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CONTENTS

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Particulars may be had from the Secretary.

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AFFORESTATION IN NORTHERN IRELAND

D. STEWART.

Northern Ireland with less than 2% of woodland stands greatly in need of large scale afforestation. Prior to the War the woodland area in Northern Ireland, apart from small areas of under 3 acres, was approximately 60,000 acres, and of this area at least one-quarter was unproductive. Since 1939 it is estimated that at least one-fifth of the productive area has been felled. Exact figures are not available, but at least 13,000,000 cubic feet of timber has been felled.

Most of this timber has been grown in and around private demesnes of the larger estates and had been planted mainly for shelter and ornament and for purposes of sport. Timber production was a secondary object, but as most of these woods were planted on fertile soils, much good timber has been produced, often in spite of lack of proper attention.

In the main these demesne woods consist of hardwood species, but it is evident that to begin with both hardwoods and conifers had been planted. The conifers tended to be cut out early in the life of the woods.

Again, during the war period, the heaviest demand has been for softwoods.

To allow areas on highly productive soil which have been clear felled to remain unplanted would result in a heavy loss in timber resources to the community and financial loss to the owner of the land. It is, therefore, of the first importance that all felled areas should be replanted as soon as possible and that the woodland should be properly managed so that full crops may be produced. With a view to encouraging replanting of these areas the Ministry have now made available Planting Grants at the rate of £7-10-0 per acre, and in addition, are taking what steps are possible to make plants available for replanting.

State Afforestation.

State afforestation in Northern Ireland dates back to 1912. Three small estates were purchased by the D.A.T.I. at Ballykelly, Co. Londonderry; Knockmany, Co. Tyrone, and Castlecaldwell, Co. Fermanagh. The rate of planting was, however, slow and up to 1921 only a little over 300 acres had been planted.

The end of the war period of 1914-18 brought the establishment of the Forestry Commission, with control of forestry in the British Isles as a whole. Under this Body 3,000 acres were leased on Baronscourt, Co. Tyrone, and planting was started there on a considerable scale.

With the passing of the Government of Northern Ireland Act forestry in Northern Ireland came under the Ministry of Agriculture, and some progress was made with planting, and additional land at Newcastle was acquired on lease. From 1922 to 1928 an average of 350 acres per annum were planted. It was then decided to increase the forestry programme and to plant at the rate of 1,000 acres per annum, and this programme was fully carried out up to 1940. Since then, owing to war conditions, there has been a slight reduction in the area planted annually.

The area of woods and plantations now owned by the Ministry is approximately 20,000 acres. The total area of land acquired by purchase and lease is now over 34,000 acres, of which something like 6,000 acres are unplantable owing to various causes.

The area acquired in each County is as follows:—

Armagh	200 acres
Antrim	3051 acres
Down	7111 acres
Fermanagh ..	1620 acres
Londonderry ..	13236 acres
Tyrone	9097 acres

In County Armagh only 200 acres of forest have been acquired. This County has not a large area of suitable forest land and what does exist is scattered in small units. It is hoped in time to secure additional land in this County, but the forest area is never likely to be a large one.

County Antrim has extensive hill ranges, but acquisition to date has been disappointing. Much of the land which has been offered in North Antrim has been at considerable elevation and covered with deep untractable peat, unfavourable to forest planting. The glens and slopes suitable for afforestation have a high grazing value and it has, so far, not been found possible to secure any large block at an economic price.

In County Down the Mourne Mountains form the principal range. This granite formation gives little scope for planting, the soil being mainly thin and unfertile, with a thin covering of poor peat. On some of the lower slopes and outliers silurian shales take the place of granite and give much better soil conditions for tree growth.

Forest areas have been acquired at both ends of the range—at Rostrevor and Newcastle. The Newcastle area includes Tollymore Park, famed locally for the quality of the Larch grown there. This area has also produced Beech of fine quality, and a very large Silver Fir. One Fir felled recently had a volume of 670 cubic feet.

County Fermanagh offers suitable soil and conditions, especially around Lower Lough Erne, and some progress has been made in this district.

Remnants of natural forest still exists on some of the islands and around the shores of the Lough. Many communities are represented:— Ash-Alder, Ash-Birch, Ash-Oak, Moist Oakwood and Dry Oakwood.

Land annuities are high in this district and this tends to slow down acquisition, but it is not unlikely that ultimately a considerable forest area will be built up.

In County Londonderry good progress has been made. Much of the hill land is very suitable and. partly due to the fact that the soil on most of the hills is too wet for good sheep grazing, it has been possible to acquire a good deal of land for afforestation.

The rocks are mainly basalt, giving a fairly fertile soil. A great deal of peat has been removed for fuel, leaving only a thin covering of peat over the mineral soil. Where the peat remains at a considerable depth much of it is of a type which is readily plantable.

There is every indication that this County will provide land for a very large forest area.

In County Tyrone reasonable progress has been made with the acquisition of land. The main hill ranges are composed of metamorphic rocks, and the soils produced are somewhat less fertile than those found in County Londonderry, and peat is more in evidence. Nevertheless, there is much suitable land available of a type which can be depended upon to produce heavy stands of timber.

Where suitable land is obtained, hardwoods are planted, but conifers form the bulk of the plantations. A larger area of Sitka Spruce is planted than of any other species, and Norway Spruce and Sitka Spruce together occupy more than half of the plantations. Sitka is used on all the poor peaty soils and on exposed elevated areas. Norway Spruce is preferred only on old woodland and for the less exposed sites and on peaty loam or mineral soils which are on the dry side for Sitka Spruce.

Douglas Fir is planted wherever suitable conditions exist. Very fertile friable soils are avoided, as it is found that the best results are obtained on moderately light rather dry soil. Under these conditions growth is controlled and trees of good type are produced.

European and Japanese Larches are planted extensively. Certain areas in County Down and County Antrim are very favourable for the growth of European Larch. All seed supplies of European Larch are either collected at home or procured from the North of Scotland. It has been found that plants grown from Continental seed are much inferior to those produced from seed grown in the British Isles. Japanese Larch grows well on a variety of sites in all Counties. Quite good results are obtained on poor soils and very fertile soils are avoided as they tend to produce a rather coarse twisted type of tree.

Scots Pine is used only on sites unsuitable for other species and, where suitable, 12½% to 25% of *Abies nobilis* is planted in admixture with the Pine. Scots Pine does well in the Mourne area, but over the rest of the Six Counties early development is retarded by defoliation which takes place each winter and spring and which would appear to be due to climatic conditions. Once canopy is formed defoliation becomes less troublesome and usually disappears altogether.

Pinus Murrayana is used to some extent on the poorest sites and as a nurse species with Sitka Spruce on the poorer heather covered peats.

Abies grandis is used to a limited extent, but as the trees require rather fertile soils and while the quantity produced is high, the quality of the timber is very moderate, it is not thought advisable to plant this species extensively.

Hemlock Spruce is used for under-planting thin stands of hardwood and for filling up blanks in natural regeneration. It grows very rapidly under these conditions and is regarded as a tree well worth cultivating. This species, together with Thuya, is used to some extent in admixture with European Larch, 12½% of one or the other species being mixed through the Larch.

Private Planting.

In addition to their State Afforestation Scheme the Ministry have encouraged private planting by means of Planting Grants and the supply of plants to farmers and others at low price. Up to date Grants have resulted in the planting of a small area, but as recently the amount of Grant has been increased to £7-10-0 per acre, it is anticipated that as a result considerable areas of woodlands which have recently been cleared of timber will be replanted.

The Scheme for the distribution of plants has met with growing success, and over a quarter of a million plants have been sent out during each of the past two seasons. The main conditions attached to the Scheme are that not less than 1,000 plants must be taken and that the applicant should undertake to plant the trees on his own holding. Up to 1943 the price charged was 30/- per thousand, but has now been raised to 40/-.

THE IMPORTANCE OF FORESTRY IN NATIONAL PLANNING *

M. L. ANDERSON.

I feel honoured, indeed, by the invitation which has brought me before this distinguished assembly. I come before you as a representative of a very important industry—namely that of Forestry. Forestry, in spite of much talk about it, seems to remain something of a mystery. This is very largely due to excessive emphasis being placed upon its romantic side. All industries have their romantic aspects, but forestry apparently more than most. It is my intention to-day to stress the more prosaic aspect of forestry—the economic or utilitarian aspect—firstly, because I feel that it is the aspect of forestry which ought to be stressed, and secondly, because I feel that that is the aspect which will appeal most to the members of the Rotary Club.

From the purely utilitarian point of view, what is a Forest and what is Forestry? From this point of view I would define a forest as a factory for the production of certain commodities essential for the well-being of man and for his existence at the general level of subsistence to which he has now attained. The plant of this factory consists of the land plus the trees growing thereon; the raw materials for the factory are certain elementary substances—very largely secured in gaseous form from the air, but partly also in liquid form and to a still less extent in the form of solutions of mineral elements from the soil; and the power or energy upon which the plant runs is the light of the sun. When one realises the immense variety of complicated chemical compounds which the forest produces, and the vast number of commercially useful substances which it provides, one begins to appreciate the extremely high efficiency of the forest as a factory.

Forestry is the business of managing this factory to the best advantage for the production of the greatest quantity of the most valuable or useful materials, while at the same time maintaining the equipment—that is, land plus trees—at the very highest rate of productivity of which it is capable.

At this point it might be well to interject that forestry differs in one very important respect from all other industries, without exception, including the most closely related industries of horticulture and agriculture, in that, in order to maintain the equipment at its highest productivity, it is necessary to keep in being a large mass of wood capital in the form of material, that is, timber, which does not differ in any way from the goods which the factory is producing. This wood capital, which may really be regarded as the factory proper and whose maintenance is essential for the very existence of the forest, constitutes a constant object of temptation to the commercial world. It is so easy to over-cut this wood capital and, in fact, to convert it all to the immediate use of the community on extremely plausible pretexts, but without the slightest consideration for the serious destruction of productive potential which that involves. It would be well if all timber merchants were to bear that in mind. Wholesale clear-cutting of any forest and especially of one at its highest rate of production, is, in the long run, just as harmful as the dropping of a block-buster on a motor-car factory or any other factory. It is worse, indeed, in one important respect, because a new motor-car factory could probably be rebuilt and be bigger and better in a few months, whereas to rebuild a forest takes anything from 50 to 100 years, and it is not likely to be so good as the last one.

The cardinal object of forestry is to provide for what is known as the "sustained yield" which is to say, to see that the amount of goods turned out of the factory in a given period of time does not exceed the productive capacity of the factory during the same period.

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* Paper read to the Dublin Rotary Club on 21st February, 1944.

In other words, the wood capital must not be reduced in any one year by a value greater than that by which it increases during that year.

Let us now consider what the goods are which the forest as a factory turns out. It would be inadvisable to burden your minds with too many figures and statistics, especially as they are not always very reliable in respect of forestry matters. It has, however, recently been calculated that for normal life each human being requires no fewer than 400 mature trees of average size. We are obviously not all able to grow and maintain a forest area large enough to provide these 400 trees, no matter how willing we may be to do so. We have, therefore, to rely on the forestry industry to do this for us, whether it is done here in this country or somewhere else on the earth's surface.

By far the most important produce of the forest is, of course, timber, which even in its natural state is exceedingly variable in respect of quality and characteristics, not only because of the great number of different tree species in the world, but also because of the differences within each species, due to varying growth conditions, age, etc. These variations make timber in its natural state suitable for a very wide range of commercial purposes.

Broadly speaking, as a result of recent progress in chemistry, there are now—if we except the charcoal industry—three main forms in which timber as a raw material for other industries reaches these industries. In the first place, it is employed in a form which has not been subject to conversion by chemical processes, that is, in its natural condition, which has made it useful from time immemorial for constructional work of all kinds, from ship-building and house-building to the building of match boxes. The timber when in this form is converted mechanically by being cut up into pieces of the required size and shape, either for immediate use, or the pieces are joined together again to form structures of all kinds—and I would include plywood and laminated beams, etc., in this category—in which, however, the natural internal structure of the timber itself remains unaltered. A modest few of the uses to which timber in this form is put are building construction of all kinds (some 75 millions of the inhabitants of the U.S.A. still live in wooden houses), ship and boat building (an ocean liner consumes over 40,000 cubic feet of wood in its contruction), furniture making, with or without veneers, vehicle building, railway sleepers and waggon and carriage-making, telegraph and transmission poles, agricultural machine making, packing cases and wooden container making, mining timber of all kinds, fencing, firewood, musical instruments, sports goods, boot soles, peasticks. clothes pegs, pencils and toothpicks.

