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THE SCOTTISH GALE DAMAGE

By R. LINES

THE gale which struck N.E. Scotland on 31st January, 1953, caused unprecedented havoc among our woods. It seems likely that the final volume assessment of blown timber will be over 40 million cubic feet. Of this it is estimated that 85% is of coniferous and 15% of broad-leaved species. Some idea of the magnitude of the damage is gained by reflecting that only 7 million cubic ft. of conifers were authorised by the 1951-52 felling quota for the whole of Great Britain. The latter, however, does not include Forestry Commission fellings or timber cut in thinnings, which would bring the figure up to about 16 million cubic feet. Nevertheless it is clear that Scotland has never before had such a disastrous gale.

METEOROLOGY

There are many difficulties in trying to assess the relative values of particular gales. This is partly because one must consider four variables: wind speed, duration of high speeds, geographical extent and direction. It is also difficult to make comparison with earlier gales due to the smaller number of records as one goes deeper into the past. In particular is this difficult for gales before 1900, in many cases only average wind speeds rather than speed of the maximum gusts being recorded.

The " gustiness factor " is higher for inland than for coastal stations, i.e., for a given mean speed of 30 m.p.h. the gust-level might be 37 m.p.h. for a coastal station and as much as 45 m.p.h. for an inland station. This is important as it is the gusts which blow down trees. Gusts do not change in speed with height above the ground in the same way as mean winds. " During any one gust over open country it is not expected that the speed will change in any regular manner with height. On the average, however, the maximum gust does increase with height although more slowly than in the case of mean speed." [2]

It is important to realise that in the higher ranges, as the wind speed increases so does the chance of gust occurrence become less. Gusts of 70 m.p.h. are not uncommon but gusts exceeding 90 m.p.h. are most rare.

At midnight on 30th January the storm centre was located between the Orkney and Faroe Islands and during the next twenty-four hours it took a straight course towards southern Denmark. By noon on January 31st it was situated about 150 miles off the N.E. coast of Scotland.

The hourly anemometer readings for the stations at Kinloss, Morayshire, at Dyce, Aberdeen and at Leuchars, Fife, give the best picture of what happened. The pattern is similar for all three. The early hours of Saturday 31st were increasingly windy, with the wind coming from W.S.W. at Kinloss and at Dyce and from W.N.W. at Leuchars. By 6 a.m. the wind had moved round almost to N.W. and was steadily increasing in violence. By eight a.m. it had reached Strong Gale strength and it was about then that major wind-blow commenced. It continued to rise until by eleven a.m. it was blowing a Whole Gale and veering to N.N.W. It is noteworthy that it continued for so long at this high strength. At Dyce it was blowing a Whole Gale from 10.30 a.m. till 3 p.m., by which time most of the damage had taken place. By five p.m. it had abated slightly but was still at Strong Gale strength. It had also veered almost to due N. and it remained blowing strongly from this direction until after 10 p.m.

These are, of course, mean wind-speeds, and it is the gusts which interest us most. At Leuchars there were gusts exceeding 32 knots (37 m.p.h.) in twenty hours of the twenty-four, and seven hours with gusts exceeding 47 knots (54 m.p.h.). The highest gust was 62 knots (71 m.p.h.) at 12.20 p.m. from N.N.W. At Dyce the number of hours with gusts exceeding 32 knots was twenty-two and nineteen with gusts exceeding 47 knots The peak gust was 88 knots (101 m.p.h.) at 11.30 a.m. from N.N.W. At Kinloss there is no anemograph, but frequent gusts of 85 knots (98 m.p.h.) were recorded between 9 a.m. and 11 a.m. The peak gust of 93 knots (107 m.p.h.) was recorded at Milltown near Lossiemouth.

January had been an exceptionally dry month in Scotland with only two inches of rain over most of the affected area. It must be remembered, however, that the water table is at its highest at this time of year, and that this depends upon many factors, of which rainfall is only one. The gale was accompanied by varying amounts of snow or sleet. Along the Moray Firth there was but little snow, higher up and inland from Aberdeen the gale carried with it a fair fall of snow. There is no report of this snow clinging to the branches as occasionally happens with wet snow.

Reference to figures of previous gales shows that though this part of Scotland does have periodic high winds, it is in fact more sheltered than most of Scotland north of the Tay. In his table of " Gales and Extreme Winds at Anemometer Stations " Bilham [2] shows that in this respect N.E. Scotland has a similar number of hours of gale per year as Croydon or Felixtowe, with maximum gusts for the period 1907-1947 of 83 m.p.h. at Aberdeen and 84 m.p.h. at Balmakewan, Kincardine. However, bad gales do occur frequently, so that weakly rooted trees are eliminated. Gold [3] records that for the period 1909-1935 winds exceeding 58 m.p.h. occurred every year except 1921 and 1922 at Aberdeen.

From the forestry point of view past gale records are sparse. According to Fisher [4] there were severe storms in 1801, 1833, 1868, 1876,

1893 and 1894. There has been one destructive storm about every four years. In this century there have been gales of unusual severity in 1901, 1903, 1911, 1912, 1924, 1927, 1935, 1936, 1941, 1945, 1949 and 1952 [5] The worst were probably those in 1876, 1893, 1911, 1927, 1935 and 1952. That of November 17th, 1893, blew down 1,850,000 trees in Perth and Forfarshire and many people remember the widespread havoc of the 1927 gale, when a gust of 70 m.p.h. was recorded at Aberdeen. The 1893 gale was noted as being westerly, that of 1927 was S.W. During the period 1922-1947 only ten places recorded wind speeds in excess of 100 m.p.h. The 1927 gale accounts for three of these records, which testifies to its widespread violence.

It would appear that severe gales occur once every four or five years and phenomenal gales every 30 years or so. With regard to direction, most severe gales are south westerly and north westerly gales of exceptional violence are rare.

THE EXTENT OF THE DAMAGE

Geographical. The ill effects of the storm were very widespread, including the calamitous flooding in East England and Holland, the foundering of the Princess Victoria in the North Channel, and the damage to woodlands in Scotland. Damage to trees was reported from as far west as Mull and from Caithness in the north to Wykeham, Yorkshire, in the south ; but with isolated exceptions there was no heavy damage west of a line between Inverness and Arbroath, Angus. It is also probably true to say that the severity of the damage increases as one goes eastwards, though the tendency is hidden by the higher proportion of agricultural land there. The isolated estates of Fyvie and Haddo have both suffered severely relative to their total area of woodland. The area which has suffered the greatest loss in volume is Middle and Lower Deeside. About 90% of the blown timber is on private estates and 10% on Forestry Commission land.

By Species. N.E. Scotland has always been a predominantly coniferous area, as the maps in the Census of Woodlands [6] show. Approximately 85% of the blown volume is of coniferous and the rest of broad-leaved species. Of the conifers Scots pine is by far the most common species and has undoubtedly suffered the worst damage. Larch and Norway spruce are also common species ; Norway spruce has suffered more than the Larch, but perhaps chiefly because it is selected for planting on wet sites. Although there is a large acreage of Sitka spruce it is mostly much younger than the Norway spruce and for this reason does not figure high in the damage lists.

Of the broad-leaved species, there was far more beech in the area than anything else, and it is this species which has chiefly suffered. A high proportion of the volume of fallen beech is made up of mature or overmature stands, though middle-aged beech also has blown. One has to look for stands of oak—other than scrub—and when found it is surprising to find that in many places it has not proved wind-firm.

Blown Scots Pine, 70 years old, on Haddo Estate, Aberdeen.

In general there is no species which has not been blown at one place or another, while on the other hand species notorious for their poor root-hold have sometimes stood firm in exposed positions.

By Age Classes. By far the highest proportion of the damage has been in the middle-aged and mature woods. There was very little over-mature timber left after the wartime fellings but where this has been in the line of the wind it has also suffered badly. This has surprised some people, who point out that the trees have stood in the mature state for fifty years and were therefore thought to be wind-firm. It merely serves to accentuate the extreme violence of the gale.

FACTORS AFFECTING THE DAMAGE

We now come to a more detailed consideration of the factors combining to cause the damage. There is no doubt that the chief cause was the wind velocity, which has already been dealt with ; added to this was the unusual direction. The prevailing winds are south-west, so that it is to gales from this direction that the trees are most wind-firm. Inside the plantations there is no unilateral pattern of the root systems directed in a N.E. to S.W. direction and this is generally also true for the edge trees, but one of the noticeable and recurrent features of the gale has been the "hedges" left on the S.W. edge of the smaller woods. In several woods the whole compartment is flattened except for a line of trees perhaps 40 feet wide on the S.W. edge. In these " hedges " only a few trees are blown. This effect is most noticeable in woods surrounded by fields on all sides, which have always had a high degree of exposure.

The snow probably had little effect, although it may have increased the relative damage to Scots pine in pine/larch mixtures. Its presence, however, would increase the " punch " given by the wind.

Physiography. The important factor is exposure, but this is compounded of elevation, aspect, slope and surrounding shelter. Elevation does not seem to have had a considerable effect and in some cases there are badly blown woods on the lower slopes of a hill and little damage higher up. Woods at 50 feet elevation near the coast are as badly blown as those at 1,300 feet, many miles inland. Aspect is of far greater importance. It has been remarked that it is as if a giant searchlight had been turned on to the countryside knocking down all it illuminated. During a six week's inspection tour I found less than half a dozen woods with a southern aspect which were seriously damaged. The vast majority were on northerly slopes or else on flat ground. Slope again appears to have had little effect, although it is very hard to say whether a difference in angle of slope would have made any difference. On very steep slopes the damage seems to be less. This is explained partly by the wind being " buffered off " and its direction changed to a vertical one, and partly by the greater force needed to blow down a tree whose main roots are downhill. Shelter from surrounding hill features or mature crops has sometimes saved a crop, but more often the shelter-wood has itself been blown. There has been little change in the wind's direction along valleys ; a feature which had been noted before. The effect of the high

hills of Upper Deeside has been more to lift the general level of the wind so that valley bottom woods have been " jumped." Several interesting cases have been observed where the wind has alternately flattened and " jumped " woods along a line in this region. There is much truth in the saying : " The wind bloweth where it listeth."

Edge Effects. It is clear that the state of the windward edge of the wood is very important. To illustrate this point, I have found uniform stands in which the windthrow of one edge tree has been responsible for the start of a " wedge " carrying down dozens of trees. These " wedges " were most commonly cut into the older pole woods of say 40-50 years and in almost every case one could trace their origin back to some small gap in the edge, trees with diseased root systems, or a local wet patch. It is a common practice to plant an edging row of some other species along the edge of the Scots pine plantations. Often beech is used and in other cases Abies nobilis or Douglas fir. Generally these have stood very well, but where they have blown there is usually damage to leeward. This does not apply to woods where wholesale destruction has been caused and which look as though a giant bulldozer had smashed its way across them. As for gaps, so it is for holes. It is common to find that a small clearing, used perhaps for stacking pitwood, has been the cause of a " wedge " starting. It would seem that an eddy is set up in such places causing a greatly increased local pressure. Another not uncommon feature is a " sucking-out " effect. Wind passing over a tall stand creates a strong vacuum in its lee and this is often enough to " suck " trees out.

