

Passing Crianlarich we continue to climb up towards Tyndrum. Both of these places were on the main drove road from the west, and before the railways came to Scotland this glen would have witnessed the passage of many thousands of beasts on their way to the markets of the south. Another relic of the old native forest (Coille Coire Chuile - The Wood of the Rushy Corrie) can be seen across the valley before Tyndrum; later old lead mines will be noted on the left and on the right is an interesting belt of woodland. At the roadside there is fairly reasonable growth at an elevation of 266 m. At the top where the elevation is 500 m. the trees have become scrubby bushes. This gives a good example of the effect of increase in elevation on tree growth in West Scotland.

It is interesting to note that on the drive from Drummond Hill to Tyndrum we have passed from a region experiencing a mean annual rainfall of 1,140 mm. to one receiving more than twice as much. At the western end of Loch Tay the rainfall is 1,520 mm. and near Tyndrum it is 2,540 mm.

As we go down Glen Lochy the valley narrows and the scenery assumes a different aspect. We are now in Argyll. If the weather is suitable, Ben Cruachan 1,124 m. will be seen ahead with the other hills of Lorne. On the right is Glen Orchy in which are found remnants of the old Caledonian Forest. In the early part of the 18th century an Irish company bought one of these ancient woods for $\frac{1}{3}$ penny per tree. A few miles further on and we come to the head of Loch Awe.

Thursday, 19th July

Maps $\frac{1}{4}$ " Sheet 3
1" Sheets 60 & 61.

The bus follows the road down the east side of Loch Awe for about 16 miles. There are fine views (in clear weather) of Ben Cruachan and to the south of it the Pass of Brander, through which flows the only outlet from Loch Awe. After passing Port Sonachan the great mass of Inverinan Forest can be seen on the hills on the far side of the Loch. Inverinan will eventually dwarf Inverliever but it is a much younger forest, only being acquired by the Forestry Commission in 1932, four years after planting was completed at Inverliever.

We enter Eredine forest, acquired even more recently, and go on to Portinnisherrick. Here the party boards the Forestry Commission launch and crosses Loch Awe to Cruachan Point where we enter Inverliever Forest.

INVERLIEVER FOREST

The Forestry Commission. West Scotland Conservancy.

District Officer: Mr. G. Dey
Head Forester: Mr. R. Crozier

General Introduction. This, the first State forest in Scotland, extends for nine miles along the west shore of Loch Awe. It has been formed on land acquired by His Majesty's Office of Woods in 1907 from the Malcolm family of Poltalloch.

Area and Utilisation. Apart from two recent acquisitions totalling 1,046 ha. the original area acquired extended to some 5,100 ha. It was estimated that of this area some 2,100 ha. were plantable.

At the time of purchase the Estate was divided into four farms carrying 6,650 sheep and 30 cattle. In order to keep these farms going as economic units it was decided to allocate to them a certain amount of plantable land; further areas of good land were reserved for the formation of small holdings.

As a result, only 1,170 ha. were scheduled for afforestation and of this area approximately 970 ha. have been planted to date. There has been a corresponding decrease in the area of hill grazings and the sheep have been reduced from 6,500 to 4,500 but it is interesting to note that cattle have increased from 30 to 85 head.

Natural Features and Climate. The plantations cover steep slopes rising from Loch Awe, broken country of parallel ridges and valleys and a high exposed plateau. The highest point is 290 m. above sea level.

The annual rainfall is between 2030-2160 mm. and the climate is generally mild and cloudy. Strong south-westerly gales occur fairly frequently.

Geology and Soils. Another facies of the complicated Dalradian series gives two geological formations at Inverliever. Of these, the series known as the Loch Awe Epidiorites stretches from Ford in the south to Cruachan in the north. The other group, the Loch Awe Metamorphic Grits, occupies the area from Cruachan to the northern boundary of the Forest.

The Epidiorite series varies from definitely igneous massive rocks, such as andesite and epidiorite to strongly metamorphosed schistose rocks such as chlorite schist and even calcareous lenticular slates. The rocks on the whole are fine-grained and are basic in character; weathering takes place slowly and results in the production of a somewhat heavy, stiffish yellowish soil.