The second form in which timber as a raw material reaches other industries is after it has been put through a mechanical or chemical process which breaks it up and separates its structure out into the small fibres which compose it. It is then available in the form of wood-pulp for rebuilding and moulding into such important materials as paper of all kinds, cardboards, and, when mixed with other materials and subjected to compression, wall-boards of various kinds. an improved type of plywood, and a wide range of so-called plastic substances, from which many small fittings are made, the number of which constantly grows.

The third, and what will probably eventually prove to be the most important form of all is that in which the timber as a raw material will reach other industries and enter new markets in the nature of various materials derived by the conversion of the wood substance through chemical action. That is to say, the wood is used as a chemical raw material and this use is based on the possibillty of further converting the cellulose of the fibres and other components of the wood into certain synthetic compounds. Some of these are already important commercial commodities, for example, rayon or acetate silk, cell-wool for use as a textile, photographic films, cellophane, artificial sausage skins, glycerine, artificial camphor. wood alcohol, acetone, turpentine, etc., while prospects have opened for the manufacture from timber as a raw material of artificial glass, rubber, soap, sugar, molasses, yeast and animal fodder. No wonder that wood has recently been declared to be the scarcest raw material—and the universal raw material.

One feature of first-class importance concerning the third form of usage just described is that it can be applied to the sawdust and small waste material which in the first or original form of timber usage has been estimated to amount on the average to fifty per cent of the whole tree. For the second and third forms of usage the technical qualities of timber for which it is so highly prized when used mechanically are of very little importance, as the timber is either ground or converted into small particles and the qualities of toughness, strength, elasticity, straight and even grain, durability, etc., cease to be of major importance. An inferior quality of timber can thus be utilised. This is of some considerable importance in this country, where the production of soft-wood timber in quantity is much easier than producing it in quality.

I have dealt at some length with the variety of purposes for which timber as a raw material is suited, mainly with the object of showing how the number of its uses has steadily increased and is steadily increasing. One sometimes hears it suggested that there will be less demand for timber in the future. as it must be replaced to a great extent by other substances, such as steel and cement. Experience has shown, however, in the past, that in spite of the substitution of steel and cement in constructional work, both in house and ship building, the all-over demand for timber in these same industries has increased. A vast amount of timber of new kinds and forms has come into use for interior dcoration, etc., in these industries. In the period preceding the emergency the consumption of all forms of timber and timber products, especially of paper goods, throughout the world was rapidly increasing. Between 1911 and 1929, that is in 18 years, the demand for artificial silk in the U.S.A. increased by 60 times. In the same country the demand for newsprint has increased by 2,000 times in the past 125 years. In the U.S.S.R. the plywood industry has increased by six times since 1913, and the Soviet mining industry has increased by 5 times in in the same period.

In the period following the emergency it is as certain as anything can be that the demands for timber and forest products will continue to expand. first of all, on account of the vast amount of constructional timber needed to make good the damage to buildings and dwellings in Europe and elsewhere ; secondly, to make up for the building which has had to be postponed everywhere owing to war, and thirdly, because it is to be expected that certain hitherto little developed countries, the Soviet Union, for instance, will show the same tempo of industrial development as has been displayed by the United States in the past century, and this must inevitably result in the making of vast demands upon the forests.

Hence, it is abundantly clear that there will be considerable competition after the emergency for the supplies of available timber. Countries with an excess of timber or which could increase their exports over their pre-war figures are very few indeed. Countries like Great Britain, Germany, Italy, Holland, Spain. and even the United States are already great importers. Countries like Sweden and Finland have now reached the limit of the cut possible under sustained yield. Probably Canada and the Soviet Union are the only two countries capable of increasing their softwood timber cut and exports over prewar figures. Incidentally, the position of the U.S.S.R. in this respect should be particularly strong as within the Union stands one quarter of the total forest area of the world, two-thirds of it consisting of softwoods, and the Russians appear to be fully determined not to follow the bad example of America in allowing the wholesale destruction of the natural forests. The U.S.S.R. has included forestry in its national planning as one of the most important industries, and the planning appears to be on the soundest of forestry lines. In one forest zone alone the Soviet Union has planted in 12 years a total of 2,625,000 acres, or over 200,000 acres a year. In 1938 the massive total of 573,700 acres was planted—in one year alone. During the forty years of its existence the U.S.A. Federal Forestry Administration has planted very much less.

From what I have said I feel certain that everyone here would subscribe to the view that in the national planning of any country, and of this country in particular, it is important that every effort should be made to build up the industry of forestry to the fullest extent possible, because it is clear that even if the timber famine, which has so often

been predicted for more than a century at least, is not realised—and I am not predicting it now—the heavy, world-wide demand for forest produce must greatly enhance the value of the forest and from a national point of view alter the former relationship between forestry and the other land-using industries to the advantage of forestry. This must make it desirable to grow as much as possible of the home requirements of timber and forest produce internally. Forestry must, therefore, have an important place in national planning, as one of the important users of the national resources for the production of essential raw materials.

I believe there is widespread and general agreement with that point of view, to judge from the disappointment which is often expressed at what is considered to be the failure of governments to deal with the problem. It is one thing, however, to have an idea. but it is another to put it into effect. This is especially true in a country with such an old established civilization as Ireland, when the idea is one which is concerned with the use of the land. The fact has to be faced that all the land in this country is in the ownership or occupancy of some individual or corporate body, who must be presumed to be utilizing it for some purpose. The fact has also to be faced that the land is divided up, probably to a degree unparalleled elsewhere, into innumerable small farms and holdings. When these sub-divisions were made unfortunately forestry was of little consequence and secured no consideration. Consequently the land area better suited for forestry than for farming, and which, in a new country, like Australia, could have been definitely set aside for forestry purposes, was nearly all divided up, largely for attachment to farms or, what is worse, converted into commonages. upon which a number of farmers obtained grazing or other rights. That is a situation which makes the development of large-scale afforestation—and afforestation is merely the process of building forest factories—extremely difficult.

Consequently, the best has to be made of the position by scaling down the size of the forests and by establishing them widely over the country in the hope that the normal processes of land acquisition of small areas which can be attached to existing forests will ultimately result in the conversion to forestry use of all land suited for forestry and less valuable economically for agriculture.

The only other possible course, and it is sometimes suggested, is to apply compulsion, which means in effect taking land from the present owners or depriving the owners of grazing and other rights of these rights in order to make land available for forestry. These people have not only to be adequately compensated, but in many cases have to be given an alternative means of living. The seizure of the grazing land and commonages attached to holdings will usually leave the remaining arable areas uneconomic and will certainly cause distress. Then again, the payment of excessive compensation when acquiring land for forestry purposes might easily upset all the land values in the country.

It seems essential, therefore, in any national forestry plan to avoid any drastic dislocation of the existing rural economy and land values and to continue trying to acquire quietly and as expeditiously as possible all areas of waste land definitely capable of growing trees, but which other land users are prepared to part with at a reasonable price.

It is unfortunate in some ways that forestry is not adapted for private enterprise, at least where the process of afforestation or building up the forest has first to be undertaken. There is little enthusiasm on the part of private enterprise to promote forestry for the simple reason that there is no return on invested capital for a long period of years. Nevertheless, private enterprise is still capable of helping by planting quite small areas of waste land on farms and estates, not better suited for farming purposes. In the aggregate these could amount to a considerable area and the existence of woods has other important advantages besides that of producing commercial commodities. Their aesthetic value for example, especially in a flat country. is very important.

Leaving statistics for private forests out of account, as they are not very reliable, the land area so far acquired by the State for forestry

purposes in this country amounts to over 156,000 acres, of which 112,000 acres are now covered with satisfactory woods and plantations. The number of forests is 118, averaging about 1,500 acres each. Some of the purchased woods are between 50 and 100 years old, and the oldest State plantations will soon be 40. The time is relatively not far ahead when the State Forest Service will be faced with another very difficult problem, and that is the large-scale marketing of the produce This will not be easy until the annual production becomes considerable. It will be impossible to dispose of all the material produced in local rural markets. It would, therefore, be invaluable if manufacturers and business men in the larger cities were to be mindful in the future of the help which the existing woodlands have provided during the present emergency—and could provide in future emergencies—and were to make a point of encouraging the use in every way possible, however small, of home-grown forest produce.

From a forestry point of view it is unfortunate that over one-third of the population of the country lives in 10 seaport towns. to which the transport of such a bulky commodity as timber by sea is relatively easier than its delivery overland. This means that these urban populations are not so fully aware of the possibility of obtaining some, at least of their requirements—of timber, for example—from the interior of the country, as they might be. Their interest in forestry is usually more academic than practical. I hope my address to you will have done something to encourage you to believe that forestry is of very considerable importance in the planning of the national economy, not only to the rural population, but also to the urban communities, and that it will be much more so in future.

ROAD CONSTRUCTION AT GLENDALOUGH STATE FOREST

J. J. MAHER.

In this short article it is hoped to give some account of the many difficulties, the many interesting problems met with and surmounted during a short period of road and bridge construction at Glendalough State Forest.

For those who do not know Glendalough it is necessary to describe briefly the peculiar topography, due geologically to the over-deepening of a pre-existing valley by local glaciation at the end of the Ice Age. This resulted in a comparatively narrow, steep-sided glen, gouged out of the rock to a depth of some 300 feet below the original level. It extends in elevation from 450 to 1,000 feet, with often a slope of 1 in 2 (1 foot rise for every 2 feet horizontally) and occupies only a very limited area. Above this are comparatively gentle slopes. rising to 2,000 feet, on which exists the bulk of the forest property of Lugduff and Derrybawn, which the road system was intended to serve.

The problem, it will be seen, was to make accessible the considerable area of young plantations on these upper slopes by negotiating as directly as possible the steep glenside with a graded motor road. The only possible road site was the old zig-zag cart road, cut through schist soil and rock, on Derrybawn, near Poolanass waterfall. It climbed in traverse arms steadily and steeply, with an average gradient of 1 in 7, and, though only serving in itself this limited area, it was the gateway, the main artery, to the upper slopes.

To make usable this old cart track for lorry traffic, three things required to be done:—

1. Widening of track to 12′ by cutting into slope.
2. Substituting curves for sharp angles at turning points.
3. Easing of gradient at bends and superelevation.

Except for the blasting of some rock, the widening did not present any great difficulty. Special attention had to be given to the question of turning points.

Turns.

Two of the turns on the zig-zag track were marked by eye, while the remainder were marked by using the method outlined below. See Fig 1. In using this practical method of setting out a curve, the choice of radius must be made on the ground available for turning and the starting point must be obtained by trial and—possibly—error. Text books usually specify 50′ as optimum radius, but in really difficult ground such as this, radii of 30′ and slightly less had to be used. Incidentally it should be remembered that the radius refers to the centre and not to the margins of the road.

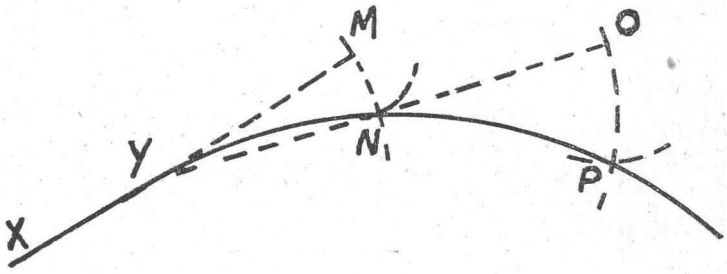

Fig I

For a curve of 50′ radius and starting point Y on road X.Y., proceed as follows. With Y as centre and 25′ radius describe an arc passing through M, a point in line with X.Y. With M as centre and 6¼′ radius describe an arc cutting the previous arc at the point N. This is the first point in the curve. Now, with N as centre and 25′ radius describe an arc passing through the point O in line with the chord Y.N. With O as centre and 12½′ radius describe an arc cutting the previous arc at the point P. This is the second point in the curve. To complete continue as above, using 12½′ offset, and ease off to the other road arm. The above practical method is based on this simple rule for forming a circle :— "The offset is to the chord as the chord is to the radius." For a road curve the first offset will be half the normal offset being taken from a tangent and not a chord.