Funnel effects have been noted in many places and are undoubtedly responsible for certain wind-blows. Funnels are caused by the edges of a wood running out at an angle which will funnel the wind down into it. Funnelling can be due to the topography or the layout of the surrounding woods. Examples of both are frequently found. This point is of some importance as it is one of the few ways that the forester can help to prevent wind-blow. Even wide angle funnels are to be avoided if possible and any angle less than 100 degrees may be dangerous. Very noticeable funnel effects are sometimes seen along forest rides or roads. If they are running in the same direction as the wind, it becomes canalised along them, and then impinges with its full force on the trees at the end of the road, when the road stops or turns a sharp corner. It is a commonly held belief that if a wind stream is forced up at the edge of a wood it will hit the horizontal stream above and rebound down into the wood some distance from the edge. According to wind experts this is not so, at least not to any appreciable extent.

The Root System. Under this head soil, drainage, root patterns and disease are included.

There are three chief parent rocks in the area: Old Red Sandstone, Granite, and Mica schists and Gneiss; but these have been so often overlain with glacier drift that a classification of the soils on their geology is liable to be misleading. On the whole, a mild podsol is the common

One of the youngest woods blown—Scots Pine, 30 years old, 37 ft. total height

condition, the worst soils having a thin highly acid peat layer sharply differentiated from the mineral soil. Below this is a leached layer and at varying depths a very vague horizon of deposition of humus and sesquioxides. A sharply defined iron pan is the exception rather than the rule. The best soils are very fertile. The main feature of the soils of this region is the very compact layer of soil (the indurated layer) which occurs particularly on the granitic soils. The soil experts are still in the early stages of research on this factor but to the foresters its presence is well-known and it is sometimes referred to as the "pan." It should not be confused with the pan of a heath podsol. The compacting effect may be slight, or it may be so hard as to resemble concrete and it occurs at varying depth, but usually at 1 to 3 feet. It is found only on freely drained or slightly impeded soils. On some sites it appears to form a solid impenetrable layer causing the trees to be shallow rooting, elsewhere it has fissures of less compact material in a sort of hexagonal pattern and it is down these fissures that the roots penetrate, forming vertical plates, almost like a honeycomb. There is usually a very dense plate of roots directly above the indurated layer. Above this, in the leached layer, roots are sparse, and there is another active zone of rooting in the thin peat layer near the surface. From the point of view of wind it will be seen that the arrangement is not ideal, the surface roots easily pull out of the peat and the roots in the fissures also have less

holding power than if they were more evenly distributed. It it almost invariably the case that the roots "peel off" at the indurated layer as this forms a plane of cleavage. It would, however, be entirely wrong to put all the damage down to poor root systems, as the case described is the worst and in many cases trees with deep, spreading, root systems have blown. The vast majority of roots have been torn up rather than broken, breakage most frequently taking place in hardwoods and in surface roots.

Poor drainage results in a high water table with the consequence that only shallow rooting is possible. There is no doubt whatever that this has been a very potent factor in aggravating windblow. The areas of poor drainage in this part of Scotland are, however, not large and it is doubtful if 10% of the damage could be attributed to this cause.

Root disease played only a small part in the damage, in fact it was not unusual to find trees rotten and snapped off at the base, but whose roots remained firmly embedded. On the physiologically shallower soils the lowest roots were often dead, but rot did not appear to spread into the rest of the root system. In this investigation only Abies nobilis was observed to have suffered windblow as a direct result of pathogenic fungal attack.

Wind-blow and Wind-break. Reduced to its simplest form if the wind is exerting sufficient pressure a tree will be wind-thrown, but whether it is blown down or broken depends chiefly on its roothold. The main exceptions to this are trees with some mechanical fault in the stem, such as a previous injury or a forked leader. Roothold has already been discussed above.

Metzger considered the tree as a beam of uniform resistance, but he was concerned more with static breaking forces whereas we must picture a tree lashing about in a hurricane. The crown will be bent almost parallel to the ground with the stem forming a scimitar-like curve. Here the rigidity of the stem is important. Tall, whippy stems may easily take up this movement, whereas less pliant older stems will probably break. The proportion of heartwood to sapwood and the taper will govern the flexibility of any particular species. There are eye-witness accounts that the trees in some cases broke on the rebound after a gust and not as they were bent down. How far this is the general state of affairs is hard to say.

Over very large areas a sort of unselective thinning has taken place. It would not be true to say that the wind has selected trees in any one class. Some dominants have gone, presumably because their crowns offered a greater resistance to the wind, but sub-dominants and suppressed trees have also blown.

Once a blow has started there will be a tendency for it to continue, as the trees fall on each other and add their weight and wind resistance to that of the tree on which they fall. With large heavy timber this may be especially important. There have been very few eye-witness accounts of the blowing down of a large wood, but according to one, a swathe was first cut through the wood on a narrow front and this was then

S.P./E.L. blown at Allticailleach Forest, Upper Deeside.

increased on either side, as the wind veered about, until most of the wood was down.

Crop Height. No other factor has proved so striking as crop height. There appears to be a fairly narrow limit between stands in the undamaged and heavily damaged categories. At the time of writing this opinion is based on about 80 stands examined in detail. The lowest crop-height at which serious wind damage occured was 35 feet, in Scots pine, and there are a few others less than 40 feet tall. As a general rule however, it can be firmly stated that there was no widespread windblow in crops below 40 feet tall. Crops 40-50 feet tall were approaching the danger height and crops over 50 feet tall were seriously damaged. The majority of damage has occurred in woods 60 feet and over, but this is what one would expect, since there are more woods in this class than in the 50 - 60 feet class. It is the main reason why Forestry Commission woods have suffered so little damage. This point is being further examined in detail. There seems to be some basis for believing that Scots pine is at least as liable to windblow at 45 feet as either larch or the spruces, assuming the drainage to be good, and possibly may be more liable.

The critical height below which damage does not occur seems to vary with the district and is presumably a demonstration of the different wind speeds which existed at the same height above the ground in different regions. Thus in the easterly parts such as Haddo House and on the

Dunecht estate there has been more damage in the 40 - 50 feet stands than in those of Upper Deeside.

It is difficult to explain this sharp dividing line and I suggest the explanation is based on the decreasing flexibility of the lower part of the stem which begins to be apparent about this stage. It may be possible to test this by experiment. Added to this, of course, is the fact that it will need very little extra force to cause the wind-throw of an already highly stressed tree.

Thinning and Spacing. Up to now the factors which have been dealt with are largely beyond the control of the forester, but when one approaches thinning it is immediately apparent that there are strongly divergent views. The majority of the woods have been very much underthinned. On at least one estate it is the policy to do no thinnings until the crop is 60 years old. The reasons are chiefly financial, though the non-thinning tradition takes a long time to die. It is therefore natural that the vast majority of the blow has taken place in underthinned woods. It is only when one gets side by side, comparative plots thinned to different intensities that one can make a comparison. In half a dozen places where this is possible one cannot help observing that it is the more heavily thinned plots which have suffered most and the more lightly thinned plots which have suffered least. In some cases there had been previous windblow in the heavily thinned plots, but this reinforces rather than weakens the argument. One factor which might explain this difference is that after thinning the crop is always more liable to windblow until the root systems have enlarged and the trees closed canopy again. The trees give each other less mutual protection in the more heavily thinned plot, so that if a gale does follow close on a heavy thinning, it is not unnatural to get windblow.

Having said this, it should be pointed out that examples of closely spaced stands being blown while wider-spaced stands of similar height have stood alongside also exist.

To some extent the effects of thinning cancel each other out. The root system is able to expand and forms a more secure roothold, but at the same time the crown enlarges in girth and depth so that its wind resistance increases. It may, however, be desirable to have a deep crown with a low centre of gravity. Spruce is a case in point; on well drained soils both Sitka and Norway spruce have a strong tendency to break at 6 - 16 feet up. This can often spoil a high proportion of the timber due to cracks and shakes. With a deeper crown and a lower centre of gravity the tree may not blow down at all, but if it does, then it will be windthrown rather than broken and the timber consequently saved.

There is a school of thought which favours the forest being as irregular as possible, and from many points of view there is much to commend it . When windblow is considered, however, my experience points to the opposite view. Irregular natural Scots pine woods have suffered just as badly as plantations where the wind has struck them, and in all the crops which have an uneven canopy, due to the failure of one species

in a mixture, indifferent soil conditions, grazing etc., then damage has always occurred. In fact some of the smallest trees blown (down to 15 feet tall) have been in such crops.

DAMAGE BY SPECIES.

Scots Pine. As already stated, Scots Pine has suffered more than any other species due to its widespread occurrence. It has a reputation for being a wind-firm, deeply rooted tree. Over large areas of N.E. Scotland, however, this is not the case; root systems deeper than three feet are the exception rather than the rule, and where a compact "indurated layer" exists, two feet is more common. After examining hundreds of root systems I conclude that tap-roots are extremely rare, - if they exist at all, - though on deep friable soils a good "root-ball" develops. A surprising feature of the gale was the large number of isolated trees and trees in hedges which have been blown down, after standing fully exposed to gales from all directions for 150 years.

Larch. One has perforce to deal chiefly with European larch, as there is very little Japanese larch tall enough to suffer. The few stands which I saw indicated that both species behave similarly from the point of view of wind-blow. Larch timber is stronger than that of Scots pine so that it is rare to find a broken tree. Where they are found it is usually a break at the base due to butt rot. Added to this the leafless crown offers less wind resistance, so that it is not surprising to find more larch standing than Scots pine in a mixed wood. The root systems are not greatly different; that of larch tends to be more spreading whereas that of Scots pine is deeper and less extensive. Most of the older crops were rather open so that the trees gave each other little mutual protection. Heavy losses are usually the result. On the other hand some of the tallest stands which have not blown were closely spaced larch whose whippy stems probably saved them.

Spruces. Norway spruce has a poor reputation for wind-firmness and as a whole this has proved correct. Past policy has always been to plant it in the wetter parts where the water table is frequently only a few inches down. In these circumstances it is hardly surprising that it should blow down. What is more interesting is the fact that on a deep, freely-draining soil it can adapt its root system to the conditions and make a great "ball" four feet six inches deep. In some cases, due to error, Scots pine has been planted on these wet patches and, whereas the spruce can adapt itself to deeper rooting, the pine is not able to form the extensive plate root which is so characteristic of the spruce. A notable feature of the blows in spruce plantations has been the wind-throw of drainside trees. In one case seven trees blew down along a drainside, their roots all interlocked, and forming a neat carpet of the thin surface peat, where it peeled off the underlying clay. It is difficult to suggest measures to deal with this problem, other than to fell all drainside trees during thinnings,but where drains are frequent this is out of the question. Another feature of wind-blow in spruce has been the high percentage of

trees which have snapped. The main reason is doubtless the weaker wood, though it does suggest that a plate type of root can provide just as firm a hold as a deeper, less extensive root system. Sitka spruce behaves in a similar manner to Norway spruce. One point which should be noticed is that these trees, because of their faster rate of growth, have often produced a millable log by the time they are blown, whereas Scots pine planted alongside is still of pitwood size.