On the steep slopes the soil is generally shallow and well drained but it deeper and moister in the flats and hollows.

The Loch Awe grits, which occupy the norther part of the area, often contain a slight admixture of chlorite and are generally coarse in texture. As they are, however, usually overlain by glacial material, they do not contribute markedly to the character of the soil. The more level ground to the north-east is crowned by a stiff till of mixed origin, which is of a greyish green colour, and which on exposure weathers normally to a yellow or dark red-brown soil. The glacial drift which covers the rest of this section of the area is coarser in character having been washed free of its finer material. The drift on the lower slopes has been altered by the addition of finer material washed down from the higher levels, and fairly heavy clays occur frequently on the lower flats.

On the high plateaux region of the forest peats of varying depth and textures overlie the mineral soil. Amorphous flush-type peats occur in some of the hollows but by far the largest part of the area is covered with deep, wet fibrous peat.

Selection of Species. It was at this forest that the first attempt to correlate the choice of species with existing vegetation types was made in this country. Inverliever Forest was, from the beginning, a large scale experiment in afforestation on ground considered to be typical of vast areas in the West of Scotland. The existing plantations at this forest and elsewhere in the locality had been formed on the richer slopes and valley bottoms and did not at the time provide any useful guide as to which species might be expected to thrive on the more exposed and poorer soil types. As might be expected, certain initial mistakes were made, particularly with Pinus sylvestris on exposed sites, with Picea abies on the hinterland; also with Abies alba and Pseudotsuga taxifolia. These mistakes were quickly recognised and as a result of a careful survey which was made between 1913 and 1918 of the plantations which had already been formed, and of the vegetation types on areas scheduled for future planting, the original assessment of planting sites was thoroughly revised. The selection of species in force from 1919 until planting was completed in 1932 is materially that adopted for similar sites at the present day. Certain sites originally planted would be classed today as doubtfully plantable, but otherwise the choice of species subsequent to 1918 has proved to have been basically sound.

In view of the fact that large scale planting ceased in 1928 none of the modern methods of draining and soil preparation by means of tractor drawn ploughs were carried out at this forest. There is little doubt that had the hinterland peats been ploughed much of the areas now in check would have been thriving pole stage plantations (if not carrying larger timber) at the present time.

It should not be forgotten that the late Chairman of the Forestry Commission, Lord Robinson, who died in September 1952, was intimately associated with Inverliever Forest from its inception; to him, therefore, must be given much of the credit for the development of afforestation on this and comparable hill ground throughout the country.

Thinning and Production. This region is particularly favourable to conifers introduced from the seaboard of Western North America and growth is accordingly fast. On the better soils Picea sitchensis commonly grows more than 90 cms. annually and volume increment is in proportion. One P. sitchensis now forty years old, is over 35 m. high and contains 4.47 cu.m. of timber. Elsewhere in the forest there is a plot of thirty-one years of P. sitchensis which is annually increasing its volume by over 16.6 cu.m. per ha.

Heavy thinnings every three years are the rule here and yield up to 70 cu.m. per ha. With 769 ha. under thinning and its oldest trees only 46 years of age, Inverliever Forest has to date yielded some 72,000 cu.m. of timber. The annual output is now 9,300 cu.m. which will steadily increase to a maximum annual output of 10,800 cu.m.

Management. A Working Plan has been prepared to control the management of the forest, and the first step, the preparation of a description of the growing stock, has been completed. Within each compartment are stands of different species, often of different ages, and certainly of different quality classes. Occasionally there are areas in check in which the canopy has not yet closed.

A Working Plan party (Research Branch, Mensuration and Management Section) has compiled a card for each stand, estimating the area from aerial photographs checked with the surveyed areas of each compartment. An estimate of the top height was obtained by hypsometer and of the basal area per acre by relascope. The volume was then estimated by the use of top height/basal area alignment charts prepared from Yield Tables, or for species for which these are not available, by the use of a form factor.

A check of these estimates was made by measuring 0.04 ha. sample plots covering all species and age classes, one for every 40 ha. The volume of sample plots was obtained from volume tables and thence the plot volumes from Tariff Tables. The correspondence between the two numeration methods was very close, and on this basis, proposals for the completion of planting, the control of thinnings and if necessary the commencement of final fellings and replanting are being formulated.