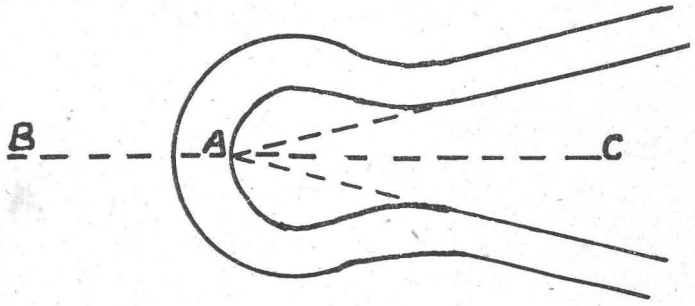

Fig II.

The use of this straighforward method on the zig-zag turns led to complications on account of the acute angle between the meeting road

arms, and the steep gradient of the bend. In fact it was found necessary to use a turn of the type illustrated in Fig. II. In this turn the straight road arms approach one another closely, and then diverge in a wide sweep. the inner margin of the bend being around the intersection of the produced road arms. In this type the curve gradient need not be greater than the gradient of the road arms. The further from the point A along the line A.C. that the curve is marked, the greater the curve gradient and, conversely, the further out from the point A along the line A.B. it is marked, the easier the curve gradient, until a point is reached when it is practically level. See Fig II. To ease the curve gradient of curves along A.C. and to eliminate a common fault, i.e., an oversteep turn higher on the inside than the outside, the gradient of the upper and lower arms must be increased to an undesirable and impractical degree and at great expense. Bends, to be of practical value on a zig-zag like Glendalough, must be marked out along the line A.B. where the easing of gradient, if required. may be accomplished by only slightly increasing the gradient to and from.

Superelevation :—Is the inward canting of a bend and is formed by elevating the outer edge above the inner edge. This counteracts the centrifugal force which tends to swing a lorry outwards when negotiating a bend, by the inner displacement of the centre of gravity of the lorry. The degree of superelevation will depend on the radius of the turn ; the smaller the radius, the greater the superelevation required.

Embankments.

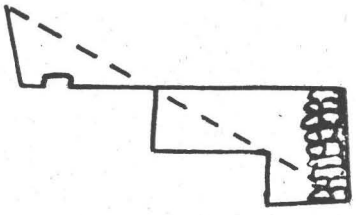

Fig III

Having marked out the proposed site of bend or straight road on steep slope where building of embankment was necessary, the slope was levelled in steps (or terraced) to the required foundation height ; the width and depth of steps depending on gradient of slope. The first step should protrude beyond the proposed outer edge of the road a distance great enough to ensure gentle sloping of embankments and approximately 2′ margin between edge of embankment top and road (see Fig. III.). Low embankments were built with soil and rubble, well tamped in shallow layers by a workman shuffling over the surface and at each shuffle pressing heavily with his feet. To stabilise and retain the embankment on steeper slopes a revetment wall was added. This wall was built with large stones, the foundation stones being embedded at right angles to the incline of wall, i.e., sloping inwards, and each course was placed approximately 2 inches inside the preceding course. This should be impressed on workmen as they tend to build perpendicularly. Large roots and boulders were not used as far as possible through the soil and rubble, as this would tend towards uneven settling of foundation. On gley and peaty areas a closely-packed layer of conifer prunings was laid on the surface before building commenced. Boning rods are most useful for finding the required depth of building.

Drains and Culverts.

On steep slopes and in districts of high rainfall, preparation of road site without at the same time making ample provision for a drain on the upper side, and for sufficient culverts, is merely a waste of time

and money. The absence of drains results in the sweeping away of road metalling, and sometimes even of soling and foundation. On the other hand, the presence of drains without making ample provision for leading-off of flow by use of culverts will result in severe undermining of road in a short time. One flood will be quite sufficient. When marking out the road ample width was allowed, where possible, for a drain on the upper side. This was levelled 6″ above the road foundation and then the drain marked and sunk, leaving a bank about 1′ wide between road and drain. (See Fig. III.).

The culverts were placed at varying distances apart, depending on the topography and road gradient. Complementary culverts were also built just above and below the zig-zag bends, which ensured easy run-off of water and saved bends from being undermined. Water from some of the culverts on the zig-zag flowed to lower arms of the road causing severe cutting of the drains. To carry this water away from the lower road or to direct it to a culvert, contour drains had to be sunk. To avoid severe undermining and cutting of these contour drains during high flood period, they were marked out some distance below the culverts so that the water from the culverts could enter them as surface water. The actual building of the culverts, 9″ square, was simple, well-faced stones and "flags" being available. Oak or larch poles could also be used instead of "flags" for covering, but this is not so satisfactory. The "flags" or poles should not be higher than the level of the road foundation, as the soling and metalling absorb the shock and distribute the weight of the passing load. All culverts were built at right angles to the road and had only slight fall to prevent undercutting.

Soling and Metalling.

Having prepared the levelled, graded foundation as above, the final steps were soling and metalling. The former consists of a layer of large stones (6″ approximately) which, in County Council work, are simply spread and rolled in. As a steam roller was not available for forest work, it was necessary to pack the stones closely by hand. The stones available—mainly schist slabs—were rather flat, and they had to be built standing vertically, so that when subjected to load they would bind tightly. If laid flat they tend to rock and remain loose. On one section where, during a rush period, the stones were not so laid, rutting has become very troublesome. Ideally, the soling should not come in contact with the wheels, but should be permanently protected by a layer of smaller stones—the metalling. Hard rock, i.e., silurian and quartzite, were used for this layer as far as possible, but unfortunately, owing to scarcity, long haulage and anxiety to push ahead to enable timber extraction to begin, schist, where plentiful, had to be used. This rock is practically useless for metalling; being soft and extremely fissible, it tends to form a tenacious mud when subjected to heavy traffic during rainy periods.

Bridges.

The most interesting, yet the most difficult, problem was the erection of two bridges, one having two spans of 11′, and the other one span of 15′. Both were built over boulder-strewn mountain streams; rivulets in summer and rushing torrents in winter. The location of the bridges had to be selected with regard both to the road and streams. As far as possible, in this instance, they had to be built so that the road could curve gently to and from and at the same time be at right angles to the flow of water. This required much preliminary examination of sites, marking of trial sites, etc., but amply repaid the time so spent, as once the proper sites had been selected the work proceeded quickly and efficiently.

The following is a short outline of the building of the two-span bridge. This was marked out by using a twine line accurately squared by checking the diagonals. The water was then diverted into a prepared channel at one side, and the boulders turned down stream. These boulders were used afterwards to form the new stream bed, which sloped gently to and from the bridge. The foundation was then sunk 2½ feet. It was 16′ long to allow for abutments. This was levelled, using concrete 3 : 1 mixture of sand and cement. The sand was tested for purity by shaking some with water in jam jars and leaving over-

night to settle. All tests showed only slight traces of dirt. The foundation wall, about 3 feet wide, encased between timber panel (or mould) and the bank, was then built, using the above mixture, with stone filling. It was levelled at about 1 foot above the proposed new stream bed. The stones used in filling were placed 4 inches apart and about the same distance from the edge of the panel. All stones to which clay or humus adhered were washed, and all round stones broken to ensure good bonding. Each course of cement was tamped with a small stick, and from time to time, and at the end of the building a workman tapped the outside of the panel with a hammer. This gave a very smooth wall.

The pier was then built on the foundation wall, using 5 : 1 mixture of sand and cement. It was 2′ wide, 13½ feet in length at the base. The ends tapered 2″ for every 2 feet in height. This allowed sufficient length to embed guide rail hooks at both ends. This pier, when built to the required height, was levelled by using carpenter's level and straight edge. The outer edges to carry the guide rails were built level with the proposed level of the decking. The other side pier was similarly built. The centre pier differed in that two panels had to be used. These were held the required width apart by passing plain wire through the panels, and round opposite battens and twisting it between the panels until it pressed tightly to laths of the required width. The tops of the laths were held in position by cross laths nailed to battens. This formed a rigid box which, when quarter filled with concrete, could be pushed into the vertical. It will remain in this position unless subjected to a strong force.

Having built all the piers to the same level, nothing remained to be done but lay the timber girders and decking. To disperse the weight evenly along the walls 5 larch girders, approximately 8 inches square, were laid on wall plates 3 inches in depth. The girders were 1½ feet apart, one at the centre and two on either side. Owing to the width of the two spans, two sets of girders had to be used. These were joined at the centre with a scarf joint. The flooring, 9″ x 3″, and guide rails were then laid and flooring cut flush with outside of guide rails.

The second bridge was built with round timber. Four girders were used, two iron and two round larch girders with average diameter of 15 inches. No wall plate was used, all girders were levelled and then embedded in the concrete. The decking, consisting of round poles approximately 5″ in diameter, was then laid. Every fifth pole was pegged to the wooden girders and acted as tightening pole, the fourth pole being slightly wedged between it and the other three.

The new road was opened for lorry traffic on the 9th December, 1944, and, while there are still a number of minor improvements to be carried out, it is already proving of use in serving a large area of rapidly developing plantations which could not otherwise be exploited. Considerable quantities of poles and firewood are now being extracted and much more will become available later on. Its efficiency is such, that even after the very heavy rains of last autumn it has been successfully and safely negotiated by convoys of ten lorries at a time, which have removed materials from an area to which horse-drawn vehicles could formerly be taken, only with the greatest difficulty and with the lightest of loads.

SITKA SPRUCE IN IRISH FORESTRY

F. McMAHON.

Amongst the many conifers introduced into Ireland there is none of such economic importance as the Sitka Spruce.

The Sitka Spruce was first planted in this country about 80 years ago and the very fine specimens found here and there would indicate that it was planted mainly as an ornamental tree on estates and parklands. It may be of interest for me to mention some particulars regarding these. The tallest Sitka Spruce appears to be growing on the estate of the Duke of Abercorn at Baronscourt, Co. Tyrone. According to recent measurements it is 140 feet high and has a girth at breast-height of 12ft. 6 ins. Other fine specimens over 100 feet high are growing at Curraghmore, Powerscourt, Headfort, Clonbrock, Ballyfarnon, Glenstal, Shelton Abbey and Emo Park; from 90 to 100 feet at Killarney and Fota, and from 70 to 90 feet at Rockingham, Blandfort, Ards, Adare, Castlefreke, Kenmare and Ballyduff, Co. Kerry. All the above are individual trees and carry branches very low on the stem, with the typical swelling at the base of the stem.

Sitka Spruce was not planted as a forest tree until early in the present century, and some of the pure stands of this species which we find to-day are really the outcome of plantations where Sitka Spruce was used in mixture with Norway Spruce, European Larch, Scots Pine and *Thuia*. The Sitka Spruce, being a fast grower, soon got away from these other species and soon had more growing space than it required for full development.

Except for an experimental plot at Avondale, Co. Wicklow, which appears to have been planted about 1905 or 1906, Sitka Spruce does not appear to have been used in the form of plantations before 1909. From 1909 we find it was planted at Camolin, Dundrum, Kilrush, Knockmany, Co. Tyrone; Mountrath; Tardree, Co. Antrim, and elsewhere.

Most of these plantations were mixed, mainly with Norway Spruce, but some other species were used. Most of these earlier plantations have been felled or heavily thinned during the recent war period, and the Sitka Spruce, which had in nearly every case suppressed the Norway Spruce early in the life of the stand, had been growing under conditions resulting in rough or tapering stems, but also in the production of a very large volume per acre.

Two examples are worthy of special notice. One, and I should say it is the best, occurs in the form of several plots of pure Sitka Spruce on the Lough Eske estate in Co. Donegal. These were planted with European Larch and *Thuia*, and now after 35 years, furnish some of the finest, if not the finest, Sitka Spruce trees in Ireland.

The other was planted in 1916 on the Ballykelly State Forest, Co. Derry, on an area of about 1½ acres.

The plots on the Lough Eske Estate, which were planted in 1910, and which now contain individual trees 100 feet high with breast-height girths of 3ft. 6ins. to 6ft., must, I think, show the best height growth. These trees are growing now in close pure stands and, I should say from a commercial point of view, are second to none in Ireland to-day.

Natural Habitat of the Sitka Spruce.

According to "A Handbook of Coniferae," by Dallimore and Jackson, the Sitka Spruce (sometimes called Great Tideland Spruce, Menzies Spruce, Silver Spruce, Tideland Spruce and Western Spruce), "extends further north-west than any other N. American conifer, its westerly limit being the east end of Kadiak Island. It extends through the coast region of Alaska, British Columbia, W. Washington, Oregon, southwards to N. California, rarely extending inland more than 50 miles."