Douglas Fir. This species is in many respects anomalous. It has acquired a reputation for being less wind-firm than Scots pine, but this is partly due to its very fast rate of growth, which brings it into the danger category long before Scots pine planted alongside. On the other hand it is not unusual to find very large Douglas fir standing up with occasional other trees, above a sea of devastated policy woods including hardwoods, Scots pine and Norway spruce. Douglas fir 60 - 70 feet high is certainly liable to wind-blow. It has an adaptive root system which can sink deeply into a freely drained soil or make an impressive "plate" on shallow soils.

Other conifers. There are few stands of unusual conifers in this region, though plenty of individual exotic trees exist. One stand of Thuja plicata was seen, which had been damaged in a peculiar manner. 75% of the damage consisted of trees snapped just below the junction of a forked leader. The Abies species have proved very liable to windblow in policy woods and elsewhere where the ground is fertile. On the drier, less fertile parts they have stood remarkably well, as edge trees to plantations, or in small pure woods. The timber is rather brittle and it is usual to find tops broken off; but little windblow has occurred except in really big trees, or where root rot was present.

Broad leaved species—Oak. Of the comparatively small number of oak stands one is surprised to find so many which have been blown. The only reason seems to be the strength of the wind, as roothold was good and they have usually been well tended. The only lesson one can draw is that one must not rely upon oak as being completely wind-firm, though there are many instances of it standing better than beech.

Beech. Probably 90% of the hardwood timber blown is beech, which has certainly not proved wind-firm as an old tree, indeed I found several cases of windblow amongst the younger stands I visited. There is a great dearth of young and middle-aged beech so that this impression may be due to chance.

Other broad-leaved species. Sycamore has stood the gale well and would probably repay more widespread planting. It is not unusual to find a mixed wood with many beech blown and nearly all sycamore standing. It has also stood well as a roadside tree. Alder, again, has proved remarkably wind-firm, considering the boggy ground on which it is found. Birch has suffered rather badly and has been blown about equally when in a loose mixture with Scots pine. Ash has stood fairly well, so long as it has a freely draining soil; on wet soils it has blown rather badly.

Minor Damage. The effects of the storm will continue to be felt for several years to come. Insect attack, particularly of Pine Shoot Beetle *(Myelophilus piniperda)* will almost certainly be heavy in 1954. They will be aided by the exceptionally early spring this year. Pine Weevils *(Hylobius abietis)* will also be a menace to any new planting.

The trees which remain in the devastated woodlands will be subject to full exposure to gales from all directions. Many trees were injured by surrounding trees falling on them, leaders were broken and branches pulled out. In Douglas fir woods the ground was completely carpeted with foliage torn off by the wind and the lashing of branches against each other. Even trees which did not blow have probably had their root systems injured by wrenching and rubbing between stones, with the consequent risk of fungal infection.

Indirect effects such as rabbit fences broken down, letting rabbits into young plantations, roads blocked for extraction, and the neglect of other forest work until the timber is cleared should all be remembered.

Some Conclusions. The importance of drain maintenance cannot be overstressed. The edges of plantations and their outlines, - planted so as to be free from funnels, - are matters which must be attended to from the start. Once gaps exist in pole woods, either made consciously for stacking, cross cutting, etc. or occurring naturally, they are difficult to fill.

The choice of species is very important. There is little doubt that Scots pine is the correct tree for the area, and it would be wrong to switch to another species just because of this gale. At the same time it should be noted that other species will give a greater volume of timber. If one's planting programme is to be governed by phenomenal gales, then it may, on some sites, be better to produce a large volume of Douglas fir by the time it is blown, rather than hope that a smaller volume of wood of Scots pine will survive the next gale.

As the author's knowledge of Irish conditions is slight, it has been the intention to concentrate on the facts and leave readers to draw their own conclusions.

Acklowledgments. In conclusion I would like to take this opportunity to thank the very many owners, factors and foresters, who at all times gave me generous assistance. Thanks are also due to the staff of the Meteorological Office who gave both factual information and useful advice. The work would not have been possible without the helpful co-operation and advice of members of the Forestry Commission staff.

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SOME ASPECTS OF GERMAN FORESTRY AS SEEN BY AN IRISHMAN

By J. J. DEASY.

ON the invitation of Forstmeister Scherer, of Wildeck, I paid a visit to West Germany in July, 1952.

In this paper I shall give some items of forestry interest culled from my diary of an unforgettably pleasant interlude.

It is only fitting that first of all I should record my gratitude to the Forstmeister who acted as my guide and companion during my fortnight's stay and to all the other busy men who gave me so generously of their time, knowledge and hospitality. I shall always cherish the memory of the warm welcomes, the great kindness and the many courtesies which they extended to me.

From Wildeck in Hessen we travelled southwards on the *autobahn* by " Volkswagon " car stopping at the State Experimental Nursery and Seed Extractory at Wolfgang, near Frankfurt-on-the-Main. There we were met by Forstmeister Dr. Messer, who very kindly showed us round.

This nursery, opened in 1928, has an area of 25 acres and a diluvial soil. A light railway is laid along all the main paths, the ground being level and hydrants are placed at suitable points to enable overhead irrigation to be carried out. Our visit coincided with a heat wave, the temperature in the soil a few days previously was 133° F., and many of the first year conifer seedlings, although shaded, showed effects of the extreme heat. In discussing sun-scorch Dr. Messer mentioned that he had found Douglas Fir to be less sensitive than Norway Spruce in all stages of its nursery life.

A striking feature was the breaks of *Populus robusta* raised from cuttings. First year plants were on an average five and a half feet high and second year plants nine feet. Second year plants of the class " 1 on 2 " (i.e., one year shoots on two year old roots, the plants having been cut to ground level after the first year, to encourage the production of straighter stems, and relined) were six and a half feet high. One reason for their remarkable size so early in the season, Dr. Messer explained, was that close by and in the direction from which the water flows to the nursery there is limestone rock. The water-table in the nursery is normally sixteen inches below the surface, and the calcium-charged water, so beneficial to Poplars, is freely available to the plants. In this sandy soil they found that cuttings take best if completely covered with the soil when being set.

We were then shown an example of the *Dunemann* system of raising seedlings. The results were not very impressive owing, as far as I could gather, to neglect of watering but as the system seemed to have been increasing in popularity in Germany where, in other nurseries, I saw some successful beds and as it may have possibilities in this country, I shall give an outline of the technique.

A frame is erected of normal seed bed width, any desired length, and about fifteen inches high. This is filled to a depth of about twelve inches with Spruce needles well packed and liberally watered. On the needles is sieved a layer of hardwood leaf-soil just sufficiently deep to form a smooth even surface, half a centimetre (about one fifth of an inch) is considered the optimum depth. When the seeds are sown on this and pressed into the mould they are covered to a suitable depth with the same material. The bed is then shaded, the conventional laths or tree branches being suitable. Except during wet spells watering through a fine rose must be carried out each evening.

On germinating the seedlings absorb the plant food being released by the rotting of the Spruce leaves and the heat rising from the decaying mass has the effect of prolonging the growing season, resulting in bigger seedlings. In addition it is claimed that the unrestricted movement of the roots through the compost results in the seedlings being furnished with an abundance of fine feeder roots and for this reason a much denser stocking than normal is possible. Another advantage claimed is that the necessity for weeding is entirely obviated. This last point is of major importance in the economics of nursery work in this country although in recent years considerable relief has been provided by the use of White spirit and Vapourising Oil sprays on pre-emergence weed growth. I didn't hear of any damping-off fungi having attacked the seedlings but every nurseryman is aware that leaf-soil can be a very fruitful source of these. Even if sterilized the danger of introducing spores in the frequent watering is quite real as many with experience of mushroom-growing know. Normally seedlings are lifted after one year although they can be allowed to stand for two years if required. When the seedlings are lifted the compost can be used to advantage as a mulch through transplant lines.

Although Douglas Fir was the only species I saw tried under this system there seems no reason why it would not be suitable for raising any of the common conifers or hardwoods.

The system seems to be worth a trial here with a view to making comparisons between the cost and quality of the seedlings raised by this and the conventional systems. It should be a useful method for the land-owner who would like to sow his own tree seeds, but who is hampered through not having any ground inoculated with the necessary mycorrhizae.

We next inspected some plants of Scots Pine and European Larch on which were grafted scions of plus trees of those species for the purpose of forming a seed orchard. All plants were in pots and the grafting had been done in Spring in the glass house. Under glass the temperature and humidity can be controlled and in this manner at Wolfgang a take of 90 per cent. in Pine and 68 per cent. in Larch had been achieved.

Having left the nursery we were shown through the seed extractory. Established in 1826 this is claimed to be the biggest and best equipped plant in Germany.

The cones, on arrival, are whisked by electric elevator to the top of the storage building where the different provenances are kept in separate compartments. Air drying takes place here, the sides of the building being open. When considered sufficiently dry for storage a trap door in the compartment is opened and the cones are let down by chute to the storage accommodation on either of the two floors beneath. On these floors the dry cones are stored to a depth of one metre. From this building they are again conveyed by elevator to the top of the extraction house. From there they move downwards through four different stages, the temperature, which is thermostatically controlled, increasing at each stage. At the first it is 77° - 95°, at the next 95° - 104°, at the next 104° - 113° and finally at 113° - 122° F. The cones are in constant movement in rotating drums and by means of the combination of this movement and the heat, even refractory cones such as those of European Larch can be broken down. For de-winging, the seeds are placed in a long narrow trough which is fitted with an electrically driven spindle which runs through the length of the trough and to which are fitted wooden pegs radially arranged at frequent intervals. When, by this means, the wings are separated from the seed and broken down, the resultant dust is sucked out through a duct. A high moisture content in stored seeds has an adverse effect on their viability and therefore the moisture content of all conifer seeds is reduced to 6 per cent. before they are placed in storage.

The seeds are stored in glass jars in a cellar which is fitted with electric air-conditioning equipment and in which the temperature is maintained the year round at 4° - 6° C (39° - 42° F.).

Travelling down to Heidelberg along the beautiful Neckar Valley we passed some examples of devastated woodland. Actually such scars were surprisingly few in the part of Germany I visited. It would appear that much of the felling done to meet post-war demands was in the nature of heavy thinnings—barbarous treatment admittedly in the eyes of a forester of the orthodox German School who favours such dense stocking but, in the eyes of those who favour the other extreme, the treatment might be regarded as having been indeed necessary!

