Fort Augustus); Taylor, G. G. M. (Dingwall).
CONSERVANCY ENGINEER:	MacKillop, E. R.
MECHANICAL ENGINEER:	Ross, R. B.
ASSISTANT ENGINEERS:	Davidson, K. T.; Thompson, G. M.
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SURVEYORS:	Clark, W. J. (Inverness); Urquhart, T. (Inverness).
SENIOR EXECUTIVE OFFICER:	Nicolson, M.
HIGHER EXECUTIVE OFFICERS:	Macbeath, T. S. B.; Stewart, W.

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ASSISTANT FORESTERS

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SCOTLAND, EAST CONSERVANCY

6 Queen's Gate,
Aberdeen.

Telephone: Aberdeen 33361

CONSERVATOR: F. W. A. Oliver.

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DISTRICT OFFICERS II: Bearhop, A. (Perth); Cathie, R. G. (Fochabers); French, W. F. (Kemnay); Whayman, A. (Aberdeen).

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ASSISTANT ENGINEER: Auld, J. M. (Perth).

CLERKS OF WORKS: Clerk, J. D. (Roseisle); Forbes, C. (Bin); Logan, G. McF. (Perth); Rothnie, W. (Drumtochty).

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FORESTERS

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ASSISTANT FORESTERS

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SCOTLAND, SOUTH CONSERVANCY

Greystone Park,
Moffat Road,
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Telephone: Dumfries 2425-6-7

CONSERVATOR: J. A. B. Macdonald.

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SURVEYORS:	McMillan, J. G. (Dumfries); Shearer, R. B. (Newton Stewart).
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HIGHER EXECUTIVE OFFICERS:	Cowan, A. A.; Burnett, A. G.

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ASSISTANT FORESTERS

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FOREMEN

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SCOTLAND, WEST CONSERVANCY

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CONSERVATOR:	J. E. James.
DIVISIONAL OFFICERS:	Davies, E. J. M.; Robbie, T. A.
DISTRICT OFFICERS I:	Dey, G. A. (Cairnbaan); Gillespie, I. (Cairnbaan); Gwynn, J. M. (Cairnbaan and Knapdale); Haldane, W. D. (Barcaldine); Murray, G. K. (Glasgow); Stewart, I. J. (Glasgow); Sutherland, W. B. (Benmore); Thomson, W. P. (Stirling); Townsend, K. N. V. (Knapdale).
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CONSERVANCY ENGINEER:	Chapman, F. G.
MECHANICAL ENGINEER:	Atkins, F. C.
ASSISTANT ENGINEERS:	Bennett, D. (Benmore); Gibson, W. (Aberfoyle); Nisbet, J. D. (Cairnbaan).
CLERKS OF WORKS:	Dalgleish, T. (Benmore); Miller, R. (Aberfoyle); Robertson, J. R. (Barcaldine); Stark, W. (Cairnbaan).
SURVEYORS:	Connor, P. T. (Aberfoyle); McLachlan, R. W. (Benmore); Sturroch, W. G. (Cairnbaan).
SENIOR EXECUTIVE OFFICER:	Kinnaird, B.
HIGHER EXECUTIVE OFFICERS:	Hogarth, J.; Ettles, W.

EXECUTIVE OFFICERS

Brunton, I. A.; Clelland, Mrs. I. M.; Griffin, J.; Liddell, A.; Macniven, Miss B. B.; Sifton, J. G.

HEAD FORESTERS

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DISTRICT OFFICERS I: Francis, G. J. (Gwydyr); Goodwin, J. F. (Dean); Gough, P. C. (Benmore); Tulloch, N. W. (Faskally).

DISTRICT OFFICERS II: Cram, A. R. (Faskally); Dickenson, M. E. S. (Dean); MacDonald, R. (Benmore).

HIGHER EXECUTIVE OFFICER: Harper, E. C.

EXECUTIVE OFFICERS: Frost, Miss M. A. E.; Priest, Miss J. B.

FORESTERS

Betterton, S. J. (Dean); Black, D. F. (Faskally); Claydon, G. W. (Gwydyr); Gale, B. (Northerwood); Garrioch, I. M. (Faskally); Hart, R. B. (Benmore); Kemp, R. A. F. (Gwydyr); Mitchell, R. F. (Benmore); Powell, A. (Gwydyr); Webster, J. T. (Dean).

MANAGER, NORTHERWOOD HOUSE

Brown, G. (Northerwood).

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