It is indigenous in a great tract of country lying between the western slopes of the Coast Ranges and the Pacific Coast, where the climate resembles that of the western coast of Ireland. Perhaps the following information respecting the climate from one part of its natural range will convey a clearer picture of the rainfall conditions than the quoting of a whole mass of figures. At this particular station—on the Sitka Sound—it rains or snows for 208 days in the year. The mean annual rainfall varies throughout the natural range of the Sitka Spruce from 40 to 120 inches, being given as 88 inches for Sitka Sound. I am sure there are some places in Ireland where similar conditions occur, and the fact that the Sitka Spruce flourishes in such conditions is a point in its favour here. For comparative purposes the following figures, kindly supplied to me by the Meterological Service, Department of Industry and Commerce, Dublin, of recorded mean annual rainfall for a number of stations in the western counties of Ireland for the period 1881 to 1915, may be of interest:—

Co. Mayo, Delphi Lodge—99.00 inches.
Co. Kerry—Gap of Dunloe—94.00 inches.
Co. Galway, Ballynahinch—61.00 inches.
Co. Sligo, Markree—43.53 inches.
Co. Cork, Roche's Point— 41.88 inches.
Co. Donegal, Malin Head—39.60 inches.

In its natural habitat Sitka Spruce grows to 160—180 feet. and occasionally to 200 feet, with a trunk girth of 24 feet to 36 feet or more above the buttressed base, but ordinarily 100—125 feet high, with a trunk 9—18 feet in girth.

Exposed trees such as we have—those mentioned above—are broadly spreading and pyramid-shaped, but those grown in pure stands, close together, have fine clean timber, gradually tapering and free of branches for 40 feet and sometimes 80 feet.

In parts of Alaska, where the Sitka Spruce is found up to 3,000 feet above sea-level, the tree gets smaller after it passes 1,000 feet above sea-level, those found at the 3,000 feet mark being nothing more than shrubs.

The tree was first discovered by Archibald Menzies, the distinguished traveller, after whom it was first named by Lindley. It was not introduced into cultivation until 1831 in Britain, and at a much later date in Ireland.

Professor Sheldon in his book, "The Forest Wealth of Oregon," calls it the largest tree in the State, and says it is distinctly a moisture-loving tree, and in an extensive coast belt is an ideal lumber tree.

In California it grows on rich alluvial plains, at the mouths of rivers or on low valleys facing the ocean, where it is found associated with *Sequoia* and *Abies grandis*, and this may be said to be a region where there is perennial moisture in the air and a rainfall of 50 inches and upwards.

Sargent says its growth is rapid, the leading shoots on young trees in Puget Sound being from 3 to 4 feet.

Nursery Treatment.

Sitka Spruce seed is small (about 200,000 to a lb.) and exceptionally fine digging and raking and breaking of the soil is necessary. Sown usually at the rate of 1 lb. to 40 yards of 4 foot bed and lightly covered. A mixture of leaf mould through the fine soil is an excellent cover. A light mould soil is recommended for Sitka Spruce and shelter from sharp winds is desirable. The seed is sown in April or May, and in some nurseries it would be wise to cover the seed with sand, as the seeds are so small that they often dry out, resulting in complete failure. Sand as a dressing is also necessary to diminish danger from damping off and frost lift. The latter seems to be the greatest worry for the nurseryman, but this can be corrected by proper drainage of the seed bed.

Lined out at two years, the seedlings should be given ample space for development above and below ground, and it is usual to line them out 10 inches between lines and 3 inches between plants.

Sir John Stirling-Maxwell on his estate in Inverness-shire, Scotland, has used Sitka Spruce in his system of employing "flying nurseries," in which the seedlings are first planted out in turfs clustered closely together and after a year or two moved to their permanent position along with the turfs on the adjoining moorland. These flying nurseries need not be very extensive and each one should not contain more plants than will stock 1½ to 2 acres at a spacing of 5 feet by 5 feet. Sir John carried out extensive experiments on moorlands and incidentally says in his booklet—Loch Ossian Plantations, 1929—"of all trees we have tried Sitka promises the best return." He says that it is very much less subject to frost damage than at lower elevations and that one merit peculiar to Sitka is the ease with which it can be transplanted when grown on turfs.

Subsequent Cultivation.

Although Sitka Spruce loves a wet climate it loves a wet soil even more and soon becomes unsightly and loses its foliage in dry localities. No conifer except the Douglas Fir grows so rapidly where it has suitable conditions, and in some parts of Ireland it is growing where it would be hard to get any other conifers to live. Owing to great resistance to wind, Sitka Spruce, where conditions are favourable, is eminently suited for bleak mountain slopes and it does well near the sea.

Sitka Spruce with turf planting may be said to have opened up a new era for forestry in Ireland. On poorer moorland soils the volume of timber produced by Sitka far exceeds that which Norway Spruce will produce on land of this type. At low elevations on old woodland and on fertile soils Norway Spruce produces heavy stands of timber, but on higher, more exposed and less fertile types of land, Sitka Spruce is to be recommended and has already proved itself a better tree, especially when grown in pure stands. Norway Spruce will thrive on soils hardly moist enough for Sitka Spruce, but, I may add, that on such soils many other species can be grown. As long as there is sufficient moisture in the soil Sitka is very accommodating, but it will not thrive on water-logged soil or on one deprived of air by a tight peat skin. It will not grow well on dry peat as indicated by heather, but will grow on grass-covered peaty soils. Where it is planted on soils covered with grass and heather it will often do quite well for a time, but it is safer not to take a chance with Sitka on such ground.

Where there is any doubt about excessive moisture in the soil it is advisable to plant Sitka on turfs. It is much cheaper than carrying out extensive drainage. Sitka Spruce, being a shallow rooter, thrives well when planted on turfs and it is remarkable the difference it makes when the trees are planted deeply in pits, as the roots usually die or the plants remain in a state of check, living on their own vitality until a new root system develops from the collar. This is, in my opinion, the cause of very uneven height-growth in many young Sitka plantations.

In cultivation Sitka Spruce suffers from frost damage and may remain in a state of check for a number of years, until, as examples show, the plants get above the frost line and growth becomes normal. In an area planted in 1935 near Dunmanway, for example, growth has been so badly checked by frost that after ten years the largest trees are not yet more than 9 feet high. Similar cases have occurred elsewhere.

In cases where frost hollows are recognised or even suspected, Grey Alder should be planted two to three years before the ground is stocked with Sitka Spruce. I do not consider the planting of Alder at the same time as the Spruce any immediate advantage, and in nearly every case the Sitka Spruce are damaged beyond recovery before the Alder provide the all important cover.

Another feature of the Sitka Spruce which causes many foresters to dislike it is the blowing out of the half-ripened shoots and the formation of double leaders. I do not consider this any just reason for

any person to denounce it as a poor forest tree. I have observed this on Sitka, but I think that only a small percentage of the trees suffer and it is not likely to cause permanent damage to the crop. I have heard it said that trees grown from seed of Queen Charlotte Island origin are less subject to damage from the breaking of leading shoots and less from frost damage.

Sitka Spruce also suffers from attacks by an aphis, but so far no permanent damage appears to have been noted in this country. If large blocks of Sitka are broken up with belts of other conifers or hardwoods where the soil and situation suit, there is not likely to be any danger of the spread of this pest.

Height growth is normally from 2 to 2½ feet per annum, but many instances have been noted where growth has been 3 feet and even 4 feet yearly. I have never observed Sitka produce a second annual growth.

It has, I am sure, been noted that I favour the formation of pure Sitka Spruce stands, but I am aware that certain mixtures have been tried. It is claimed that a mixture of hardwoods lets in the light and checks the formation of raw humus, lessens the danger of wind-throw and may be a protection against frost. Such a mixture requires attention however. Part of a plantation laid down in Killeshandra State Forest in 1932 on an area of old woodland suffered because of the presence of too many alder birch and other shoots, and it was only when the Sitka Spruce were freed by the removal of some of these that they showed anything like normal progress. In an adjoining compartment, where the trees were planted on unwooded ground, the Sitka Spruce made excellent growth and are now nearing the thinning stage.

I am indebted to Mr. M. O'Beirne for information about another interesting mixture of Sitka Spruce and Japanese Larch which was planted in 1904 at Avondale. The Larch outgrew and suppressed the Spruce and after twenty years the former were almost all removed. The Sitka Spruce made a remarkable recovery and showed normal growth and increment. One would never think that the Sitka had ever been suppressed to judge by the present appearance of the plot.

At Pettigo State Forest in Co. Donegal there is now one of the most extensive tracts of young Sitka Spruce plantations on difficult moorland soil, consisting of a deep water-logged peat, mostly between the 400 and and 700 foot contour lines above sea-level. The vegetation was mainly *Molinia* on the planted areas, with occasional rushes and bog myrtle. Planting was begun in 1937 and was exclusively carried out on turfs at a spacing of 4½ feet by 4½ feet. The tallest of the Sitka Spruce are now about 20 feet high, but height growth is not uniform and some years must elapse before the stands will reach thicket stage.

Thinning.

In the ordinary course, thinning of Sitka stands should commence when the trees are 25 feet high and should be continued at intervals of three years. In well-stocked pure stands the trees are free of side branches, but it may be necessary to do some brashing of the lower branches a year or two before the stand is due for thinning.

In pure stands the number of trees per acre will vary from 1,200 to 1,700 according to the original spacing when the stand is ready for thinning. When the stand has reached maturity there will probably seldom be more than 250 trees per acre. In other words, 80% to 85% of the trees will have disappeared before the end of the rotation, which I would put at about 55 years of age. In addition a certain number will already have been lost during the first 15 years or so of the life of the stand owing to natural deaths. The majority of these trees, however, in a well-managed plantation are deliberately cut out. Neglect to carry out thinning at the proper time causes permanent injury to the crop and may lead to severe damage from wind-throw.

The grade of thinning suitable for Sitka Spruce is, I suggest, one in which many of the weaker dominants are removed as well as whips injurious wolf trees and any suppressed or sub-dominant trees not required for ground cover.

Yield.

I have endeavoured to collect some particulars of yield and rate of growth from some stands of Sitka Spruce in Ireland, and I have specially to thank the following for kindly supplying the figures quoted and for giving permission to publish them:—Mr. Scott McD. Swan, Lough Eske; the Forestry Division of Northern Ireland and the Forestry Division of the Department of Lands, Eire.

The first figures refer to the plot of pure Sitka Spruce planted at Ballykelly in 1916 on a fairly deep peat over heavy clay in a sheltered position at an altitude of 100 feet.

This plot has had four thinnings and in addition special poles have been removed for urgent war purposes. The fellings were heavier than normal owing to danger from wind-throw due to the clear-felling of an adjoining area. A sample plot of a tenth of an acre, recently measured. gave the following figures:—

	1939	1945
Number of Stems per Acre	540	300
Total Height of Sample Tree	63 ft.	78½ ft.
Timber Height to 3 ins. diameter	48 „	60 „
Q. G. at Half Height	5½ ins.	6 ins.
Volume per Acre (U.B.)	4540 cu. ft.	4163 cu. ft.

The second lot of figures refers to a plot at Knockmany, Co. Tyrone, felled in 1939. At 20 years of age there were 1440 stems per acre, with a total height of 41 feet, a timber height to 3 inches diameter of 26 feet, a Q.G. at half height of 3½ inches, and an under-bark volume per acre of 4320 cubic feet.

Three individual trees planted at Knockmany in 1914 now measure as follows:—

Age	Total Height	Timber Height	Q.G. b.h.	Q.G. Half Height	Volume Q.G u.b.
32	91ft.	80ft.	13½in.	10½in.	56.6 cu ft.
32	88ft.	76ft.	12½in.	10in.	48.3 cu. ft.
32	92ft.	80ft.	13¼in.	10¼in.	54.0 cu. ft.

Measurements of three individual trees on the Lough Eske estate, Co. Donegal, believed to have been planted in 1910, are as follows:—

Age	Total Ht.	Q.G. b.h.
35	100ft.	10½in.
35	86ft.	18 in.
35	95ft.	19 in.

One of the trees on this estate yielded 74 cubic feet Q.G. of first-class timber up to a diameter of 6 inches, and thinnings from an adjoining plantation yielded an average of 26 cubic feet per tree.