Risks. This forest has demonstrated that it is possible to free a large area of rabbits, less possible to keep out sheep and completely impossible to rid it of roe deer (*Capreolus*). The presence of roe deer will always subject areas of natural regeneration, replanting and underplanting to damage from browsing; but this damage can be reduced if sufficiently large areas are tackled systematically in blocks, and stalking and driving are sensibly planned. Fencing off areas of regeneration and underplanting internally should only be resorted to if all other measures fail.

Wind damage has been observed at Inverliever for a number of years. In every case it has been possible to discover the reasons for the damage. In some cases this has been due to serious neglect in thinning or draining, in others to clear felling for road lines and in yet others to the planting of shallow soils over rock. Nevertheless, the hurricanes in the first week of January 1952 indicated that winds of gale force can be capricious and that there will always be blows even in areas where silviculture and management have been sound.

Transport and Communications. The original access routes serving the plantations were the public road from Ford to Kilchrenan and a farm road leading from this. Until 1950, both roads were incapable of carrying heavy wheeled transport and most of the timber leaving this forest had to be rafted across Loch Awe to the county road on the other side. In 1950, the Ford-Kilchrenan road was reconstructed. This road at present carries approximately 80% of the produce whilst the balance is still rafted across the loch. All the produce routed by water is scheduled to come from the precipitous slopes between the road and Loch Awe.

In order to get the produce to the main forest road, some twenty miles of subsidiary roads and tracks are required. Good progress has been made with this work in recent years, and to date eleven miles have been constructed.

Horse drag, tractor drag, chutes, wire ropes and most forms of wheeled transport together with water transport, have all played a part in extraction. It is felt that all are useful in certain circumstances and each must be perfected in detail to be integrated into a sound, overall, extraction system.

Labour. Far more labour is required for systematic forestry than for an equivalent area under sheep farming. In 1908 the resident population consisted of 43 people drawing their livelihood from farming and 12 others. By 1912, when 243 ha. were planted, the population had grown to 87 of whom 33 were connected with forestry while 36 were on farms or holdings. In 1955, when the planted area had increased to 971 ha., the forestry population had risen to 239 while the total population was 285. In addition, 21 men were employed by forestry contractors but did not live in the district.

Housing. A natural accompaniment of the steadily increasing demand for forestry labour had been the need for more houses. From the beginning the existing accommodation was insufficient and a start was made with two cottages in 1908. Between the two World Wars a further nine Forest Workers' Holdings were established. Further augmentation of the forest staff was achieved by the creation of bothies (or hostels) but these have always been regarded as purely temporary expedients. Similarly the amount of labour which can be recruited in the surrounding districts and transported daily to and from the forest is strictly limited.

It is now accepted for this and comparable forests that the only permanent solution to the staffing problem is the construction of houses within the forest area. For obvious reasons the great majority of these houses should be concentrated into settlements or forest villages. The new settlement at Dalavich is a typical example of the forest villages which are being and will be built elsewhere throughout the Highlands. To date forty-seven houses have been built. The new village school is a natural consequence of this development, as are the village shops, and other amenities are also planned. Only the Church was already in existence. In due course this will be a self-contained settlement, probably the largest on the shores of Loch Awe.

Itinerary

After crossing Loch Awe inspect the log raft at Cruachan Point.

- (1) Stands of Picea sitchensis and Pseudotsuga taxifolia planted 1915 (see table below). P. sitchensis produces a much greater volume per hectare at Inverliever than P. taxifolia.
- (2) On this area, cleared of windblow, will be seen first some cultivated bands sown with Thuja plicata and next, screefed patches which have regenerated naturally with P. sitchensis. Also P. sitchensis and P. taxifolia planted in 1950 showing the rapid early growth of planted trees compared with natural regeneration.
- (3) Picea abies. Planted 1915 (see table below) has grown less rapidly than
- (4) Picea sitchensis also planted in 1915.
- (5) Picea sitchensis. Planted 1909. These trees were amongst those first planted at Inverliever and some individuals are now very large. (see table below).