Up at the Königstuhl, highest point overlooking the town of Heidelberg and 563 metres (1,829 feet) over sea level we inspected excellent crops of Norway Spruce. The annual rainfall here is 34 inches,* 18.5 of which falls during the six months March to August inclusive, July having the highest monthly temperature of 60.5° F.

This crop contrasted with the Norway Spruce one can imagine growing at a similar elevation here brought home the difference between the effects of the Continental climate which prevails there and the insular climate which is ours.

*All climatological data in this paper is taken from "Fremländische Wald—und Parkbäume" by C. A. Schenck, Berlin. 1939.

After a pleasant interlude in Heidelberg we travelled north to the Forest District of Weinheim. There we had as guide Forstmeister W. Fabricius, who spared no pains to make our visit interesting and enjoyable.

In the Weinheim Forest District which includes the estate of the Count von Berckheim there are upwards of eighty exotic species up to 85 years old. There an Irish forester will rub his eyes when he sees young plantations of such species as *Cercidiphyllum japonicum, Magnolia Kobus* and *Magnolia tripetala* all growing vigorously and nursed by Beech and Maple with which they seemed to have no difficulty in holding their own.

Outstanding, however, in respect of volume production were some conifers from Western North America. We inspected eighty-five year old plots containing *Abies concolar* var. *Lowiana* up to 156 feet total height, green coastal Douglas Fir *(Pseudotsuga taxifolia)* 150 feet and *Abies grandis* 134 feet. The last mentioned became stag-headed at 80 years and no further height growth or seed production took place. A seventy-five year old plot of Incense Cedar *(Libocedrus decurrens)* and an eighty year old plot of Western Red Cedar *(Thuja plicata)* were also very successful, having average heights of 80 feet and 85 feet respectively. The latter had produced an abundant crop of self sown seedlings quite a distance from the parent stand. An eighty-five year old plot of Sugar Pine *(Pinus Lambertiana)* was almost completely wiped out by *Cronartium ribicula* which had spread from orchards of *ribes* in the immediate vicinity. *Pinus ponderosa* had grown reasonably well, an eighty year old plot having an average height of 65 feet. The pride and joy of the Forstmeister, however, is the stand of eighty-five year old *Sequoia gigantea* containing 230 stems, the highest being 140 feet and the true volume per acre being 14,967 cubic feet. For comparison Norway Spruce of the same age and on a site of similar quality, yields, according to Schwappach, 8,719 cubic feet.

All the plots mentioned are on the estate of the Count von Berckheim where the elevation ranges between 440 and 820 feet, the soil is sandy and the ground rock granite, except for a small area of limestone. The annual rainfall is 27 in., the area is subject to occasional late frosts and, often in April, wet snow. May is very dry and growth continues late into Autumn. Dahlias are often in bloom in the garden at the beginning of December.

From Weinheim we travelled north to Frankfurt where we were met by Frau Dr. Keil and Forstmeister Preiss who showed us over the newly planted pinetum attached to the Frankfurt community forest. The range of species in the pinetum was wide and planting was carried out through shade trees which were reserved in the process of site preparation. We were also shown an arboretum in which were many East American broad leaved species.

Next item of forestry interest was a visit to the Meissner mountain, one of the most picturesque and romantic places in Northern Hessen. It has a rich flora and some very interesting forest crops. We were shown through the district by Forstmeister Von Trott who drove us over the sharp gradients in his "Mercedes" car, powered by a Diesel engine.

The geological formation of the foothills is sandstone while that of the upper slopes and plateau is basalt. On some of the sandstone areas we inspected work done on the conversion of blocks of pure Spruce, legacy of the days when monoculture was widely practised in Germany, to mixed stands. Very briefly the process is thus : small openings are made during years of good seed crops and patches 10 - 15 feet in diameter, suitable for the germination and growth of seedlings, are prepared by mixing the soil and humus. Surplus seedlings in some patches are transplanted to others where regeneration is not so successful. After further gradual opening out the resulting groups of young Spruce are linked by planting Beech, Oak and Douglas Fir. On moving into the basalt area we inspected some very striking three-storey crops of Beech. In what had been a mixed hardwood stand we saw where, after the usual regeneration fellings, there had been a good crop of Beech, Ash and Norway Maple seedlings. Clear felling was carried out in what was regarded as due time but which, however, proved to have been too early as the Beech was not quite advanced enough to compete with the vegetation that sprang up. The Ash and Maple, however, being better equipped to endure smothering herbaceous growth came away vigorously. It is the intention now to interplant these with large Beech and European Larch.

An important part of the work on Von Trott's domain is the treatment by means of *Dauerwald*† of approximately 300 hectares (740 acres) of mixed crops of Beech, Maple and Ash. He explained that the process is a tricky one and that not the least of his difficulties is to prevent the disappearance of Beech from the young crop. Some factors militating against Beech are its infrequent fruiting as compared with the frequent and abundant fruiting of Ash and Maple and also the fact that its seeds do not lend themselves to dispersal over such wide areas by natural means as do those of the other two species. Furthermore on southern and southwestern exposures young Beech cannot survive if the canopy is more than 60 per cent. closed. (In the northern and northeastern exposures where conditions are more suitable it can stand more shade).

On descending the mountain by a circuitous route we came across some very good specimens of fifty-eight year old Douglas Fir and *Thuja plicata* which indicated the possibilities of those species there, possibilities which are, in fact, recognised by the Forstmeister who includes some in much of his plantings.

From this charming and interesting countryside we travelled northwards to Hannoversch-Münden where we visited the Forestry Faculty of the University of Göttingen, *alma mater* of my friend Forstmeister

†The term *Dauerwald* embraces all silvicultural systems which do not involve clear cutting or exposure of the soil.

Scherer. There we were met by Professor Dr. Schmucker who showed us over the botanic gardens and nurseries attached to the Faculty. We inspected some work on controlled pollination of Birches. There were lines of plants derived from crosses of *Betula pendula (verrocosa)* X *B. papyrifera, B. pendula* X *B. ermanni,* and *B. pendula* X *B. maximowicziana* all of which displayed *heterosis* (hybrid vigour) but this was most pronounced in the progeny of the first mentioned cross. In inspecting work on the grafting of Pines, Spruces and Larches for seed orchards we saw where a student had tried grafting Scots Pine on Norway Spruce and *vice versa,* both successfully. Having taken us through the botanic gardens the Professor showed us his rich collection of dried specimens and in conducting us through the Faculty building showed us a new wing built by contributions from timber merchants.

It was unfortunate that Professor Dr. Wittich, Director of Soil Science of the Faculty‡ was absent due to illness but we were lucky in having Dr. Themlitz to tell us something of the latest developments in that field. We were shown soil profiles which illustrated very well the different stages of the podsolisation of Loess (a fine fertile loam, yellowish brown in colour, of which there are extensive deposits in Germany and which is believed to have been transported to its present situation by the wind). In discussing soil amelioration Dr. Themlitz told us that by the application of lime to Spruce crops over forty years old, thereby activating the raw humus, increment was increased by as much as 45 cubic feet per acre. The rate of application depends on the depth of the humus layer, the composition of the soil and its pH value but quantities up to four tons of burnt lime per acre may be necessary. This should not be applied all at once, however, as among other possible harmful effects from such a dosage, earthworms may be killed, but over a period of 5 to 10 years. The recommended minimum quantity at any one application is 22 cwt. per acre. It is important that burnt lime be mixed with the soil immediately it is distributed.

In reference to the amelioration work in clear felled areas, the soils of which have been degraded by successive crops of pure Spruce we were told of the system known as *Waldfeldbau,* a very old system and for long out of fashion but which has been revived in some parts of Germany during the past 10 or 15 years. This involves intensive cultivation of the soil, which necessitates the removal of the stumps, thereby mixing the impoverished and enriched layers and improving drainage. This is followed by liming and manuring. One or two grain crops may then be taken from the ground and again at the time of the direct sowing of the tree seed a further crop is sown, usually buck wheat, rye or oats. This crop shelters the young trees and can be cut just above them without causing damage. Being isolated these grain crops command a high price for pure seed purposes when special strains are grown, as is almost always the case. A few years later perennial lupins are sown between the rows of trees for the purpose of increasing the nitrogen content of

‡See " Irish Forestry," Vol. VI, Nos. 1 and 2, 1949, for an article by Dr. Wittich on "The Possibility of Afforesting Soils of the old Red Sandstone in Ireland."

the soil by their nodule bacteria and of suppressing undesirable vegetation. It is claimed that the return from the sale of the stumps for fuel, and of the cereal crops together with the increased yield from the succeeding tree crops more than pays the cost of the intensive soil preparation.

The same intensive cultivation is carried out in afforesting heathland and other wasteland types, as (1) it is claimed it pays and (2) naturally, owing to the absence of the tree stumps, the work can then be done so much more cheaply than is possible later when a tree crop is established. Furthermore, and this is closely related to (1) these methods result in the possibility of a much wider range of species, and mixtures which not only can maintain the fertility of the soil but improve it.

The adoption of such methods in Germany can be readily understood as, owing to their happy position,-28 per cent. of their land surface is under forests—the Germans are not in a desperate hurry to plant up land. Indeed in almost all cases they have reached the limit in regard to the acquisition of land for forestry purposes and it only remains for them to produce the maximum from the ground they already have.

From Hannoversch-Münden we travelled westwards through the famous Reinhards-Wald, home of some of Germany's finest Beeches, to Rhoden. There we visited a special type of work-instruction centre. We were met by Forstmeister Backhaus, the Instructor-in-Charge, who told us that the centre was established for the purpose of giving intensive practical courses on felling and extraction, planting and road construction to forestry students, and refresher courses on these subjects to Foremen, Foresters and Forstmeisters.

Instructions are given in great detail on the best type of tool for use at the various operations, e.g., in the case of the axe: the material suitable for the handle, *Acer montana* is preferred to Hickory or Ash; the shape of the handle, the weight of it—the same length as the arm of the user—the shape of the axe and the weight of it. This last is always a matter of surprise to an Irish Forester who is accustomed to 5 and 6 lbs. axes—the Germans will not use an axe one gram over $2\frac{1}{2}$ lbs. I was assured that the decision to use this light axe exclusively was taken only after years of research. It was found that its use over any given period resulted in a higher output by and less fatigue to the workman than if a heavier axe were used. Investigations of this nature have been carried out in respect of all tools and equipment used in the forest. Those attending the course are instructed in the proper use of all tools, methods of sharpening them and their general maintenance. I noticed that the edges of all axes when not in actual use are protected by sheaths ingeniously made from wood or leather. Attention is also given to the time taken to carry out various operations which information necessary in arriving at peace-time rates, is ascertained with the aid of a stop watch.

At the time of our visit there were 30 students in residence at the

centre and the staff consisted of the Forstmeister who was also District Officer, four Forester-Instructors part-time, a housemaster, a matron and four maids.

From this place we returned to the point from which we started—Wildeck (see article, "German Forestry To-day" in Irish Forestry Vol. VI., Nos. 1 and 2, Winter, 1949).

