

Wednesday, 18th July

Maps $\frac{1}{4}$ " Sheet 3
1" Sheets 55, 56, 61, 62

We leave the valley of the Tummel at Ballinluig and crossing the R. Tummel follow the road up Strath Tay into Breadalbane.

After crossing the Tay at Grandtully, on the left will be seen a small wood of Picea abies (edged with Pseudotsuga taxifolia). In this wood were two sample plots; but the more heavily thinned "D" grade plot was entirely destroyed in the gale of January 1953. The ground was somewhat wet near the edge so that it is more remarkable that the windblow abruptly stopped at the edge of the lightly thinned "B" grade plot than that the "D" grade plot should have blown.

There is a particularly fine bridge of five graceful arches spanning the Tay at Aberfeldy. The bridge is built of the grey chlorite schist of the district and its middle arch is of 18 m. span. A tablet reads: "This bridge was erected 1733. This with the roads and other military works for securing a safe and easy communication between the High Lands and the trading towns in the Low Country was by his Majesty (George 2nd) committed to the care of Lieut. General George Wade, Commander in Chief of the Forces in Scotland".

Close to this is a cairn raised to commemorate the first mustering of the 42nd Regt. or Black Watch. This celebrated regiment was so named because of the dark coloured tartan which its members wore. Across the bridge one passes along a line of poplars (Populus italica var. fastigiata) which clearly show themselves to be a single clone.

Weem was the birthplace of Archibald Menzies (1754) the distinguished Scottish plant collector who was responsible for the discovery of Picea sitchensis (1792) and other conifers of the Pacific coast. To him we also owe the introduction of Araucaria araucana in 1795 from Chile. This was the result of his pocketing some seeds at a dinner party given in honour of Captain Vancouver in Valparaiso.

On the right a mile further on is Castle Menzies, the home for centuries of Clan Menzies. The castle was built in 1571 and was a favourite retreat of Mary Queen of Scots. The woodlands behind the castle are now part of the Forestry Commission's Drummond Hill Forest.

We pass some Standing Stones - a reminder of the strong hold of the Druidical culture in these parts - on the left and dismount from the bus at the foot of Dull Wood. The party walks up the hill to the Tirinie Experimental Reserve of Drummond Hill Forest.

DRUMMOND HILL FOREST

The Forestry Commission. East Scotland Conservancy

District Officer: Mr. D.A. Woodburn
Forester: Mr. J.M. Kennedy

The present age class distribution is:-

1 - 10 yrs.	392 hectares
11 - 20 "	270 "
21 - 30 "	708 "
31 - 40 "	276 "
41 - 50 "	41 "
Remaining to plant	122 "
Unplantable	35 "
Agricultural	653 "
Total	<u>2,497</u> "

General Description of the Forest. Drummond Hill Forest consists of seven sections extending from Killiechassie in the east to Tirarthur (Killin) in the west, a distance of 24 miles. Most of the forest, however, lies on the north side of Loch Tay, near its eastern end, being centred on the original acquisition of Drummond Hill itself. The elevation varies from 107 m. above sea level at Loch Tay to 460 m. Generally speaking, the hill faces of all sections are very steep, while parts are almost precipitous. In spite of this, most of the ground is fairly sheltered, except the top of Drummond Hill itself, which is very exposed. Rainfall varies from 1020 to 1140 mm. per year in the east, to about 1500 mm. in the west, and is well distributed throughout the year.

The principal geological formation is the Dalradian series, most of the underlying rock being mica-schist with occasional garnetiferous bands. Parts of Drummond Hill and the outlying sections are overlaid with boulder clay. Elsewhere the underlying rock breaks down to form a deep, rich, well-drained brown forest soil. Peat occurs to a limited extent on the higher slopes.

The origin of the name "Drummond Hill" is not clear. It may be derived from the Gaelic "druim" meaning "a ridge" with the word "hill" added as an anglicisation of the name. It is also possible that since the family of Drummond once owned part of the district, they may also have owned the hill and given it their name.

For most of its recorded history as a forest it was owned by the Lords of Breadalbane and it is believed to have come into their possession in the fifteenth century. The hill was acquired by the Forestry Commission in 1923.

Drummond Hill is particularly well-suited to the growing of trees being situated near the centre of Scotland. The climate is less humid than further west and less cold than in the east. The lower slopes are comparatively well

sheltered and the soil is fertile. Apart from having grown some of the finest conifer timber in the country, this area has carried in the past large oak (Quercus spp.) and Fagus sylvatica of excellent quality.