(6) Thuja plicata. Planted 1914. (see table below). A quarry across the road from this point shows the soil depth and the form of the root systems at this point.

(7) A partially failed area planted in 1912, with Picea abies and P. sitchensis. It was planted by direct notching on peat bearing a vegetation of Molinia coerulea, Calluna vulgaris, Eriophorum vaginatum, Trichophorum (Scirpus) caespitosum with Sphagnum and Rhacomitrium in some places. This is typical of many areas which were the earlier subjects of research by the Commission. On some types the difficulties have been overcome by ploughing with crawler tractors and heavy ploughs, manuring and emphasis on the use of species of pine. Precise details of the relationship between the various limiting factors of excessive moisture, lack of aeration, nutrient deficiencies, effects of competition of different kinds of vegetation, etc., are often lacking and are the subject of present research.

(8) Sample plots of Picea sitchensis. These trees were planted in 1924 and the sample plots were established in 1939. Originally there were four plots but one has been windblown and today we examine only plot No. 117, which has been thinned to a Light Crown grade, and Plot No. 118, which has been given a Moderately Heavy Low Thinning (C/D). On establishment the top height of plot 117 was 10.5 m. whereas that of plot 118 was 11.4 m. indicating that the site of the latter is probably somewhat better than the former. Today the top heights are 22.6 m. for the Light Crown plot and 23.8 m. for the Moderate Low thinned plot and this brings the crops nearer to Quality Class I than Quality Class II of the Picea sitchensis Yield Tables. Height increment of both plots has averaged .82 m. per annum.

The plots have approximately 390 dominant trees were ha. although the numbers in their other canopy classes are very different. Due to the different thinning grades Plot 117 has a greater basal area (40.3 sq. m.) and standing volume (421.7 cu.m.) compared with 34.9 sq. m. and 393.6 cu.m. for Plot 118; but the total production including thinnings has been greater in the latter (760.6 cu.m.) compared with 693.0 cu.m. for Plot 117.

Thinnings from these plots were tested at the Forest Products Research Laboratory at Princes Risborough and the timber was found to have a low specific gravity. The average number of rings per centimetre was two. There was only a very narrow band of summerwood with a broad band of springwood.

Stand No.	Species	Age	Top Ht. metres	No. of trees per hectare	Av. Diam. cms.	Estimated Vol. per hectare cu.m.	Remarks
1	(P.sitchensis	41	29.9	376	42.0	624	6 Thinnings
	(P.taxifolia	41	25.3	457	34.0	350	4 Thinnings
3	P.abies	41	23.2	655	31.5	410	5 Thinnings
4	P.sitchensis	41	28.3	452	42.8	668	8 Thinnings
5	P.sitchensis	47	32.3	440	42.0	780	6 Thinnings
6	Thuja plicata	42	19.8	1,223	29.1	446	3 Thinnings
		*	* *	* *			
<u>No.</u>	<u>Sample Plots</u>						
117	P.sitchensis	31	22.6	1,065	21.9	421.7	Light Crown grade
118	P.sitchensis	31	23.8	558	28.2	393.6	Moderately Heavy Low Thinning

After this the lorries continue southwards through outlying blocks of the forest interspersed with farms until they reach Ford. Here the party re-joins the bus and goes on via Kilmartin to Lochgilphead and Tarbert on the shores of Loch Fyne. On the way the bus passes alongside the Crinan Canal, which was constructed about 1800.

This general area was part of the ancient Celtic Dalriadan Kingdom founded by the Scots who came from Ireland.

Friday, 20th July

Maps $\frac{1}{4}$ " Sheet 4
1" Sheets 61, 65

We take the bus to Kilmichael Glassary where lorries are waiting to carry the party over the forest road through Kilmichael and Minard forests.

KILMICHAEL AND MINARD FORESTS

The Forestry Commission, West Scotland Conservancy

District Officer : I. McNeill

The five state forests of Minard, Asknish, Kilmichael North, Kilmichael South and Kilmory form a more or less compact block of approximately 10,000 ha. on the N.E. shores of Loch Fyne. Of this area 5,840 ha. have already been afforested and 360 ha. remain to be planted while 3,965 ha. are either unplanted or are to remain permanently under agriculture.