This was a haven of rest after our somewhat hectic tour and our quiet drives through the magnificent old woods in a hunting carriage drawn by a pair of horses was in sharp contrast to travelling on the *autobahn* where the normal speed is around 70 miles per hour.

In the 5,000 or so acres comprising Wildeck *Forstamt* we inspected examples of some silvicultural systems, an aspect of Forestry which, above all, is the German Forester's forte. Particularly successful was the *Blenderscaumschlag,* (a variation of the Shelterwood Strip System) applied to Norway Spruce. The Forstmeister told me that this system did not, however, suit Beech as, owing to the long intervals between the seed years and the limited distance over which the seeds are dispersed it would take a lifetime to regenerate a small area. In Wildeck the system is not suitable for Scots Pine either, as regeneration on the North side is severely attacked by leaf shedding diseases owing to the dampness and where they escape disease they are more attractive to slugs, insects, deer, hares, etc., being soft and succulent due to the parital shade. Of special interest for me was a Beech wood in compartment 40 where, as a student in 1938, I assisted in marking the trees to be removed in the first regeneration felling in accordance with the *Schirmschlagbetrieb* (Uniform System). Since that time many regeneration fellings have been carried out, the clear felling having been done in the Winter of 1951. Regeneration was good—plentiful and vigorous. European Larch was planted through it here and there in the Spring of 1952, not so much to fill up thin patches as there did not appear to be any, but rather that a silviculturally sound and economically desirable mixture be formed.

Vigorous natural regeneration particularly of Scots Pine and European Larch was to be seen in many of the less fertile areas through the old woods particularly in fertility classes 3 and 4 (five fertility-classes are recognised in German Forestry). In the more fertile areas natural reproduction is not so successful owing to the smothering effects of the lush vegetation and direct sowing of seeds or planting, following cultivation are the methods employed. The normal espacement used for planting one year old Scots Pine, which is the recognised age for planting out that species, calls for 23,000 to 30,000 seedlings per hectare (9,000 to 12,000 per acre). This is considered necessary for the production of high quality timber, as the close spacing ensures fine branching and consequently small knots. Only the final crop trees are pruned and in the case of these the fine branching makes for quicker occlusion of the pruning wounds and lower pruning costs.

Planting costs, too, are low due to the intensive cultivation and one year seedlings are cheap. Naturally no beeting is necessary. Heavy stocking right through to the end of the rotation is the accepted method as dense slowly grown timber of the highest quality with narrow annual rings is the aim.

In the case of Norway Spruce three to four year old transplants are used and the normal espacement is 1.50 to 1.70 metres. European Larch is planted at much the same distances as Spruce and normally two year seedlings are used.

In these German forests one looks in vain for Sitka Spruce and *Pinus contorta* both of which figure so prominently in Irish plantations but with, for instance in Hessen, a rainfall of 24-30 inches and an atmosphere of low humidity, conditions are too dry for Sitka Spruce and, with the soil preparation methods practised, more commercially valuable species than *Pinus contorta* can be grown.

One looks in vain for rabbits also.

I haven't mentioned the very enjoyable and instructive visits which we paid to some commercial nurseries, viz., that of Conrad Appel of Darmstadt, Gust Ludemann of Frankfurt, the branch nursery of Messrs. Pein and Pein near Kolenz and the branch nursery of Willi Emmerich at Celle near Hanover. To the proprietors of all of these my best thanks are due for the facilities so readily afforded me to study their nursery technique and systems of management.

THE RIVERAIN FORESTS OF SIND IN PAKISTAN

By H. P. DAVIS

THE province of Sind forms the north-western seaboard of the vast peninsula comprising India and Pakistan. As the Punjab is called after its five rivers, so the Indus, into which they all merge, gives its name to the land through which it thereafter continues its solitary course.

For a short stretch the river flows in sight of the Kirthar range of the Baluchistan highlands, and at one point even washes its foothills. But by far the greatest part of its wanderings lies through flat or slightly undulating country, where rainfall is almost unknown. The only source of moisture for cultivation here is found in the river itself. In summer, when the snows melt in the Himalayas, the lower waters rise and submerge the surrounding country. This annually flooded area formed originally the limit of cultivation, but the annual distribution of flood water has been brought under control : firstly by the construction of retaining dykes at some distance from the banks : more recently by the damming of the headwaters, near where they enter the province, to form a great reservoir. By this means a large part of the surplus water is held up during the season of abundance and then gradually released over a much wider area. The arable territory has been thereby enormously increased. Distribution moreover is prolonged over the winter months, instead of ceasing abruptly on the recession of the flood, so that now two crops a year can be grown in place of one.

Except in two places, one in Upper and one in Lower Sind, where a more stable rock formation is encountered, the Indus is continuously altering its course; here eroding its banks and there throwing up new alluvial deposits. By constant vigilance and counter-measures on the part of the Irrigation authorities this action is restricted almost entirely to the tract, that, on either bank, is enclosed by the protective dykes. Within these ramparts lie the bulk of the natural forests. These are subjected to an annual submersion lasting several months and extending to a depth of six or seven feet. It is under such conditions that regeneration, if any, must take place, and it is probably this unusual factor which has led to a severely restricted forest flora.

Actually the indigenous forest species are only four in number : Babul *(Acacia Catechu)*, Kandi *(Prosopis spicigera)*, Lai *(Tamariscus Indica)* and Bahan *(Populus Euphratica)*. Of these the first three are universal ; the last occurs sporadically in groups. Babul, besides being the source of several useful by-products, is the fuel tree par excellence of the East. Although extremely durable it is unsatisfactory for general structural purposes. The others are of less value ; Lai, in fact, would have little market except for the general shortage of fuel. The poplar, curiously enough in view of its poor reputation elsewhere, is the only one of the quartette used locally for timber. It is light, easily worked, and very suitable for the brightly coloured lacquer articles which are a peculiar product of Sind. Where timber for furniture or building is required it is more convenient to import deodar or sissoo from North India.

Where forests are established outside the bandh, i.e., by canal irrigation, many other valuable species have been introduced. The only restriction to what can be grown on this rich alluvium is that imposed by the climatic range, which varies in Upper Sind from a light frost to a maximum shade temperature of 125° F., while a somewhat milder range is recorded in the lower part of the province. As these figures indicate, Upper Sind in summer is one of the hottest regions in the world, with a climate rendered all the more trying by the high degree of humidity in the flooded areas. In winter, in spite of almost continuous sunshine, there is a freezing wind from the snow-clad hills in the north-west which drives the inhabitants to fur caps and padded clothing.

In area and population Sind approximates fairly closely to Ireland, though in other respects there is little resemblance. Until the last world war the river Indus, which crosses the province diagonally from north-east to south-west, was, with the exception of the railway on its bank, practically the only rapid means of communication. Owing to the absence of stone, local roads have no foundation and crumble into dust so deep that it is often only by spreading long grasses and reeds that they are rendered even temporarily passable for vehicles. They are used by cars only as a last resort. The bandhs, indeed, provide an excellent surface for motoring (all other traffic being rigorously excluded). Driving, however, requires a steady hand, as the track is only wide enough for one, and there is a steep twelve foot slope on either side. At rare intervals the bandh is widened to allow of two cars passing. Woe betide the driver who for any reason finds his progress blocked between any two of these points, and is obliged to drive his car in reverse to the nearest crossing!

The necessity to despatch military transport rapidly up country during the late war led to the construction of an excellent tarmac road the length of the province. The first hundred miles of this road crosses desert country from Karachi to Kotri, where it meets the river, and thereafter follows the cultivated belt.

The importance of Karachi, which has long been the only seaport serving the north-west of the sub-continent, increased enormously six years ago when this city became the capital of Pakistan. Its position renders it one of the world's most vital airports. Unfortunately its power of expansion is limited, for it lies not on the Indus bank, but some miles to the north of the estuary, with an immediate hinterland of desert and bare hills.

The fuel requirements of the ever increasing urban population has for some years presented a serious problem to the authorities. Domestic consumption is met almost entirely from charcoal and firewood produced in the forests of Sind. With its new capital status, the demands of Karachi have increased immensely and create an intolerable drain on these sources of supply, already strained by wartime overfelling.

The conservation and expansion of these forests is therefore of the utmost importance. By setting aside for afforestation part of all the new

lands brought under irrigation by the original Sukkur barrage, and by providing for a generous measure of afforestation in all the similar irrigation schemes recently undertaken, notably the new barrage under construction at Kotri, the local Government are now endeavouring to augment the existing fuel reserves, and also, where possible, to create forests of timber species capable of supplying local needs.

To a forest officer, even one who is accustomed to many varying types of tropical forests, the first introduction to the Sind riverain areas is a unique experience. Forests are elsewhere usually associated with hills or broken country: the level lands are too much in demand for agriculture to be spared for tree growth. In the tropical jungle, too, we are accustomed to find a very wide variety of species and ground flora, and abundant wild life. Sind offers the reverse of these conditions. The terrain is dead flat ; the lack of ecological variation is monotonous, and, although wild duck on the water and partridge on the land are plentiful, the only indigenous quadrupeds appear to be wild pig and a small variety of deer. The compartments are laid out in chessboard fashion, separated by broad rides, and each covers a quarter square mile. The chief species are thorny and often offer an impenetrable thicket which precludes all but the most objective inspection. Growth is rapid and the rotation short. The main silvicultural problems are concerned with natural regeneration, and in the inundated, as distinct from the irrigated areas, these are of some complexity. For ideal soil conditions there must be a good " abkalani," a word which in Sindhi connotes the period of inundation, on the abundance and duration of which, as on the monsoon elsewhere, the whole success of growth depends. Babul, the most desirable species, does not coppice well and is a capricious germinator. It has a hard pod, intended by Nature to be disseminated after digestion by grazing animals, and its seeds do not readily respond to other treatment. The most effective sowing is by broadcasting from boats, just before the recession of the waters, so that germination may take place on the heated surface of the mud. This method is adopted on the freshly felled areas as well as on the newly formed alluvial tracts. Besides being a very laborious proceeding it involves a very careful judgement by the local staff of the most propitious moment. This means in practice that the water must have become so shallow that the boat is continually grounding, and becomes merely a receptacle of seed pushed or dragged by wading men. The other two species reproduce freely from coppice and require less elaborate propagation.

In the irrigated plantations regeneration is usually accomplished by agri-cum-silvicultural methods. The land is leased, often at a high rental, for cultivation of cotton or cereals, and the tenant undertakes to level the ground, to sow lines of seedlings between his crops, and to tend them for the period of his occupation. In irrigated plantations the duration and depth of the inundation is controlled by sluices admitting the prescribed quantities of water. Levelling has to be accurate in order

to make the most economical use of the water, which is expensive and limited, and this operation requires technical skill and experience. By leasing out the land on agri-silvicultural tenure to a contractor the necessity of carrying out the levelling and watering by departmental action is avoided, while a substantial return is secured which can be off-set against the expense of irrigation in the later stages of the rotation. After three or four years the side shade from the rows of young trees begin to overshadow the crop and the tenancy ceases.