Previous Utilisation. Apart from the north face, which was maintained as a deer forest, Drummond Hill was one of the earliest planted areas in Scotland, the eastern end being planted with Pinus sylvestris and Betula sp. of local origin between 1582 and 1631. Planting continued during the eighteenth century, reaching the west end by 1805, by which time Larix decidua and Fagus sylvatica were also being used. The crop planted by the Lords of Breadalbane was felled in 1918-24 and included what was then the largest Larix decidua in Scotland. It was 34 m. high, with a volume of 26.1 cu.m. and was 150 years old when felled in 1924.

Very large Pinus sylvestris and Picea abies have also been recorded. The following Sample Plot figures indicate the development of the Pinus sylvestris. The plots have all been felled.

Age	Top Height	Diam.	No. of Trees	Basal Area	Form Factor	Volume under bark	Crown %	Elevation of Plot m.
137	24.1	52	425	35	0.42	893	39	320
136	22.9	42	581	32	0.45	826	27	320
125	23.8	48	457	34	0.38	769	45	260

These show that though the old P. sylvestris was of low Quality Class (IV or V) it had produced a large volume per hectare even at a fairly high elevation. The stocking was very dense.

Choice of Species. The past reputation of Drummond Hill rested on the excellence of the Larix decidua grown on it, and this species was largely used for replanting. In the light of present knowledge it is possible that much soil derived from drift on the north face might have been better planted with Picea abies and the drier parts of the south face with Pinus sylvestris. The higher slopes carry Pinus sylvestris now. The high fertility soils of the south face bore broadleaved species with the former larch crop, and it is proposed to continue this system by retaining the best young Larix, either singly or in groups, and introducing broad-leaved species, together with small groups of fast growing exotic conifers. The lower slopes at Remony, south of Loch Tay, are due to be planted with broadleaved species.

Thinnings. Thinning of the plantations formed by the Forestry Commission began in 1939 but was seriously interrupted by the war. Work started again in 1945 based on a 3-year thinning cycle but this was again suspended as a result of the gale of 31st January, 1953. At Drummond Hill some 1,150 cu.m. of timber were blown. Thinning is now in full swing again. During the years 1948-51 the average annual out-turn was 2,300 cu.m. while under the present 10-year thinning plan, which runs until 1962, it is estimated that the total volume of thinnings removed will reach 45,000 cu.m.

Roads. There are now nearly 11 miles of all-weather roads in the forest, and a further 6 miles of fair-weather ones, though it remains to be seen whether the latter will stand up satisfactorily to the combination of rain, fairly heavy soil, and constant use during at least one year in three.

Itinerary

(1) Experiment No. 7. Planted 1935. Larix decidua Provenance.

This experiment was originally laid down with the object of testing three different provenances of Larix decidua grown at four different nurseries. There were significant differences in the mean height of plants from the different nurseries, but these have now disappeared and the experiment can be treated as a 3 x 3 Latin square.

Up to date figures will be available for the height growth of the provenances but in general it can be said that:-

(a) The Sudeten larch has grown fastest from the start.

(b) Though the Darnaway plants were smaller than Münsterthal at planting they later grew faster and outstripped them.

(c) The Münsterthal provenance has fallen behind and many trees have suffered from disease. Although the mean height of the dominant trees is not so inferior to the other provenance, the average of all trees is much less. The presence of some vigorous dominants suggests that the crop will improve in time.

Details of Provenances

Silesia, Sudeten. J. Rafn & Son.

Scotland, Darnaway Estate, Morayshire, Scotland. Elevation 60-150 m.

Switzerland, Münsterthal. Elevation over 1,200 metres.

(2) Experiment No. 8. (Part). Planted 1937. Larix decidua Provenance.

This experiment, which is laid out in 5 randomised blocks of 30 plant plots demonstrates the superiority in height growth of the genuine Sudeten larch. Again, recent data will be available, but at the age of 14 years it was 1.5 m. taller than any of five different Scottish provenances. Larch from the Central Alps and North Tyrol was not significantly different in height from any of the five Scottish collections. Larix decidua from the French Alps was very definitely inferior and the growth of this provenance is so bad that it will form only a poor crop.

This experiment confirms the very poor results of French Alpine L. decidua in an earlier experiment of 1926 (Some members of the party may be able to see this later this afternoon).