The third lot of figures refers to a plot of about one acre in compt. 57 of Dundrum State Forest, planted in 1909. This was originally mixed with other species and has been thinned from time to time. The last two thinnings were heavy ones made in July and November, 1944, whereby 156 trees were removed. with a volume of 2,420 cubic feet, Q.G. There are now 210 stems left, which are estimated to contain 3.500 cubic feet, Q.G.u.b. So that the total volume at thirty-five years of age was approximately 5,920 cubic feet, not taking earlier thinnings into account. The mean total height is 70 feet, and the mean Q.G. at breast height, 8 inches. These trees are in a somewhat exposed position and have often lost their leaders. Another area of 14 acres at Dundrum, planted in 1914 and thinned three times, is now 30 years old, and is estimated to contain 420 trees per acre. with a mean total height of 67 feet and a mean Q.G. of 7 inches.

The fourth set of figures refers to an area planted in the Kilrush State Forest, Co. Clare, in 1913, a small part of which is still standing. in which the trees have an average height at 32 years of age of 60 feet, and a mean Q.G. of 9 inches, with an estimated volume of approximtely 6,500 cubic feet Q.G.u.b. per acre. Another area of 4½ acres at this forest, planted in 1913, contains 425 trees per acre and is of the same mean height and girth, with an estimated volume per acre of 7,000 cubic feet, Q.G. Kilrush Forest is generally very exposed to the Atlantic gales and there has been repeated loss of leaders in these stands, so that many of the trees are rough and coarse and not very straight.

Mr. H. A. Booth in a short article in a recent issue of the Quarterly Journal of Forestry gives some very interesting figures and information

about two plantations of Sitka Spruce which he had come across in England.

These were both about 35 years old and contained 1,150 poles with an u.b. volume of 3,929 cubic feet, and 1.100 poles with a volume of 3,817 cubic feet per acre, respectively.

He makes a comparison with the figures shown in the Forestry Commission yield tables for quality Class IV., which gives 545 stems per acres with a volume of 3,750 cubic feet at 35 years. He points out that while there is a close relation in respect of volume, there is a very great difference in the number of stems per acre, and concludes that the plantations were under-thinned and that the result should certainly have been better if proper thinning had been carried out. He places the value of the contents of the crop per acre at approximately £110, and that for material merely of pitwood sizes! With proper thinning a crop of this kind might be expected to produce trees of much larger size and better timber quality.

The Timber and its Uses.

Now we come to the timber and its uses.

The following description of the properties of Sitka Spruce timber is based on a paper by Mr. James Kay, published in Vol. XXXIV. of the Transactions of the Royal Scottish Arboricultural Society.

The wood varies in colour from white to light brown; it is soft, light and easily worked, but tough and very strong for its weight. It is even grained and long fibred, flexible and does not split or warp. Being odourless and tasteless, strong and light, it is suitable for cooperage and packing cases.

For structural work where great strength is required it is not so suitable as Douglas Fir, but it is used for framing and shelving. It is very good for panelling, office fittings and furniture; it is suitable for interior finish; takes paint and glue well, is easy to nail and does not split.

When cut into thin boards its quality makes it suitable for piano sound boards, organ pipes and stringed instruments, and it is a very good pulp wood.

Spruce makes, it is claimed, the very best type of paper, and it is on account of this latter quality that it has been so strongly advocated for use in the afforesting of the waste lands of Ireland.

In conclusion, I would like to say that I think the Sitka Spruce has not always been fully appreciated in this country. I submit that its performance has been good, but a tree, like a person, a place, or any other thing, can hardly do anything right if people are prejudiced against it.

I hope the Sitka Spruce will get more consideration in the future and that from the mistakes we have made in the past, we shall learn, not at the expense of other species, to give it a chance to make a place for itself in Irish Forestry. I should like to thank all those friends and members who have helped me by furnishing details and items of information respecting individual trees and stands, which I have made use of in preparing this paper.

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THE USE OF HOME-GROWN TIMBER FOR THE MANUFACTURE OF MATCHES DURING THE EMERGENCY

M. SWORDS.

Previous to 1939 matches were imported to this country in large quantities and of various brands, but the home match-making industry was also supplied with logs and splints from abroad for the manufacture of matches. In fact, the cigar-, cigarette- and pipe-smokers could choose their own particular brand of match from almost as wide a selection as they could their cigars, cigarettes or tobacco.

Shortly after the beginning of the war the import of matches on a large scale ceased, as also did that of the raw material for the home industry. The problem then arose of meeting the needs of the home industry for raw material. Even for so small an article of commerce as a match the timber used must have quite a number of special virtues. The following qualities in the timber are desirable. It should be of a texture and hardness to fit it for passing through the veneering machine; it should not be so brittle as to break in the user's hand; it must be capable of absorbing a certain amount of inflammable liquid, and it should not continue to glow after being extinguished. Comparatively few timbers possess all these important qualities, but generally speaking most Poplars do, and among the Poplars the Aspen excels.

Experiments were tried with home-grown tree species, and four of them were found fairly satisfactory, namely Poplar, Scots Pine, Lime and Horse Chestnut, the first two named species being almost equal to the imported material if selected from the proper type of tree. Unfortunately supplies of Poplar were limited, and ultimately the industry had to rely almost solely on selected Scots Pine.

The Scots Pine best suited for the manufacture of matches is that grown on well-drained, moderately fertile soil, on an area not exposed to severe or constant wind-pressure. The stands require to be grown closely in their young stages and pruned as soon as dead branches appear. Thinning out of irregular or badly shaped stems should take place at suitable intervals in order to procure trees as symmetrical as possible in the final stand, with a maximum branch-free height and a minimum of concealed dead knots. It is considered that trees from 50 to 75 years old produce the best match splints, as the wood of older trees is liable to be too brittle.

One small stand of Poplar (*Populus robusta*), about 30 years old, grown at Dundrum, Co. Tipperary, produced excellent match splints. This stand was planted with trees 12 feet apart, with a 75 *per cent.* admixture of *Thuia gigantea*. Another useful poplar stand near Midleton, in Co. Cork, provided a high volume of suitable timber per unit of area.

Lime and Horse Chestnut were wasteful owing to the fluted and irregularly shaped butt-ends, only a small percentage of the stem being usable. but otherwise the qualities of their timbers render them satisfactory for matchwood. Most of the trees used had, of course, not been grown in dense stands under proper satisfactory silvicultural conditions.

Trial lots of Sitka and Norway Spruces were supplied, but the timber was reported to be unsatisfactory, mainly due to the number of small, hard, dead knots met with during conversion. Butt lengths were used for this experiment, and it is possible that if second length cuts, about six to eight feet from the butt, had been tried the result might have been better, as less small dead knots would have been encountered.

When the importation of logs and splints for the manufacture of matches ceased, efforts were at first directed towards securing from the native woods stocks of Poplar and Lime, Scots Pine being in more

pressing demand for other more important emergency uses, such as building work. After a short period, however. it was found that supplies of Poplar and Lime, both on private estates and in the State Forests were extremely limited, and Scots Pine came more and more into use. Ultimately it was found necessary to give the match-making industry some priority in securing suitable material from the available Scots Pine stands, and in the long run every stand in the State Forests and many in private ownership were combed to provide the timber necessary to keep the industry in being.

It may not be out of place to give some idea of the type of trees suited for this purpose. The average Scots Pine in demand gives a butt length log varying from 10 to 16 feet, with a mean mid-quarter girth of 8 to 20 inches. The maximum under-bark diameter of the log that the veneering machine handles is about 27 inches, and the minimum diameter which would not be too wasteful to manufacture is approximately 9 inches. This high minimum diameter is due to the fact that the machines leaves an unveneered core of from 3 to 4 inches diameter, which cannot be converted.

The average match is a very small scantling, a cubic foot of timber containing approximately 96,000 match splints, but, in view of the amount of waste due to knots, branch whorls and other defects, only a small proportion of the log is suitable for first-class match splints.

The manufacture of matches from the round log is a tedious and lengthy process, difficult to explain, but the following are a few of the important stages through which the timber passes from the log intake to the match-box.

(1) The round logs are hauled from the dumping ground on a conveyor and are run under a pendulum cross-cut saw and cut into the required lengths, which are approximately 17 to 25 inches long to suit the particular cutting machine.

(2) The billets so cut are trimmed by axe and adze to remove the bark and any irregular projections and to make them roughly cylindrical for the cutting machine.

(3) The prepared billets are then placed in a revolving headstock and are turned against a fixed. keen-edged knife, from which the timber runs out in sheets approximately one-tenth of an inch thick. This continues until the billet is reduced to a core with a diameter of from 3 to 4 inches.

(4) These sheets or strips of timber, which resemble pieces of plywood, are collected as they pass out from the veneering machine. Knotty and other defective portions are discarded and the approved, selected portions pass on to a vertical cutting machine to be cut up into match splints.

(5) The freshly-cut match splints are soaked in water, dried and then passed through a sanding apparatus.

(6) The finished splints are then fixed vertically in a broad revolving endless belt which moves in such a way that the splints are first dipped into an inflammable liquid and later into the prepared chemical solution which forms the striking head.

(7) The finished matches are now removed on a drying conveyor to the packing department, where they are filled into boxes. The boxes then pass through a number of labelling and packing processes before they are finally made up into the cartons ready for distribution to the town and country retailers.

Thus in the course of a month or less a match from a tree that once played its part in adorning the shores of Lough Corrib or the Glens of Wicklow may be used in its native habitat in the form of a "Friendly" or "Safety" match to light the pipe, cigarette or dinner-fire of a woodman engaged in the task of replanting the land with a new generation of conifers or hardwoods to meet the national requirements of matches and many other commodities at some future date.

OBSERVATIONS ON THE RESULTS OF CUTTING BACK NATURALLY REGENERATED AND PLANTED ASH AT DONADEA FOREST

T. S. MADDEN.

Compartment 18, Donadea Forest.

On this twentieth day of February, 1945, I stand waist-deep in healthy, vigorous naturally regenerated ash. Just a year aga I stood in this same spot, and then, as now, my thoughts were of the "natural" ash. On that occasion I was, with a very good reason, pessimistic. Around me lay an area of partially-cleared woodland. Parent-trees were left wherever a well-developed healthy tree had been found. The ground had been cleared free of brushwood in the usual thorough fashion of "Charcoal Ltd." The forester's "nightmare" of Donadea rank grasses, had not yet invaded this old woodland, and the peaty soil looked eager and ready to receive next year's seed fall. My concern, however, was not for the natural regeneration which I expected, but for the natural regeneration which had come before the stand was opened up. Around me lay extensive patches of crooked, deformed and diseased natural ash—neither a straight nor a healthy plant in the lot. There they stood, ten or twelve feet high, and. for all their deformity, their cutting back on the morrow afforded me no satisfaction. To those of us who realise Ireland's pitiful dearth of timber, the cutting of any age or kind of tree is excused only by sheer necessity or impending decay. Perhaps, now that the excessive overhead shade has been removed, a careful pruning would be more effective and less destructive. Thus I argue like a counsel for the defence, but in my heart I know that their fate is already sealed, for to-morrow "Carrick" hook and secateurs (for the smaller ones) will cut them to ground level.

They were cut, and to-day, a year later, I am here to compare notes as it were. Perhaps the most unpleasant feature of a State Forester's life is that it is seldom our privilege to view our work at a stage when success is assured. Too often we lay down plantations with care and toil, but long before these plantations are established the "exigencies of the Service" remove us, maybe, a couple of hundred miles away. After one short year, however, this cutting back of natural ash has proved a definite success. What sturdy, straight shoots! No doubt of where they are going—the sky is the limit. Each stump has sent out from two to six shoots. I take out my rule and measure several, finding that they measure from one foot to eight feet in height. I place the average height at 2 feet 10 inches. There is not a sign of the disease from which the parent shoot suffered. This reminds me of the doleful prophesy of the labourer who did the cutting with me: "it's no use, sir, the young shoots will have the same disease." Well, no sign of it yet anyhow!

Next year, I understand, the shoots will be singled. The secateurs in my hand are itching for the work. Selection from such a pick will be easy and agreeable work.

Feeling that the world is a grand place, especially Compartment 18, Donadea Forest, I set out for Compartment 12, where similar work has been carried out. On my way I consider what a pleasant thing it is to deal with natural regeneration. One feels that Nature is on one's side. The selcetion of species is made for you. Here on the better land of this forest the tree is very unequally matched against grass. The former will win out only by man's assistance and after heavy losses. If we work against Nature we must lose. How much sweat does the mountain farmer lose in his attempt to farm natural forest land?