One peculiar feature of the management of unstable riverain areas lies in the annual loss of area by erosion, counter-balanced in the long run by the accretion of new land from which the river has receded. By close observation it is usually possible to forecast the direction and degree of each change in the river's course. Here the forest officer must work in close collaboration with his opposite number of the Irrigation Department. The general set of the river at all points of its course is checked and plotted by technical experts after each year's abkalani, and these results are used as a guide for the demarcation of the areas doomed to erosion, which are then sold standing as part of the year's annual cut. Apart from the adverse effect of these fellings on the symmetry of the working plan, where they involve often the sacrifice of immature stands, the supervision of these erosion strips, known in the local language as "loot," creates a major headache for the forest officer. Those forecast early and sold early in the working season are straightforward enough. Unfortunately the caprice of "old man river" frequently foils the best laid schemes of the experts. From the commencement of the warm weather, when the river commences to rise with the melting of the Himalayan snows, the closest watch must be kept by the local staff on the danger spots within their charges, and the slightest eccentricity reported post haste. Emergency strips may have to be suddenly selected, and attempts made to salvage the growing stock, if possible through a purchaser, or if not by departmental action. With a rapidly rising river the sequence of operations often has to be telescoped, when marking, felling and extraction proceed simultaneously, with the waves sometimes lapping the feet of the labourers as they fell and pile the faggots in the waiting boats.

The reverse process, the reafforestation of the newly recovered territory, is much more leisurely. These "kuchos," as they are called, do not automatically revert to the Forest Department, even if they originally formed part of forest. They must be formally claimed, against possible counter-claims by private owners, and only after re-allotment can reafforestation proceed. There is intense land-hunger in Sind, as in most regions with an expanding population, and the Forest Department is at all times engaged in a fierce rearguard action to maintain its territory.

The life of a forest officer in Sind follows the general pattern of that of a district officer in the tropics. Several months are spent in headquarters and the remainder of the year "on tour," that is to say in moving systematically around his charge. He is usually accompanied by his

" bandh-o-bast," a comprehensive word used to cover servants, staff and all their necessary paraphernalia.

The period from July to September is that usually spent in headquarters, with occasional flying visits to see urgent operations afield. This is the hottest time of the year in Sind, and coincides with the floods, when the riverain forests are submerged. Little or nothing can be done there till the water subsides. It is, however, a very busy time in the office, with sales, conferences, administration reports and audits, and all the important business which cannot be dealt with on tour.

Touring in this season is a severe ordeal to all but those conditioned to withstand intense heat. Forest inspection has to be completed before sun-up and the rest of the day spent indoors in semi-darkness in a temperature that, in spite of the ceiling fan, seldom drops below 100 degrees.

But if summer inspections involved a certain discomfort, conditions in the cold weather were delightful. A chain of Government rest houses stretches at intervals along the river banks, permitting a stay of several days at each, and the various departmental officers plan out their itineraries many months ahead with such exactitude that they follow each other in unbroken sequence like golfing couples on a crowded course. In the writer's time touring was usually *en famille,* and a station wagon sufficed for all immediate necessities and personnel, while the rest of the equipment travelled by train where possible, or by hired lorry, but most commonly by camel. Touring officers usually engage a camel contractor for the season, who provides all the necessary animals. These include one or more trained for riding, for this is by far the most convenient medium for forest inspection. Forest officers all the world over are wont to pride themselves on their walking powers, but a day's tramp over the soft sand of a Sind forest is calculated to shake the most resolute spirit. The advantages of camel riding are two-fold, the extra height of the animal adds enormously to one's field of vision, and its pace enables one to cover far more ground in a single outing with less fatigue.

The Sind riding camel carries an elaborate superstructure, which makes him appear to have two humps. This illusion is produced by the artificial backrest provided for the passenger, who sits immediately behind the driver, with the real hump, concealed by a cloth, between. The camel possesses the unique accomplishment of kneeling with its hind as well as its forelegs, and is mounted while in this position.

The transport of kit between successive halts is always carried out at night, and as darkness falls on the eve of departure the camp is full of the dim recumbent shapes of camels being loaded, and the clank of metal and the creak of cords. Now and then objurgations of the drivers are broken by the harsh bubbling groan with which one or other beast expostulates against any further impositions. When the last load is in place the whole caravan rears up and is away with surprising sudden-

ness, and nothing remains of it but a distant tinkling in the dark.

Other aspects, too, of Sind life have their evocative quality. White sails moving among the tree tops are a quaint feature in a forest scene, a constant reminder of the river's presence. Sailing barges are, of course, in regular use on the Indus, and much of the forest material is extracted by water. Such craft descend the river easily enough in the fair season. It is more difficult to return, as the stream is then too narrow to permit of tacking, and the boats have to be laboriously towed by manpower along the banks.

In spite of the frequent monotony of the forests a landscape painter in Sind would find plenty to engage his attention. The drab firelines often open on to charming vistas of sky and stream. But it is along the canals that one sees the finest contrasts. The green lines of babul stand out with brilliance, and the vivid winter foliage of the poplars, as they curve away into remote distance, is a sight to be remembered.

The prevailing style of Sindhi architecture is unimpressive, consisting mainly of flat-roofed houses, sparsely windowed and densely clustered to afford mutual shade and protection. Hyderabad city, which must not be confounded with its namesake of the Deccan, which is in India, not Pakistan, is a significant exception. Standing on rising ground by the Indus, it shows up impressively from a long distance, and puzzles the stranger by its extraordinary outline. This is produced by the air-scoops, rising from every rooftop like brooding spectres, and giving the approaches of the town a weird and somewhat sinister appearance. These " moongs," as they are called, are a most effective device, that might be advantageously adopted elsewhere, for catching and utilising the prevailing breeze. Their invention is an indication of the practical enterprise of the inhabitants, for Hyderabad, besides possessing an historical past, is the home of one of the most progressive commercial communities of the East, which has its branches and agents from Gibraltar to Shanghai.

Several miles from Hyderabad is the newly founded Miani Forest school, where subordinates up to the rank of forester receive their training. The curriculum includes a fair measure of practical work at which the students, who are mostly drawn from the cultivating classes, excel. Each has his own plot allotted to him, in which he is taught to apply not only the usual principles of nursery work but also their use in conjunction with artificial irrigation, upon which all the afforestation schemes of Sind depend.

At one of the few points where the course of the river is stable there stands a small town still bearing the traces of ancient fortification. There is a very strong local tradition that here resistance was offered to the conquering army of Shikander, better known as Alexander the Great, on his march down the Indus to the sea. Historians have not located with any certitude the various episodes of this phase. According to original sources several forts were encountered along the bank, in the storming of one of which the monarch exposed himself recklessly and

was wounded. The old fort at Saiwan stands in a distinctly strategic position, capping an almost vertical knoll on the very edge of the river, where it commands a wide view on all sides. It is a possibility that this may be the authentic scene of Alexander's exploit. The crest is now the site of a couple of Rest Houses, and the touring officers who occupy them to-day look out over a prospect of forest which cannot be markedly different in content from that encountered by that doughty warrior.

But the Sind forests are linked with even further antiquity than Alexander's invasion. This is the buried city of Mohendro Dero, the existence of which was only discovered in 1922. These remains, which cover about a square mile, are now agreed to belong mainly to the third millenium B.C. They indicate a remarkable degree of civilisation. The town is laid out in chess board style, divided by main and side streets into convenient rectangular blocks. The streets are narrow and unsuitable for vehicular traffic, very like many towns of Sind to-day where protection from the sun's rays is the first consideration. The houses are built of burnt brick, which argues an ample supply of fuel for baking, such as might have been provided by forests similar to those of the present day. The city is situated entirely within the original boundaries of reserved forest and is protected from inundation by a bandh. Previous to its discovery as a site of major archeological importance, it had received its name from the curious series of mounds which cover the area, and were the reputed burying place of some previous generations. Mohendro Dero means in Sindhi "the mound of the dead." It was only in excavation of these tombs that a whole system of underlying strata was found, dating from a very remote urban civilisation.

Just how advanced these ancient people were can be gauged from the excellent system of sewerage found beneath the main streets, fed by subsidiary drains from the houses, many of which were also fitted with rubbish shoots leading down into permanent brick bins, presumably cleared by the municipal sweepers of the day. In the matter of public swimming baths Mohendro Dero, for its size, could show a lead to our own capital, for it possessed at least one very fine establishment, 40 feet by 24 in area, and 8 feet deep, lined with bitumen, surrounded by changing rooms, and with arrangements for changing the water.

The best evidence of the conditions of life existing at the time is furnished by the objects found in excavation, some of which are on view in the museum on the site. Among these we have pottery, jewellery, toys and images. But the most striking of all are the engraved seals, which are executed with great technical skill. These are important not only for their inscriptions, which have so far baffled the scholars, but for the light they shed directly or indirectly on the climate and customs that prevailed in Sind in the third millenium B.C. In them are shown not only domestic animals very much as they are to-day, but also elephants, tigers and rhinoceros, none of which are found at present within a considerable distance of the Indus valley. This would seem to indicate the

existence there in those days of the mixed deciduous rain flora which is the usual haunt of these animals, quite unlike the present inundated desert forest.

Apart from Mohendro Dero there is now abundant evidence available to show that in prehistoric times the Indus flowed through a densely populated region, and this points to a considerable climatic change in the course of time.The extensive use of burnt brick found in the excavations has been taken to show that not only was ample fuel available, but the necessary manpower to use it. While the inundated fringe of the Indus might conceivably have produced the requisite fuel, even as it does now, it is unlikely that it could at the same time have supported a numerous population. There must therefore have been abundant arable land in the vicinity, dependent, not on river flooding, but on actual rainfall. This view is borne out by the frequent traces found by Sir Aurel Stein in the adjoining rainless hill region of Baluchistan, of artificial dams and terraces evidently designed to conserve a copious annual rainfall.

It is therefore, I think, reasonable to assume that the southwesterly monsoon currents, that visit the rest of the west coast of the sub-continent, extended once far enough north to include Sind, and that the Indus valley enjoyed originally the double advantage of regular rainfall combined with inundation, which must have rendered it one of the most fertile regions in the world.

REVIEW

CENSUS OF WOODLANDS

Forestry Commission—Census Report No. 1

GREAT BRITAIN, like our own country, is one in which, comparatively speaking, forestry as a national industry is in its infancy. The position of forestry in the economic life of the nation has hitherto not been fully appreciated. The British are, however, rapidly becoming a very forest conscious people. The lessons of two world wars are finally and firmly learned. The Forestry Commission since its inception in 1919 have tackled the problems presented to them in a very realistic manner. Their State Forests are administered in a highly organised and competent fashion. The recent Dedication of Woodlands Act, a bold and courageous step, has brought the private woodland owners within their sphere of influence. Hence they are now well placed for the development of an overall forest policy embracing the entire timber producing potential of the country. As a preliminary step this very comprehensive survey of woodlands has been carried out. As the Report puts it, " The necessity for such a comprehensive census arose from the inadequacy of existing data for the detailed planning and execution of forest policy."