Details of Provenances

Germany, Zulzhoff, Silesia, of guaranteed Sudeten parentage.

Scotland, Tom-un-Uird, Morayshire.

" Advie, Morayshire.

" Glencoe, Argyll.

" Glentress, Peeblesshire.

" Tullimet, Atholl, Perthshire.

Central Alps, Elevation 700 - 900 m.

North Tyrol, Elevation 580 - 800 m.

France, Alps, Elevation 850 m.

The party will then walk down through larger plots (planted in 1936) of the following provenances.

Scotland, Grandtully Estate, Perthshire.

Switzerland, Münsterthal, Elevation over 1,200 m.

Silesia, Sudeten (?).

Scotland, Loch Kennard.

Boarding lorries the party will drive to the main section of Drummond Hill forest.

(3) Experiment No. 11. ^{Commenced} ~~Planted~~ 1938. Pruning and Thinning of Picea abies.

An experiment in pruning with the following treatments:-

	Thinning
1. Unpruned control.	C/D
2. Pruned up to lowest live branch (every 4 years)	LC
3. Pruned up to and including second live whorl (every 4 years)	LC
4. " " " " " " " " (every 8 years)	LC
5. " " " " " " " " (every 4 years)	C/D
6. First pruning to 50 per cent. of tree height. Second to 66 per cent.	LC
7. " " " " " " " " (at different seasons)	LC

A portion of one block will be examined.

The lowest intensity of pruning (treatment 2) was ineffective.

Pruning up to and including the second live whorl from the base of the crown either every four years (treatment 3) or every eight years (treatment 4) combined with crown thinning gave approximately similar results. The differences are mainly due to the fact that on the average the pruned trees in treatment 3 were nearly 4 ft. taller than those in treatment 4, due to irregularity of the site. These treatments, together with No. 5 (see below) were the most severe in terms of the diameter at the top of the pruned section in this experiment, because the planting was close (1.0 x 1.0 m.) and the death of the branches was consequently rapid.

No. 5, the same pruning up to and including the second live whorl, with low thinning (B grade in 1937 and C/D later), equally or even more severe at the start, showed surprisingly little difference in later years. Differences which might have been shown were obscured by the fact that the maximum limit of pruning, i.e., 9.2 m. (30 ft.) was reached very quickly, or, in other words, the pruning was started too late. All three treatments became progressively less severe as pruning approached the 9.2 m. limit.

The two remaining treatments were designed to prune to 50 per cent., 66 per cent. and finally 75 per cent. of the height of the trees. In this experiment the first pruning to 50 per cent. was actually less severe than the treatment to the second live whorl, for the reasons given above, though the opposite was true in other experiments on Pseudotsuga taxifolia etc. 66 per cent. of the height was reached at the second pruning, and this was almost the 9.2 m. limit, so that 75 per cent. of tree height was in fact never attempted.

Treatment 7 differed from 6 only in that the prunings were carried out at different seasons of the year. In 1947 no differences were found in respect of the percentage of stems suffering from canker, but live pruning at all times caused some damage, and this was investigated at the Forest Products Research Laboratory, Princes Risborough, and by W.R. Day at Oxford (Forest Record No. 4). It was concluded that the canker or bark necrosis might easily affect the timber, but the attack passed away and the wood in thinnings since felled has been found to be healthy, all the damage being outside the cambium.

Tests on the timber will be started later on, but in the meantime a pruned thinning has been sectioned and will be displayed.

It is apparent that pruning started too late in this experiment and also that the method of control of pruning intensity was ill-defined. The position of the second live whorl varies with thinning treatment, and in newer experiments pruning is being carried out up to different stem diameters and the relationship of these points to the position and depth of the live crown and total height of the tree is ascertained.

The most interesting point about the experiment now is the contrast between the crown and the low thinning. Some difficulty has been caused by the original pruning of too many trees, the experimental plan having visualised about 750 per ha. which has proved to be too many, and in the latest thinning it has been necessary to reduce the number severely by removal of pruned dominants. In the crown thinning the excessive number of pruned dominants has also resulted in the loss of the smaller trees.

(4) Alnus incana Sample Plot No. 169. "D" grade (Heavy low thinning).

Age years	No. of trees						Total thinning yield		Total crop yield
	No. of trees	Top Ht.	Form factor	Diam.	Basal area	Volume	No. of trees	Volume	Volume
21	309	17.1	.467	21.0	10.5	83.1	1282	173.1	256.2

This sample plot has been thinned seven times and much more heavily than is normal practice with broadleaved species.