Compartment 12, Donadea Forest.

In 1938 a Norway Spruce/Ash mixture was planted in this Compartment The predominant growth is meadow-sweet. The soil is "heavy and tight" and rather peaty. The ash has far outgrown the spruce and now stand twelve feet high. In some cases, however, the stems were so hadly shaped as to justify cutting back. I examine six of the stumps which had been cut back. Three have not put out any shoots, and the other three have sent out crooked, deformed, diseased and practically horizontal shoots. Where is the sturdiness, the vigour and the health of the natural ash shoots? Another contrast—those plants we cut back were certainly badly shaped, but they had no disease, but these young shoots have got disease in abundance.

Leaving Compartment 12 I am considerably subdued. I have seen success and failure resulting from the same treatment to the same plant. growing in similar soil. The only difference arises because one plant was planted by man, the other was natural seeding. Is it that the root system was not sufficiently established in the case of the planted ash? Perhaps if those struggling, diseased shoots were again cut back this year, the results will eventually be good.

REVISION OF THE STATE PLANTING GRANT SCHEME

K. L. SCHORMAN.

Many landowners may not be fully aware of recent developments in the scheme of State aid for planting on private estates. The substantial increase in the grant has not received much publicity, possibly on account of the present shortage of supplies of the necessary materials for planting, and the following notes have been prepared with the view of drawing the attention of members, and others interested in this matter, to the main features of the new Planting Grant Scheme announced some time ago by the Minister for Lands.

Although more than a century ago the Royal Dublin Society made grants for tree planting on private estates no provision for any assistance of this kind appears to have been made by the State until the passing of the Forestry Act, 1919. Under that Act the Forestry Commissioners were empowered to make grants, but these were hedged with such restrictions as made the proposals rather in the nature of joint profit-sharing operations between the State and the landowner than free grants. So much book-keeping was required and so many possible sources of friction were immediately apparent that, in this country at any rate, the relative section remained a dead letter until the passing of the Forestry Act of 1928. This Act abolished the conditions imposed by the earlier Act and empowered the Forestry Authority to make grants free of any restrictions as to repayment or profit-sharing.

In 1930, therefore, the Minister for Agriculture, who was then responsible for State forestry operations, announced a scheme for the payment of a grant of four pounds per acre, payable in three instalments spread over a period of 10 years, subject, of course, to the condition that the plantation had been satisfactorily maintained in the meantime. In view of the limited number of qualified foresters at that time in the State Forestry Service and the consequent cost of the necessary inspections, it was decided to impose a minimum area of five acres. First instalments of the grant under this scheme were paid in respect of 542 acres, of which only 460 acres qualified for the second instalment, the remainder having apparently been so neglected as to be disqualified from further consideration.

In 1934, in view of the very poor results achieved, it was decided to amend the scheme and to render it more attractive to prospective planters.

The third instalment, for which the landowner had to wait ten years, was abolished and the amount added to the first instalment. The minimum of five acres necessary to qualify for a grant was, however, retained and up to the end of the financial year 1944-1945 some 1,657 acres had qualified for grants.

Apart from any question of the probable higher costs of planting in future years, it is evident that the earlier schemes did not offer sufficient inducements to secure any extensive rate of planting upon private estates and, in 1944, the Government decided to extend further assistance and, for planting carried out last winter or in subsequent seasons, the amount of the grant has been raised to ten pounds per acre. Possibly more important still, the minimum area necessary to qualify for a grant has been reduced to one acre. As before, the grant is payable in two instalments. The first half is payable upon completion of the planting and the remainder after a lapse of five years. Naturally the second instalment is still payable only if the plantation has been properly maintained in the interim. Though it might be expected that any person who had gone to the trouble of laying down a plantation would not fail to give it that minimum of attention and protection necessary in its early years, experience has shown that a surprising number do so, and, either through ignorance or carelessness, see their investment wasted. Probably they lay the blame on the Government in general and the Forestry Division in particular.

The purpose of these grants is purely economic—humdrum, if you like. They are intended to assist private individuals and local authorities to grow trees for commercial use. There is no intention of financing the laying down of mere shelter belts, or the provision of ornamental avenues, etc., and with this end in view the scheme requires that the minimum width of any plantation shall not be less than two chains, and it is a further condition that the trees shall be planted at not more than five feet apart. Neither is it intended that the grants should be utilised for experiments with untried tree species, and, whilst the choice of species to be planted is left mainly to the applicant, the Forestry Division will not agree to the use of trees which are not likely, in this country, to produce useful timber, or are not required to form a protection for the main crop. Even where it is proposed to use trees of the ordinary, well-tested, timber-producing species the Division must retain the right to refuse a grant if species are chosen which are totally unsuited to the local conditions of soil and climate. Otherwise, however, the landowner is free to make his own selection and follow his own ideas.

It may not be out of place to point out here that persons who are required to carry out replanting operations as the condition of obtaining a Felling Licence are, provided they comply with the requisite conditions, equally eligible for a grant with persons who carry out planting quite voluntarily.

At present fencing wire and rabbit netting are practically unprocurable and, judging by pre-war standards, transplants are both scarce and expensive. Given, however, a return to more normal conditions, a grant of ten pounds an acre should meet a considerable part of the cost of laying down new plantations. The experience of the past years has shown how desirable it is for any farmer to have at hand a supply of timber to provide fuel, fencing stakes and boards, etc., for the erection of farm sheds, house repairs, etc., and the owner of even a small farm may, by utilising otherwise wasted portions of ground for planting, make an appreciable addition to the country's resources.

Fencing materials, it is to be expected, will soon re-appear upon the market at, let us hope, fairly reasonable prices. What of the plants? The Government has already assisted the native growers by a duty on imported seedlings and transplants, and these planting grants should greatly increase the demand for supplies. Will the nursery trade rise to the occasion and give us adequate supplies of young trees at a figure that will not make the cost of putting down new plantations too exhorbitant for the average landowner?

REPORT OF THE SECOND ANNUAL EXCURSION TO THE VALLEY OF THE RIVER OW (AUGHRIM)

JUNE 6TH TO 8TH, 1945

J. J. MAHER.

Aughrim, in the Valley of the Ow, Co. Wicklow, was the venue of the Society's very successful second annual excursion. Accommodation was excellent aad the weather, though flirting slightly, held in our favour, enabling us to walk in comfort through the many interesting plantations.

The following members attended:—H. M. FitzPatrick (President), T. McEvoy (Convener), T. Clear (Secretary), P. Barry, W. Breslin, Miss N. Brunner, W. N. Chisholm, D. J. Corboy, J. A. Crammond, P. Cronin, M. Dalton, J. J. Deasy, N. Devereux, N. Diver, T. J. Dolan, J. P. Doyle, J. Galvin, G. Haas, P. J. Harte, J. C. Kearney, P. J. Kerrigan, H. R. Langley, T. Madden, J. J. Maher, D. P. Mangan, O. V. Mooney, T. McCarthy (Athy), F. McMahon, M. O'Beirne. P. P. O'Grady, R. K. Pennefeather, P. Ryan and M. Swan.

AUGHRIM FOREST. Tuesday, 5th June.

Starting at 2 p.m., the party walked the short distance to Roddenagh Nursery, where the President briefiy addressed the members. It was a great pleasure for him, on the opening day of our second annual excursion, to welcome such a large gathering in spite of the many difficulties. They were met in the midst of the State Forests of Aughrim, Ballinglen and Avoca, which it was the intention to visit by kind permission of the Minister for Lands, who had not only given his approval, but had provided every facility. He was sure that nothing had been left undone by the Minister's Department to make our visit a pleasant and a profitable one. The forests of the Aughrim district were a spectacular example of what forestry means to Ireland. This area was no wooded estate taken over as a going concern; nor was it some gentleman's pleasure park. Except for a few scattered woods it was bare mountain devoted to sheep grazing, and contained hardly an acre of ground better adapted to purposes other than planting. Bit by bit it was bought; bit by bit it was planted, and bit by bit the countryside was transformed, resulting, as would be seen in thousands of acres of thriving plantations, which even now support up to a hundred men in steady employment. This has been the work of members of the present Forestry Service, many of whom he was glad to see present that day.

Our Vice-President, Mr. J. A. K. Meldrum, Chief Forestry Inspector, then welcomed the Society on behalf of the Minister for Lands.

Mr. P. Ryan, the inspector responsible for the supervision of the forests in the district, gave a summary of the tedious building-up of this area from the first land acquisition to the present day. The first block was acquired in November, 1913, over thirty-one years ago. When the Forestry Commission came into being in 1920 the total area was 1,126 acres. During their period of responsibility up to 1923, the area increased to 1,530 acres. Subsequent to 1923 and up to 1939 the area increased to the very high figure of 4,344 acres. The forest having now become too large for a single unit, was sub-divided into two forests by the formation of Ballinglen Forest, with an area of 1,795 acres, mainly on the right bank of the River Ow, and Aughrim Forest was left with an area of 2,540 acres, mainly on the opposite bank.

Since then the acquisition of three further properties increased the area of Aughrim Forest in February. 1941, to 2,775 acres. In April of

that year the outlying Garnagowlan property was detached to form part of the new Avoca Forest, reducing the area of Aughrim Forest to its present figure of 2,550 acres. The condition of these lands at the time of acquisition was as follows:—68 acres of woods, 379 acres of cleared woodland, 4½ acres of scrub, 1,937 acres of bare ground, and 162 acres of unplantable land. To-day 2,278 acres have been planted, including 21 acres of woodland and 3 acres of scrub cleared and replanted, leaving 64 acres unplanted, including 9¼ acres of nursery ground.

The Convener, taking over, led the party into the nursery—the forest cradle—our most appropriate starting point.

Roddenagh Nursery.

A rectangular area of approximately 8 acres, nestling in the surrounding woods and gently sloping to the south-east, is devoted to nursery work. The soil, derived from Silurian shale, is light, easy to work and excellent for conifers. Prior to being laid down as a nursery in 1920, it had been tilled by the local cottiers for a number of years. This simplified preparation—ploughing, harrowing and collecting of weeds—alone being necessary before the lining out of the seedlings in the first year. Full stocking for five years so reduced fertility that for the next five years a considerable area each year had to be put under green crops, as well as receiving additions of farmyard manure and road parings. The average annual production in normal times was approximately three million seedlings, and one and a quarter million transplants. Production has dropped considerably during the emergency period owing to the difficulty of obtaining seed, and this year's stocks of approximately one million seedlings and three-quarters of a million transplants, are the lowest recorded.

The chief point of interest was the damage to April-sown Norway Spruce seedlings by the exceptionally sharp frost at the end of April, in contrast to the April-sown, healthy, unfrosted Sitka Spruce which, as a more frost-tender species, had been protected with the regulation laths about 15 inches over the surface of the beds.

Roddenagh Wood.

The members were interested in this wood, not alone on account of Dr. Nisbet's description of it in 1904 as one of the finest coppice woods with regular age classes of standards, but also on account of the unique method of its acquisition and of the mixtures used by the Department in planting it.

This area of 179 acres, held in fee simple, was purchased by Mr. O'Beirne, acting on behalf of the Department, at a public auction in Tinahely in 1922. Mr. O'Beirne informed us that at the time of purchase the area was covered only with scrub, the oak standards having been removed during the 1914-1918 war. Twenty-two years ago, when nearly all the scrub had been removed, it was replanted with a 50/50 mixture of Japanese Larch and Douglas Fir in parts, with a 50/50 mixture of Silver Fir and Japanese Larch in other parts, with some Sitka Spruce on the wetter ground, and on one area with pure Japanese Larch.

The Silver Fir-Japanese Larch area was divided into three strips, in which *Abies grandis*, *Abies nobilis* and *Abies pectinata* respectively, were used. The Japanese Larch, now 5½ inches. Q.G.b.h. and 40 feet high on the average, has considerably outgrown the two last-named Silver Firs, individuals of which were up to 10 feet in height. Mr. Barry, Mr. Crammond and others expressed the opinion that the thinning begun in the last few years had been just normal for Japanese Larch, and not sufficiently heavy to stimulate the growth of the Silver Firs

Though grown on similar sites, *Bromus* and *Agrostis* grasses, with patches of Bluebell over slightly podsolized brown earth, these two plots presented a striking contrast to the next plot, in which the *Abies grandis*, though not so dense a shade-bearer as the others, was perfectly formed, having an average Q.G.b.h. of 7 inches and a height of 50 feet, tended to dominate those Larch which had not been removed by the recent crown thinning.