The document now published is a detailed analysis of the results of the census which were outlined in the Census of Woodlands Summary Report published in 1951. The details enumerated are prodigious but they are admirably presented in logical sequence. The Report is divided into four main parts.

Part I Purpose and Methods.
„ II Census by Area.
„ III Volume and Increment Surveys.
„ IV Comparisons and Conclusions.

In Part I the keynote of the purpose is found in the phrase " for the detailed planning and execution of forest policy." A brief history is also given of previous surveys, their adequacy and/or limitations, and how invaluable experience was gained from them in establishing the method of the present survey. A detailed account of the field work, organisation and office procedure is given. In the latter case a card punching system on the Hollerith principle was employed to tabulate results. The most notable factor in the section was the almost unbelievably low cost per acre of the entire survey. This is stated to be " in the region of 6d."

The census by Area included every block of woodland of 5 acres or more in extent and more than 1 chain in width. Thus total woodland area was established. This was then classified according to ownership (State Forest or Private Woodland). The latter category accounted for 82% of the whole. For both these classes further subdivision was made

into Productive and Unproductive types. A detailed analysis is given of all types and subtypes according to countries (England, Scotland and Wales) and according to counties. An interesting section is that dealing with the composition of High Forest by species.

e.g. Oak comprises 24% of the High Forest of Britain as a whole.
Scots Pine comes next with 20%.
Sitka Spruce and Beech have 9% each.
Contorta Pine comes under " Other Conifers," which comprises 1% of all species planted.

Private Woodlands have a section comprising 40 pages which is devoted entirely to this class. This is indeed not surprising in view of the very large proportion of woodlands under private ownership. One interesting point arising out of this section is that other factors being favourable (access, location, etc.) the average size of plot considered suitable for economic management is 15 acres.

In the chapters devoted to State Forests one of the most striking features is the predominance of coniferous species in Productive High Forest. They constitute 85% of the whole. Again, the section on composition by species is of particular interest. This shows the changes in trends in species during the past 30 years. From 12% in the 21-30 year age-class Sitka Spruce has now advanced to 39%. Scots Pine on the other hand has declined from 38% in the 21-30 year class to 15% in the 1-10 age-class.

In the area survey there is amassed the basic information required for the formation of an adequate overall policy. To implement this policy, however, in an economically sound manner further information as to the volume of produce being produced on this area is required. This is provided in Part III which deals with the Volume Survey. The sampling fraction adoped was 1 in 2,000 or one-tenth acre in every 200. This provided 6,000 to 7,000 plots and the results obtained were tabulated and worked up to give a series of results giving volume per acre and total volume according to type, age-class, and species. Again Private and State woods are given separately. The following are some notable figures arising from the Volume Survey.

Total Vol. for Great Britain = 2,658.4 million Hoppus feet over bark.
(Only 14% of this is in State ownership).

Average Vol. per acre for all **productive** woodland = 1,317 Hoppus feet.

Average Vol. per acre for **all** woodland = 771 Hoppus feet.

Estimated average Vol. per acre **if all woodland areas were productive** = approximately 2,000 Hoppus feet O.B. or 3 times their present average Vol.

The Volume Survey provides figures for the volume of timber in any particular category at the Census date. To apply these figures to various aspects of management and to the regulation of future fellings a further step was necessary. That is the determination of the increment which this estimated volume was producing. Increment was determined from Yield Tables where these were found applicable, and by direct measurement in other cases. The following are some interesting figures arrived at.

Current Annual Vol. Increment, all Woodlands, Great Britain
= 97,300,000 Hoppus feet over bark.

Current Annual Increment of Productive Woods per acre
=48.2 Hoppus feet per annum.

Current Annual Increment per acre of **total** Woodland
= 28.2 Hoppus feet per annum.

Estimated Current Annual Increment under possible systematic management for all woodlands
= 70 Hoppus feet per acre per annum.

The fourth and final section of the Report deals with comparisons with previous surveys and conclusions from the present survey. Comparison with previous surveys shows a progressive increase in the total woodland area since 1871. The present position, however, shows a large increase in the unproductive area which now amounts to 38% of the whole.

In the chapter on conclusions the main points arising out of the census are summarised. The Q.E.D., as it were, is however, contained in the final two lines of the Report : " An extensive programme of restocking will thus be required if all the country's woodland is to be brought into full productivity."

Numerous appendices show Field Record Forms, Hollerith tabulation cards, Instructions for field parties, Maps showing distribution of various types of woodlands, etc., all of which well repay some study.

This report is published as a factual record of results obtained in the census survey. As such it might be considered as literature of interest only perhaps to the statistician. On the contrary, however, it contains a wealth of technical information as regards organisation of field surveys and the principles involved in forest mensuration. Every table of figures carries a message of economic importance and many are even of silvicultural significance. Criticism might be made of the degree of assumption allowed in the estimation of volumes and increments from volume tables and yield tables whose adequacy cannot be guaranteed. Notwithstanding this, however, the results are quite adequate for the main purpose for which they are required, viz., the formulation and implementation of a sound overall forest policy.

No forester, practical or administrative, should miss perusing and studying this excellent document.

—L.C.

SOCIETY OF IRISH FORESTERS

Statement of Accounts for Year ended 31st December, 1952

Income.	£ s. d.	£ s. d.
To Balance from last Account		
In Bank on Current A/C.	241 2 4	
Less. Amount due to Secretary	4 16 5	
		236 5 11
To Subscriptions received :—		
1 1st Grade Tech. 1950	1 0 0	
7 „ „ „ 1951	7 0 0	
45 „ „ „ 1952	45 0 0	
3 „ „ „ 1953	3 0 0	
1 2nd „ „ 1949	10 0	
3 „ „ „ 1950	1 10 0	
11 „ „ „ 1951	5 10 0	
48 „ „ „ 1952	24 0 0	
1 „ „ „ 1953	10 0	
9 Associate 1951	6 15 0	
81 „ 1952	60 15 0	
1 „ 1953	15 0	
		156 5 0
„ Donations : Mrs. A. Henry	15 0 0	
„ Lord Ashtown	2 2 0	
		17 2 0
„ Journals sold and advertisements		97 19 6
		£507 12 5

Expenditure	£ s. d.	£ s. d.
By Stationery and Printing		32 4 1
„ Printing of Journal ...		137 6 7
„Postages		27 5 8
„ Expenses re meetings ...		2 0 0
„ Bank Charges and Cheque Book		1 5 2
„ Secretary's Honorarium		15 0 0
„ Balance.		
In Bank on Current A/C.	316 7 5	
less. Amount due to Secretary	23 16 6	
		292 10 11
		£507 12 5

I have examined the above Account, have compared same with vouchers and certify it to be correct, the balance to credit being £292 10s. 11d. which is on Current Account at the Ulster Bank Ltd. Credit has not been taken for Subscriptions for 1951, £18 15s. 0d. and for 1952, £52 15s. 0d. which were outstanding at 31st December, 1952.

D. M. CRAIG, Hon. Auditor,
85, Harcourt Street, Dublin.

31st January, 1953.

ELEVENTH ANNUAL GENERAL MEETING

The Eleventh Annual General Meeting of the Society was held in Jury's Hotel, Dame Street, Dublin, on Saturday, 7th March, 1953. Mr. Meldrum, the retiring President, was in the chair.

The minutes of the previous meeting, which had appeared in the Journal, were taken as read and were signed. The President then called on the Secretary to read the Council's Report for 1952.

COUNCIL'S REPORT FOR 1952.

At a meeting of the Council held on 28th January, 1952, the Secretary reported that Mr. Roy Cameron had agreed to address the Society on the occasion of the Annual General Meeting. The Council arranged for invitations to the Annual General Meeting to be sent to a wide range of people likely to be interested in this meeting.

The Council also dealt with the proposed visit to Northern Ireland and made provision for the holding of a number of day excursions.

The average attendance at Council Meetings was 10.

MEMBERSHIP

During the year 4 Grade 1, 17 Grade 11 and 10 Associate members were elected.

From an analysis of the statement of accounts it can be seen that income from members' subscriptions has increased from £144 to £156.

However, over £50 was outstanding at the end of the year showing that over 60 members were in arrears.

INCOME

Income included donations from Mrs. A. H. Henry of £15 and from Lord Ashtown £2 2s. 0d. The income from advertising has again reached a high figure and the journal is self supporting thanks to the efforts of Mr. N. Morris, the Business Editor. As a result our finances are in a very healthy state indeed.

JOURNAL

Two issues of the journal appeared during the year and the Editor, Mr. M. Swan is to be complimented on the high standard of both issues. The demand for the journal continues to increase. New subscribers during the year include Soviet Russia and Argentina.

EXCURSIONS

The excursions held during the year have been reported in Vol. IX, No. 2 of our journal. The Society visited Northern Ireland on the 27th to the 29th May. The visit was most enjoyable and instructive and the Council would like to put on record its indebtedness to the Mini-

ster for Agriculture for Northern Ireland and the officials of the Forestry Service for the excellence of the arrangement and the hospitality enjoyed by our members on that occasion.

The Council also wishes to pay tribute to the officials of the Forestry Division, Department of Lands, who gave up their time and did so much to make the day excursions really successful.

In concluding this report of the Society's activities for the year 1952 it is interesting to recall that the first meeting of the Society was held in Jury's Hotel in 1942 : 31 persons were present and were enrolled. The Society can look back with satisfaction on the first decade of its activities and claim that it has pursued faithfully the objectives for which it was founded, namely to advance and spread the knowledge of forestry in Ireland. The Council looks forward to a new decade with confidence and with the assurance of the support of the great body of serving foresters and also those in active retirement and a growing circle of enthusiastic associates.

The Abstract of Accounts was then considered and on the motion of Mr. O'Carroll, seconded by Mr. Sharkey, the adoption of both the Council's Report and the Abstract of Accounts was agreed to.

PRESIDENT'S ADDRESS

Ladies and Gentlemen,

Before dealing with Forestry matters during the past year I would like to review, in briefest outline, the timber situation in Western Europe since the conclusion of hostilities.

Once the war was over the timber consuming countries of Europe, that is to say the Western democracies, were faced with a difficult problem. Their annual consumption of sawn softwoods during the inter-war years had been in the region of $4\frac{1}{2}$ million standards. To this normal rate of consumption had to be added the need for timber in the reconstruction and rehabilitation of areas which had suffered extensive war damage and the situation was further aggravated by the fact that, during the war years, normal new construction and maintenance had virtually ceased.