The "biggest Larix decidua in Scotland" was felled near here in 1924.

After lunch the party will divide. Party A. Those who wish to see the Larix decidua provenance experiment, which commenced in 1944 with the distribution of seed by the International Union of Forest Research Organisations, will proceed to Boreland. Party B. The others will discuss the management of larch crops and see some more sample plots of larches, Tsuga heterophylla, and a small plot of Abies alba.

Party A. The party drives along the shore of Loch Tay and members will note the predominant use of Larix spp. on these steep fertile slopes. On the opposite side of the loch hills are utilised for sheep grazing except for odd patches of woodland. With the good grass cover on the Scottish mountains, erosion does not assume the catastrophic proportions found in less favoured countries, nevertheless gradual erosion does take place and agriculturists are now becoming convinced of the necessity for integrating some areas of woodland into our upland grazing regions.

(5A) The International Larix decidua Provenance Experiment. (No. 13). Planted 1947.

Last year (1955) at the age of 9 years a height assessment was carried out, based on a sample consisting of alternate trees all round the four sides of each plot. This was an interim measurement as at the present stage plots are not easy to penetrate.

The provenances, 2 "standard" and 18 "others" are grouped into three, each of 6 "others" plus the 2 standards. The three groups are replicated nine times as a 3 x 3 Latin square. One row or one column of the square thus comprises a complete replication of all "others" and 3 replications of the standards.

There were significant differences between the rows (i.e. different elevations):-

		Mean height of all provenances (metres)	
		Age 9 years	Age 5 years
Row 1 Elevation	290-300 m.	3.9 m.	2.0 m.
" 2 "	270-290 m.	3.8 m.	2.1 m.
" 3 "	260-270 m.	4.2 m.	2.2 m.
		} ± 0.05 m.	

There were highly significant differences between columns, i.e. decrease in height from west to east. This was attributed to different ground vegetation in 1952, in particular Pteridium aquilinum, but now that the trees are well above the Pteridium, the reason is probably some more fundamental site difference.

		Age 9	Age 5
Col. 1 West		4.2 m.	2.2 m.
" 2 Central		4.1 m.	2.0 m.
" 3 East		3.9 m.	2.0 m.
		} ± 0.05 m.	

The differences between provenances were highly significant, i.e. at the 0.1% level of probability. Corrections for differences compared with the two standards, both over the whole experiment and within the groups have been calculated but they do not exceed 6 cm. in any case.

<u>Origin</u>		Experimental Group No.	<u>Age 9 years</u> Mean Height (m.)
<u>Austrian Alps, medium - low elevation</u>			Corrected
A5	Krumbach, Lower Austria	II	4.4
A7	Landeck, Tyrol	III	3.8
A8	Murau-Murau, Styria	I	3.5
A12	Schottwien-Wartenstein, Lr. Austria	II	3.8
A14	Waldstein, Styria	S.2	4.1
<u>Austrian Alps, high elevation (over 1,500m.)</u>			
B18	Steinach-Gries, Tyrol	III	3.9
<u>Swiss Alps</u>			
D.26	Lötschenthal, Wallis	II	2.9
D.27	Untervaz, Graubünden	I	3.9
<u>German Lowlands</u>			
F.29	Harbke, Brunswick	I	4.0
F.30	Neckargemünd, Baden	III	4.2
F.31	Neumunster, Schleswig-Holstein	I	4.3
F.32	Proskau, Upper Silesia	II	4.7
F.34	Schlobitten, East Prussia	II	4.1
F.35	Sobbowitz, Danzig	I	4.1
F.36	Stolp, Pomerania	III	4.3
<u>Sudeten, Czechoslovakia</u>			
I.49	Parchowitz, Moravia	III	4.7
<u>Scotland</u>			
43/135	Lethen Estate, Nairnshire	III	3.4
43/502	Aldroughty Estate, Morayshire	S.1	4.2
<u>Miscellaneous</u>			
E.28	Larix leptolepis, ex Denmark	II	4.7
L.54	Sweden, ex Dunkeld, Scotland	I	4.2

The standard errors and differences for significance between means are as follows:-

		Difference at levels of			
		S.E.	5%	1%	0.1%
Between the two standard provenances (S1 & S2)		0.09	0.24	Not Sigt.	
" one standard and any other provenance		0.14	0.40	-	
" the non-standard provenances in any one group		0.16	0.46	0.61	0.79
" " " " in different groups		0.19	0.55	Not Sigt.	