Roddenagh Hill.

The many perplexities confronting foresters endeavouring to put into practice their silvicultural knowledge, must have been experienced twenty-four years ago when planting this relatively exposed area, rising from 450 feet to 1,500 feet, with aspects varying from south-east to north. The main species used were Scots and Corsican Pines, European Larch and Douglas Fir, with smaller areas of Silver Fir and Sitka Spruce. ,

The Douglas Fir, on the more sheltered portions, now look a promising crop. All coarse stems were removed in 1943/44, yielding 12 tons of material per acre. As we progressed, however, directly up the slope—from 650 to 800 feet—the Douglas Fir gradually deteriorated in quality and is now being replaced by Japanese Larch. Wind blast was one of the outstanding inimical factors. On still more exposed ground—from 800 to 1,000 feet—an unsightly checked. gnarled and deformed crop of Scots Pine and European Larch was replaced last year by Japanese Larch. What would have been the effect of shelter-belts or of the admixture of species more resistent to the harmful action of severe exposure? Mr. Dalton suggested that a contributory cause of failure might be the chafing of the roots in the sharp-edged shaly soil. Mr. O'Beirne emphasised that the plants used here were imported and might have suffered in transit, while the question of race had also to be considered.

Incidentally, one of the obstacles to the handling of unsatisfactory areas—the rabbit danger—had to be overcome by erecting a rabbit-proof fence around the area. In carrying this work out a simple, yet ingenious, method was applied in overcoming a shortage of staples; the wire was inserted in saw cuts made in the tops of the stakes—a procedure which proved quite serviceable.

Many audible sighs of relief were heard as the Convener, after this steep climb, proceeded along a contour ride at 1,000 feet elevation to the more sheltered eastern slope, where we saw just below us a stand of Scots Pine which was now a success, although it had suffered severely from *Lophodermium* during its early years. Above us was the first example of flushed peaty ground (dominated by *Molinia*, with some *Calluna*), a regular feature of these hills, forming more or less elongated pockets running up and down the slope, and nearly always planted with Norway or Sitka Spruce. In this instance the latter had been used. As usual it was in varying degrees of check, being more advanced at the edges than in the centre. At its worst the plants were barely 2 feet high, the current height growth being a matter of one or two inches a year. In recent years this area has been interplanted with that most tolerant of trees—Contorta Pine—which is growing strongly.

Later in the day a similar area was seen in the valley floor. Here Norway Spruce was used and, though presenting a similar picture, had at its worst a higher current height growth, and should give in time a satisfactory stand without the use of a nurse species.

BALLINGLEN FOREST. Wednesday, 6th June.

On the second morning the party travelled by cars to Ballygobban, the largest block in Ballinglen Forest. From there we walked to Ballyteigue, where. on the roadside, we enjoyed a hearty free and easy lunch. One of the delights of a forestry excursion is the delicious tea from the little black cans. In the afternoon we continued our walk through Ballyteigue, thence through Rosahane and Coolgarrow, where we were met by the cars.

Distinctive features of the locality traversed are the high mean elevation, most of the land being over 1,000 feet the consequent very high rainfall (about 60 inches a year) and the constantly high atmospheric humidity of the mist-enshrouded peaks.

Before entering Ballygobban the Convener gave a short talk on local geology and soils, ilustrated by a map which he had specially prepared for the occasion. We were standing at the central point of the Leinster Chain of Mountains, stretching, with interruptions, from Howth to Waterford. In this district the prevailing rock is Silurian, which in

its unaltered form as shales, slates, etc., composed the lower hills and lowlands, giving light soils of moderate fertility and drainage. In the distant geological past, the Caledonian foldings resulted in the welling up of enormus masses of molten rock—granite—raising the Silurian into ranges of hills. This granite was subsequently exposed by denudation and now forms most of the dome-shaped peaks over 2,000 feet high, e.g., Lugnaquilla (3.039 feet), the highest in the range. On the flanks of the granite mass, the Silurian rocks were altered to mica schist by the intense heat and pressure during folding. The peaks of Ballygobban and Ballyteigue, which we were to visit that day, consist of granite and the slopes of mica schist. Mucklagh property, seen across the valley, lies entirely in the schist area.

Ballygobban.

From the contour ride one could not but admire the scenery. Before us to the north frowned lofty barren Lugnaquilla, flanked by Barnamelia, Mucklagh and Ballinabarney, clothed in their delicate green forest robes.

Ballygobban was planted in the two seasons from 1932 to 1934. It was gratifying to note the perfection of selection based on the failures and successes of the older plantations in the district. Towards the valley floor and on the better type of ground, healthy Sitka Spruce could be seen. Through the poorer areas (flushed peat) it was mixed with Contorta Pine. The latter has been planted pure on the more exposed areas and on the poorer peat. Japanese Larch was favoured on the drier sites along the slopes, on rock-strewn ridges with grass and bracken. One might say of it that it was perfect except for the recent damage by deer and the dying off, blackening and shrivelling of the tips of the leading and lateral shoots of some Japanese Larch. Some members ventured the opinion that it might be due to *Phomopsis.* but the majority claimed that it was due to frost. Along our path quite a number of Contorta Pines had recently been badly barked, the damage being attributed to deer. Most interesting was the fact that the Japanese Larch and Sitka Spruce in the vicinity had been untouched. Deer have increased rapidly in these mountains during the past few years, and in the space of a few years will constitute a grave menace to the forest growth, unless in the meantime strong measures are taken to keep them under control.

Another point of interest, as pointed out by Mr. Dalton, was the contrast in colour and form presented by some of the Contorta. These had ascending branches and were of a brighter colour than the main block. Mr. Crammond referred to a similar differtnce in Contorta Pine growing in the Glen of Aherlow. Mr. Clear suggested that the plants we were now looking at might have been from seed collected along the coastal region of Western North America, where the tree is said to be of scrub type, the upright variety, known as *Pinus Contorta.* var. *murrayana* being a tree of mountain regions. The problem remained undetermined. Mr. Maher mentioned that he had noticed that seed of the Murrayana Pine differed slightly in shape and had more pronounced ridges than the true Contorta seed.

Mucklagh.

Before entering Ballyteigue we had a view across the valley of Mucklagh Mountain, where successful plantations of Douglas Fir up to 900 feet elevation, and of Japanese Larch up to 1,200 feet, have been established. This planting to relatively high altitudes on a south-western aspect has been made possible by the proximity to the windward side of the hill (1,700 feet) on which we were standing.

Close to this plantation and in a slight depression, the outline of a plantation laid down by The O'Mahony could be discerned. We are indebted to Mr. O'Beirne for its history. The O'Mahony desired to establish a plantation near his shooting lodge, and, with the co-operation of the Department, plants—quite a collection—were supplied. These were carried on the back of a bicycle from Avondale to Ballinaclash by Mr. O'Beirne. He had to complete his journey on foot across the mountain. The species used comprised the upright and creeping varieties of Mountain Pine, Scots, Banks, White and Corsican Pines, Sitka, Norway and White Spruces, European and Japanese Larches and

Douglas Fir. Unfortunately time did not permit our seeing this plantation, which, no doubt, played no small part in the selection of species for the district.

Ballyteigue and Rosahane.

These areas comprise plantations from nine to twenty-three years old. On Ballyteigue the hill area is, for the most part, a replica of Roddenagh. The lower slopes contain stands of Douglas Fir and Japanese Larch as good as the better stands on the sheltered slopes of Roddenagh. A promising crop of Sitka Spruce, three acres in extent, yielded approximately 788 cubic feet per acre in thinnings. From a recent measurement it has been estimated that the stand contains 816 stems per acre, with a quarter-girth volume of nearly 2,000 cubic feet. The age is 23 years.

Among the many points of interest were—(1) a few scattered trees and small clumps of the *caesia* variety of Douglas Fir. These were the selected stems of a very bad plot which had to be replaced with Sitka Spruce in 1943. This plot of *caesia* Douglas Fir was laid down as an experiment in 1922. It was noticed in the nursery that some of the plants raised from Douglas Fir seed from Oregon had glabrous shoots, bluish-green foliage and a more set appearance than the true Oregon variety, which has pubescent shoots and green foliage. These "rogues" proved to be of the *caesia* variety and were segregated and planted out separately on this elevated site;

(2) the susceptibility to snow-break of Douglas Fir on the heavy soils (formerly natural oakwood) on the upper slopes of Coolgarrow, resulting in many large gaps, which are now replanted with Sitka Spruce; and

(3) an interesting though small area between the river and the road at Coolgarrow, which had been prepared the previous year for underplanting. Well-formed standards of 45-year-old European Larch, with some Oak and Birch, had been left scattered over the area.

On leaving Ballinglen Forest, Mr. O'Grady, the forester in charge, was cordially thanked for his assistance during the day.

AUGHRIM AND AVOCA FORESTS and BALLYARTHUR ESTATE.
Thursday, 7th June.

On the site of an old oakwood (as indicated by the evidence of old charcoal-burning hearths) was a plantation of Douglas Fir, planted by the Department in 1926, and a smaller group of Douglas Fir, planted by the former owner 27 years ago. The difference in growth presented a puzzling contrast. The young plantation was suffering complete check and had very short leaders, while the older plantation had vigorous growth and had never passed through a period of check. The various stages in laying down a forest road were also studied in this property. Mr. Cronin, the forester in charge, gave a detailed account of the work and costs.

Tinnakilly Lower.

The outstanding features in this property were—(1) the poor development of Douglas Fir, now being replaced by Scots Pine and Maritime Pine; (2) the very pleasing Corsican Pine, its success being attributed to the gravely soil, and the relatively dry atmosphere. At Coates's Bridge, on the Aughrim Forest boundary, a cordial vote of thanks was passed to Mr. P. Cronin for having supplied much interesting information during the visit.

Aughrim Forest.

We then entered the main Ow Valley, with its steep slopes, clothed in natural and semi-natural vegetation; native Oakwood, seral Birch clumps (the first in succession to natural woodlands) and bracken- and furze-dominated rough grazings. A glance at the map prepared by Mr. McEvoy showed numerous dykes of basic rocks crossing the valley. He pointed out that to the trained observer these geological changes were immediately apparent in the vegetation—in the canopy of the

natural woodlands by the appearance of ash, wych elm and wild cherry; in the shrub layer by the ousting of holly by a continuous sheet of hazel, and in the field layer by the appearance of such plants as hart's tongue fern, prickly shield fern, garlic and wood sanicle, replacing woodrush and *Vaccinium*.

Garnagowlan.

The Garnagowlan plantation, on the left bank of the river, contained on the more basic soils, ash, planted in 1932, by the former owner—Major Bayly. It had been under-planted by the Department with *Abies grandis*—in 1941. Two groups of *Pinus radiata* (*insignis*) were observed on ground covered with woodrush. These were planted in 1940 and have now attained a height of 12 feet. Very interesting also were the clumps of *Eucalyptus Mülleri* and *Cupressus macrocarpa* in a matrix of European Larch and Beech, through stands of natural Oak, Ash and Cherry, between the road and the river. The *Eucalyptus Mülleri* had escaped the hard winter frosts of February and the severe spring frost at the end of April this year. The assistance and information given by Mr. J. T. Allman, forester-in-charge, was highly appreciated.

Ballyarthur Estate.

After an excellent lunch at the Woodenbridge Hotel we visited Ballyarthur Estate through the courtesy of the owner, Major E. A. T. Bayly, where the current treatment of native Oakwood under a system of clear-cutting by narrow coupes was seen. From the perfectly situated summer-house—the Octagon—overlooking the glen from Woodenbridge to Arklow, a graphic contrast in treatment was seen in the Glenart Woods on the opposite slopes. This treatment might possibly best be described as the Uniform system with artificial regeneration. Directly opposite the Octagon a wedge-shaped area of natural Ash in the surrounding natural Oak was immediately apparent. This appearance of Ash in the canopy was a good example of the change in vegetation on basic rocks.

The woods along the main avenue contain some very fine commercially valuable trees of Oak, Sycamore, Larch, Douglas Fir, Silver Fir and Scots Pine. One Scots Pine measured 30¼ inches Q.G.b.h., and had an estimated timber height of 45 feet. Among the many rare speciments of trees planted here in 1916 were *Abies grandis, A. nobilis, A. concolor, Picea omorica* and two *Pinus contorta*, the last-named probably being among the oldest specimens of this species growing in Ireland.