A very large proportion of the sawn softwoods supplied to the European market came from Russian sources but the scorched earth policy adopted by the Russian armed forces during their long retreat had resulted in an area of much more than one million square miles of their territory being completely devastated. Such widespread destruction had never previously been experienced in the course of human conflict and the restoration of such an immense expanse constituted a problem of first magnitude. It is not, therefore, surprising, that such a task meant the complete disappearance of Russian supplies to Western Europe.

When post-war problems of supply and demand were discussed at the International Timber Conference held at Marianske-Lazne in Czechoslovakia from April 28th to May 10th, 1947, the facts emerged that while demand and supply had virtually balanced during the inter-war years a new situation had arisen. In the fact of a potential demand much greater than hitherto, the estimated supplies from all visible sources to meet it had been reduced to about half their former volume.

Such a state of affairs created a very favourable seller's market of which exporters were not slow to take advantage and prices for sawn timber soon rocketed to nearly seven times their pre-war levels. Results in both Sweden and Finland from these grossly increased prices were none too happy, for in both those countries too much money was chasing too few goods, thereby creating a problem with which we also have been too distressingly familiar. Governmental action soon took the form of imposing export levies and quotas, failing which the economies of both countries would have been seriously upset.

Matters were not made any easier by the purchasing policy which had to be followed by the United Kingdom, which had always been the major European importer. That country had problems of its own in trying to close the dollar gap and, as supplies from North America and Sweden had to be paid for in hard currencies, purchases had to be regulated not in accordance with needs but in the ability to find the funds to pay for them.

One can not speak too highly of the way in which the Timber Control functioned in Great Britain under the capable guidance of Sir Edward Monkhouse during such a difficult period. The way in which the coat was cut according to the cloth available reflects the utmost credit upon those responsible for carrying out a policy which had to be sufficiently flexible to accommodate itself to circumstances as they arose.

United Kingdom purchases were subjected to violent fluctuations, in 1946 they amounted to 779,000 standards followed by 1,348,000 standards in 1947. In 1948 and 1949 they were comparatively stable at 999,000 and 1,072,000 standards respectively falling to 791,000 standards in 1950. The outbreak of hostilities in Korea with the underlying threat of a third World War and the consequent need for stockpiling of strategic raw materials caused purchases to rise to 1,627,000 standards in 1951 but in 1952 they settled down to approximately 1,000,000 standards as in 1948 and 1949. It is expected that they will remain at that level for some time unless there should be another threat of a world convulsion in the meantime.

Although not a great deal is known of what is going on in Soviet Russia it may be assumed that they have begun to overtake their arrears of reconstruction as limited supplies of Russian timber have recently made their appearance on the European market. These will probably increase as time goes on although it is not to be expected that Russia will once more assume her former position of being the major European ex-

porter. Nevertheless it is to be hoped that they will become available in quantities sufficient to stabilise prices at lower leve's than at present.

As timber is a vital raw material which enters into our daily lives in so many different ways, it follows that excessive rises in timber prices will have adverse repercussions on the cost of living, and that falls in prices will have a corresponding ameliorative effect.

Stabilisation of European prices at lower levels than at present need not disturb the home grower unduly as it is not anticipated that they will be depressed to such an extent that afforestation would cease to be an attractive long term investment either for the State or the individual owner. Prices for logs should remain good as there is intense competition from other sources of timber usage such as pulp mills, wall board factories, coal mines and so on, which will tend to maintain prices of logs for sawn timber.

The continuing timber shortage throughout Western Europe during these last six or seven years has not been without compensating advantages from a forestry point of view. It has caused the governments of the western democracies to give serious thought to the question of establishing adequate growing stocks of softwoods within their own borders and it is gratifying to note that twelve of them, including our own, have announced afforestation programmes which will add 15,000,000 acres of forests in Western Europe within the next twenty-five years. By the time these woodlands come to maturity they should produce about two million standards annually and thereby assist western Europe to meet requirements from internal sources.

To turn nearer home, our sympathies must go out to our Scottish friends in the severe loss they have sustained as a result of gale damage over the week end of January 31/February 1. It has been estimated that no less than 30,000,000 to 35,000,000 cubic feet of mature coniferous timber, mainly in private ownership have been blown down. The damage has been so widespread that several formerly well-wooded estates will not be able to return to normal for many years. It may be recalled that it is just fifty years since the night of "the big wind" when a similar catastrophe befell this country.

It is very gratifying to note that State Afforestation in this country is now making spectacular progress, largely due to the introduction of mechanical preparation of land. During the season 1951/2 no less than 15,000 acres of new plantations were established. That figure could be materially increased, without a very great addition to the labour force, but it could not be maintained without an adequate reserve of plantable land well distributed throughout the various forest centres. In this respect the Forestry Department is up against a major difficulty which cannot be resolved until a more realistic view is taken of the value of land for afforestation as compared with any other form of land use.

It has long been recognised that although certain types of land may be of low agricultural value they could make a much more important con-

tribution to national prosperity if they were under the forest. It is no more logical to measure forest land with the agricultural yardstick than to compare it with other forms of land use such as factory sites or building plots.

Acquisition of suitable forest land is more than ever becoming a matter of price and this demands a more realistic approach.

Once it is appreciated that land once purchased for the forest will be used *in perpetuo* for timber production and when account is taken of the large sums that will be spent upon it during succeeding rotations, initial price becomes an almost negligible factor. That is not to say that fantastic prices could ever be justified but there is every reason for assessing the price of forestable land on the basis of the returns which may be expected from it.

No forest service can hope to expand unless it has available a steady annual intake of plantable land and unless the problem of land acquisition is solved the ultimate establishment of 1,000,000 acres of forest can not be translated from dreamland to reality.

ELECTION OF COUNCIL

The meeting formally confirmed the election of the new Council as given on page 2. The incoming President, Mr. Fitzpatrick, then took the chair.

Election of Mr. Meldrum to Honorary Membership

In proposing the election of Mr. J. A. K. Meldrum to Honorary membership, Mr. S. M. O'Sullivan said that it might not generally be known that Mr. Meldrum had been almost 22 years in the Irish Forest Service. During this time he had never spared himself in furthering the cause of forestry, foresters, and in fact anything appertaining to woods and timber. Land acquisition has, however, been his *forte* and his record of land acquired over the years on behalf of the Forestry Division speaks for itself. In latter years he had made the Forest Service both house and timber conscious.

Mr. Meldrum, he said, had been President of our Society on no fewer than three occasions and he was also the first Editor of our Journal. He had always been a distinguished speaker at both private and public sessions of the Society's meetings.

Mr. O. V. Mooney seconded and the motion was passed with acclamation. Mr. Meldrum suitably thanked the Society for the honour it had conferred on him.

This concluded the private business and after a short interval the President called on Mr. J. McDonald, Director of Research and Forest Education of the British Forestry Commission, to address the meeting on " Forest Research in Great Britain."

The vote of thanks to the lecturer was proposed by Mr. T. Deirg, Minister for Lands, who expressed the Society's appreciation of the kind-

ness of Mr. McDonald in coming, at considerable personal inconvenience, to give us an outline of the work of the British Forestry Commission research organisation. This was not the only occasion, he said, on which they had given us valuable information and Mr. McDonald and his colleagues have always been most kind and helpful in giving us any information at their disposal.

We, in Ireland, he said, had nothing to be ashamed of in our achievements, but we could scarcely hope to compete with countries like Great Britain and Germany. We have the problem of Agriculture v. Forestry in possibly more acute form here, but the land is there, as shown by the Survey of Plantable Lands, without trespassing on agriculture. The quality of the land we are getting here, however, was inferior to what they got in Great Britain—there they get old woodland sites—and they also have the experience of private plantings to draw on.

Our resources were not great, he said, but we have a Soil Research Institute and if forest research on soils was to be developed it might be associated with Johnstown Castle—in any case research would have to be under either the Department of Agriculture or the University.

On the questions of entomology and pathology, he was of opinion, that while the information was useful we have been spared here the pests they have in England.

Mr. T. Clear, in seconding the vote of thanks, said that the British Forestry Commission research has contributed extensively to the techniques of Establishment and Nursery work, and we have benefited considerably by "picking their brains," but we have not reciprocated. Research is even more essential here than in Great Britain, because here we are facing the unique task of creating forests where trees never existed before and with exotic species, and research alone can direct us on the correct lines. Research, he pointed out, cost the British Forestry Commission only 2% (two per cent.) of their annual budget and this was a small percentage to pay for security. He could not agree, he said, that forest research should be under the Department of Agriculture, but should in his opinion form part of the Forestry Administration and should cover all aspects and operations of the forest.

Mr. Millar, of Bórd na Móna, in associating himself with the vote of thanks, said that some 7,000 to 8,000 acres of peat were at present in production and this was likely to increase considerably in the immediate future. The first 5,000 acres of cutaway will soon be available and reclamation was a problem. The term " peat " he said, was to them what " rock " was to the geologist, because peats vary so much in their composition, acidity (some may even be alkaline), origin, etc., all of which affected the methods of winning used. The nature of the subsoil, whether rock, marl, blue clay, etc., also affects the method. He thought that, as afforestation will probably follow most cutaway, research on reclamation should be by the Forestry Department. Forest research could help Bórd na Móna now, by indicating which method of winning

the peat is best suited to afforestation afterwards, also which method and type of drain at present used can best be adapted for afforestation afterwards. He also suggested the use of peat moss as a possible source of humus for the nursery and also peat moss cups for balling of roots of transplants.

He pointed out that our peats are different from those in England and he suggested the necessity for independent research here as the English results are not always applicable.

The President, Mr. Fitzpatrick, summarised the main points made by the lecturer and supporting speakers and declared himself in favour of Forest Research here, which he emphasised must be on its own and not under the Department of Agriculture.

Before concluding the meeting the President said, that as the Journal had now become almost self-supporting the Council were pleased to announce that for future issues the Editor would be able to pay up to £5 each for original articles published, subject to a maximum payment of £15 per issue. Payment would be made on the recommendation of the Editorial Committee.

Articles should, if possible be typewritten, and must be in final form suitable for publication. Reference to literature should be collected at the end of the paper, and numbered to correspond with the text. It should be understood that the author waives any copyright or translation rights in such articles and that their reproduction in other publications will be permitted, subject to the source being duly acknowledged.

He also announced that the Editor would be glad to receive photographs suitable for reproduction on the cover of the Journal and that the sum of half a guinea would be paid for each one used. A short note on the subject and location should accompany each photograph and should preferably be written on the back.

COVER PHOTOGRAPH

The cover photograph shows a specimen of the Noble Fir, (*Abies procera,* Rehder).

This beautiful tree (previously known as *Abies nobilis,* Lindley), forms large forests on the higher slopes of the foothills along the Pacific coast of North America, in the States of Washington and Oregon, where it is regarded as an important timber species for the manufacture of articles for indoor use.

The blue-green foliage and large "feathered" cones of specimen trees are a familiar sight on all the larger estates in Ireland.

It is not a major forest tree species in the British Isles as yet, but has been receiving increased attention in recent years for planting on exposed hillsides.

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