Unfortunately our afternoon was rather marred by several vicious showers, which reluctantly compelled us to curtail our walk through this interesting private estate, where the owner had done everything in his power to make our visit pleasant and instructive, his forethought being greatly appreciated.

Discussion on Mr. F. McMahon's Paper on Sitka Spruce.

During the evening of the 26th June a paper on "The Sitka Spruce in Irish Forestry" (which is published elsewhere in this issue of the Journal), was read by Mr. F. McMahon—the President, Mr. FitzPatrick being in the chair. A discussion followed, the main points of which were as follows:—

Mr. M. O'Beirne, in proposing the vote of thanks, and congratulating Mr. McMahon on his very comprehensive paper, agreed, that the Sitka Spruce is a tree eminently suited to this country, especially along the western coast, where the climate compares favourably with that of its native habitat. The seedlings in the first year grow slowly and must be protected against frost-lift and late frosts during the succeeding May. On deep porous soils with sufficient moisture it establishes quite easily, provided it had not been planted more deeply than it had stood in the nursery. Plants inserted too deeply require a new root formation, with consequent check to healthy growth for a number of years. He referred to a tree at Killian, Co. Galway, which, when felled,, measured 110 feet in length. One log, 50 feet long, was 5½ feet in diameter at the butt and 3 feet in diameter at the light end. The whole tree contained 350 cubic feet, plus a few tons of firewood.

Mr. T. Clear, in seconding the vote of thanks, thought that Sitka Spruce in the past few years seemed to have been losing popularity. Such a prejudice was surprising, as the numerous vigorous, healthy stands in this country proved that on proper sites it had, or at least should have, a high place in Irish forestry. One serious drawback, especially in drier sites, was its liability to butt rot. This was also experienced in Denmark, where they found that it was more susceptible than Norway Spruce. He reminded us that in virgin stands the common associates of Sitka Spruce were *Tsuga heterophylla, Thuia plicata, Abies grandis* and somethimes also *Pinus contorta.* In Scotland the last-named had proved to be a good nurse for Sitka Spruce, and we had seen during this excursion many promising plots of this mixture on flushed peat, dominated by *Molinia* with *Calluna.* On suitable sites, even where exposed, Sitka Spruce, being a very wind-firm and wind-resisting species, must be recommended. He hoped that Sitka Spruce would not be forgotten in the increased planting which would result from the present adequate State planting grant to private planters.

Mr. P. Ryan, supporting, referred to several outstanding specimens of Sitka Spruce at Shelton Abbey and Coolattin in Co. Wicklow. There was an exceptionally large tree at the latter place, which was 50 inches Q.G. at 7 feet from the ground and from 115 to 120 feet high. From information which he had received from the forester, Mr. Wells, the over bark volume was 644 cubic feet, Q.G. In the nursery Sitka Spruce required great care and attention. The seeds take about five weeks to germinate and should be sown about the end of March in fertile soils. The seed-beds should be brought to a very fine tilth by very intensive raking of the soil. The Casino Nursery at Avondale, when first used grew Sitka Spruce seedlings up to 4 inches high in the first year. These were quite strong and had not to be shaded as a precaution against frost-lift. In subsequent years the growth at one year was only up to 2 inches and the seedlings had to be protected against frost.

Mr. M. Dalton stated that co-equal in importance with tilth and fertility was the practice of steeping the seed to induce earlier germination. Care should be taken not to over-steep. To continue producing good seedlings plenty of compost must be applied to the soil, otherwise fertility will fall to such a low level as only to produce small, weak seedlings. During periods of hot dry weather the young seedlings are very tender and require protection.

Mr. T. McEvoy claimed, in the spirit of the angler who is ever anxious to cap his fellow angler's catch, that he had measured, at Curraghmore, Co. Waterford, the tallest and oldest Sitka Spruce in Ireland. Three years ago it was 108 years old and 148 feet high, with a quarter-girth at breast-high of over 18 feet. Forty years ago Professor Henry gave the height as 106 feet and the girth as being over 12 feet. Mr. McEvoy mentioned a plantation at Ballyboy in the Glenmalure State Forest rising to an elevation of 1,800 feet above sea-level. It was planted twenty years ago. Unfortunately a high percentage of the leaders were removed by wind. He had observed that during this year's severe April frost, Alder, so often advocated as an efficient nurse, had proved very inefficient, as the frost occurred before it had flushed. Nor was it suitable on sour peat, where Birch was better.

In associating himself with the vote of thanks, the President stated that the Ballykelly plantation mentioned by the lecturer was on the site of the old oak wood which supplied timber for the building of Derry. Most of the older speciments of Sitka Spruce in Britain and Ireland were from seeds collected in 1851-52 by Mr. Jeffery of the Oregon Association. The Curraghmore tree referred to by Mr. McEvoy must have been from the original packet collected by Douglas about 1831. If so it would therefore be of very special interest.*

At the conclusion of the discussion, Mr. Corboy proposed and Mr. Dolan seconded a vote of thanks to the Convener, the Excursion Committee, the Secretary, and to the various Foresters and Major Bayly, which was passed with acclamation.

*(According to Loudon (1833), only a very few plants were raised in the Horticultural Society's Garden's in the year 1832.—*Editor*).

REVIEW

DRY ROT IN WOOD (Fourth Edition). Forest Products Research Bulletin, No. 1. Price, 1/- net. London: His Majesty's Stationery Office: 1945.

The publication of this Bulletin is very timely when an early resumption of building throughout the country is generally expected, and it is particularly welcome on account of the probable utilization of proportionately much larger quantities of home-grown timber, which has an unfortunate reputation for being insufficiently well seasoned and for having a higher water content than is desirable in the trade. Since correct seasoning and storing of timber are the principal safeguards against later attack by the dry rot fungus, it would be advisable for sawmillers and builders to study these aspects of the matter before absorbing the useful contents of this Bulletin, which cannot be expected to cover these points.

The material in the Bulletin is conveniently arranged in three parts. Part 1, Fungi causing dry rot in wood is mainly botanical and gives a very clear description of the dry rot fungus, *Merulius lacrymans*, and of the other principal wood destroying fungi. There is a useful tabular statement describing these fungi, which may be used as a key for identification of the particular species causing rot. The conditions necessary for fungus growth are fairly fully dealt with, and of these, moisture and air requirements being the only two under man's control in erecting buildings, deserve special attention. In the section on the resistance of timbers to dry rot, it is made clear that none of the timbers commonly used in this country can be relied upon to resist atack by dry rot because of the wide range of timbers which the fungus can infect, and on the subject of using preservatives, it is of interest to note that the sapwood of any species and the timber of non-durable species, if thoroughly treated with a good wood preservative, are as resistant to the fungus as the most durable species and will be found cheaper to use even allowing for the cost of treatment. The treatment and durability of plywood are also referred to.

Part II. The Detection and Practical Treatment of Dry Rot, deals in a thorough manner with the investigation of suspected buildings and with remedial measures which may be applied. It is in connection with this that the botanical description and the appearance of infected timber referred to previously, prove their use It is essential first to identify the fungus if the best measures are to be taken against it, and then to discover the extent of decay. Signs of decay and tests for soundness of timber are mentioned, with a list of the most probable causes of decay. There are nine photographic plates showing infected timber, the spread of the mycelium and the fruiting bodies of *Merulius lacrymans*, *Lentinus lepidus* and *Poria vaillantii*.

As one would expect, the principal remedial measure is to remove all infected timber, even beyond points where decay appears to cease, and to sterilise thoroughly all points of contact before re-contructing with new timber. The use of heat and antiseptics is described. The sterilisation of timber and the use of different types of timber preservatives are gone into at some length, but these are rather preventive than remedial measures. A small section is added, dealing with treatment and prevention of dry rot under war-time conditions.

Part III. Precautions to be Taken in the Use of Timber in New Buildings to Prevent Outbreaks of Dry Rot, is a most useful one for builders, although it is of too technical a nature for the average forester. Precautions to be taken in design and contruction, the use of cements and damp courses, the proper ventilation of floor spaces and construction of floors are the main features of this section. Section and plan designs of various parts of buildings illustrate the printed word very clearly. The penetration of damp through walls, ground damp and condensation are worthy of study. and all points where infection by the fungus can take place or means by which it can be spread, are carefully covered.

This is a very readable Bulletin and should be in the hands of all

architects and builders. Although somewhat outside the scope of the forester, in his normal work, it may prove of substantial use to him too, as his duties seem increasingly to embrace construction and repair of cottages and other buildings within his forest area. The Bulletin covers all aspects of the subject, and if the principles are adopted and the precautions taken, as outlined in its pages, there should be a considerable drop in the number of outbreaks of dry rot. The contemplated development of building and the extensive repairs necessary in bomb-shattered towns will require an enormous quantity of timber, and it is at the initial stage, by proper seasoning, that dry rot can best be prevented. In using home-grown timber for this work, the seasoning and application of preservatives will require very careful attention.

S. M. P.

LIBRARY FACILITIES

NOTICE TO MEMBERS FROM THE SECRETARY

At a Council meeting of the Society, held in December, 1944, a letter was read from a member suggesting that a library for the exclusive use of members should be started. The proposals were discussed, but the Council decided that the matter was beyond the resources of the Society, as, in addition to the outlay on the books, there was also the question of accommodation to be considered. An attempt was made to secure accommodation at a reasonable cost, but failed. The matter came up for discussion at the Annual General Meeting, and as reported in Vol. II., No. 1, page 45, several members spoke in favour of the idea. During the discussion, Mr. Galvin suggested that the Irish Central Library for Students might be in a position to help.

Arising out of this, the President approached the Irish Central Library and found the authorities there very helpful indeed. Details of a scheme, as outlined by the President at a Council meeting held in June, were embodied in a circular sent to members in July of this year. For the information of those members interested in these facilities for obtaining books on Forestry matters and who may have mislaid the circular, I am repeating the main points.

The Irish Central Library for Students is prepared to receive applications for books on Forestry and kindred subjects from members of our Society. All applications are to be sent through me, the Secretary, and I will forward them to the Librarian. Borrowers are limited to three books at a time and are permitted to retain books for a maximum period of six weeks, but it is particularly requested that books be returned before the specified time if readers have finished with them, in order that other applicants may not be left waiting. If a borrower so desires, and there is no other applicant, the loan may be extended for a further period of six weeks. A charge of 6d. per week is made for all overdue books, which in no case may be retained longer than six months.

I wish particularly to draw the attention of intending borrowers to the following regulations:—

With each issue of books is enclosed a printed form which must be signed and returned to the Central Library immediately the books are received. The cost of carriage, as shown on the form, normally from 6d. to 1s. 1d., should be sent at the same time. It has come to my notice that some borrowers have not returned the form or the postage for a considerable time after receiving the books. This is unfair to the Library and to the other members of the Society.

All books returned to the Library must be carriage (or post) paid. They should be carefully packed in strong paper, as they were received. Printed labels for the return of books accompany all loans.

All books lost or damaged must be replaced or damage made good. This Society will be held responsible for any loss, and members are expected to exercise the greatest care with all books on loan.

As stated above, members desiring the loan of books should make application to me at the Albert Agricultural College, and not to the Central Library direct. If they wish to study certain subjects and do not know the names of books or authors, I shall endeavour to have the most suitable books on the subject sent to them. When applying for books, I must submit the title, name of author, publisher, and the price to the Librarian. It would be most helpful if applicants would supply these details when possible. I propose preparing a list of books on Forestry and allied subjects for circulation to members, and any help in this connection will be appreciated.

Many applications have already been dealt with, and while, in most cases, books requested have been forthcoming, there may have been cases of delay or disappointment. At the present time many books, even recently published ones, are out of print and unobtainable. It would be well for members to suggest alternative titles.

T. CLEAR, Secretary.

Albert Agricultural College,
Glasnevin,
Dublin.

OBITUARY

ALISDAIR GRANT.

26th March, 1896—25th September, 1945.

As we go to press we are advised, to our great regret, that Mr. Alisdair Grant, formerly Junior Forestry Inspector with the Forestry Division, Department of Lands, and for some years Instructor in charge of Avondale School, has died after a troublesome illness. We hope to publish a fuller and more detailed appreciation of Mr. Grant and his work in our next issue. In the meantime we express our sympathy to Mrs. Grant and their young family.