Conclusions: No significant differences between the standard provenances
(Aldroughty and Waldstein) 4.2 m. & 4.1 m.

Significantly better than the standards:-

E.28 <u>Larix leptolepis</u>	4.7
I.49 <u>Parchowitz, Moravia</u>	4.7

Significantly poorer than the standards:-

D.26 <u>Lötschenthal, Wallis</u>	2.9
43/135 <u>Lethen Estate, Nairnshire</u>	3.4
A8 <u>Murau - Murau, Styria</u>	3.5
A.12 <u>Schottwein-Wartenstein, Lr. Austria</u>	3.8
A.7 <u>Landeck, Tyrol</u>	3.8

} (Border-line)

Party B. The lorry drives along to the Mains farm near Kenmore and then uphill along a forest road through crops of L. decidua planted in 1920-1930. Naturally-regenerated Fraxinus, Acer and Fagus, will be noted. A stop will be made to study heart rot.

(5B) Fomes annosus at Drummond Hill. Although the old Larix had such a high reputation for its quality, a recent survey of the stumps shows that some rot, perhaps in ten per cent. of the stems, was present. The Larix growing among the hardwoods was, as is to be expected, relatively sound. Where Larix and P. sylvestris were mixed, the amount of rot was greater in the places where the proportion of Larix was higher. The Pinus were mainly sound, but rot was found in the Picea.

In the present pine crop, where there are old stumps to provide the initial infection, it is expected that the disease will develop more strongly, and that it will also infect the first rotation crops on the north face of the hill. Already there are some signs of this development, which will be studied in Compartments 70 or 72. It will also be seen later in Tsuga heterophylla.

It is proposed that this forest shall be used for field trials of creosote stump protection against spore infection; on the south face to see how effective it is in keeping the disease from increasing rapidly where it is already established, and on the north face in keeping it out of the plantations which have not carried a previous crop. Quite a large proportion of the plantations have in fact already been thinned, both on the north and south faces, but since this will frequently be the case where protection is called for, it is an advantage to have information of its effectiveness under these different conditions. The remaining trial areas are only now coming into the thinning stage and will show whether it is possible to keep the infection out altogether by applying creosote at the time of first thinning.

The party will then walk to the Black Rock, along the road built for Queen Victoria to drive along when she visited Taymouth Castle, and from which a good view of Loch Tay and Kenmore can be obtained.

The party will then drive to a small plot of Abies alba planted in 1926.

(6B) Experiment No. 2. Abies alba. The trees were dipped in a 5 per cent. solution of Lysol disinfectant before planting. Two years later they were found to be affected by Adelges nusslini but still appeared healthy. By 1938 they had become yellowish and unhealthy looking and the majority of plants had had their leading shoots killed back. Ten years later, however, they had greatly improved and today they do not appear unhealthy but have obviously suffered from the early check. When their growth is compared with the rapid growth of the nearby Larix eurolepis, it will be seen why Abies alba has not been more widely planted in Britain, even though some of our largest specimen trees are of this species (as will be seen especially at Inveraray on Friday).

(7B) Sample Plots of Tsuga heterophylla and Larix eurolepis (First and second generations) and Larix leptolepis. All "D" grade except plot 168.

Age years	Main crop						Total crop yield
	No. of trees	Top Ht.	Form factor	Diam.	Basal area	Volume	Volume
<u>Plot No. 237. Larix leptolepis</u>							
28	613	15.8	.488	21.4	22.4	167.9	305.2
<u>Plot No. 238. Larix eurolepis 1st Generation from Dunkeld</u>							
28	531	16.9	.480	22.2	20.6	162.8	335.6
<u>Plot No. 239 Larix eurolepis 2nd Generation from Dunkeld</u>							
28	588	16.6	.470	21.4	21.6	164.0	331.7
<u>Plot No. 168 Tsuga heterophylla C/D grade. Moderate low thinning</u>							
27	1712	12.2	.477	16.2	35.8	197.4	292.8

The two parties will then re-join the bus and proceed to Loch Awe.

The first stage of the journey is along the north side of Loch Tay. Loch Tay is the largest loch in eastern Scotland and at one time there was a steamer service upon its waters, the piers for which can still be seen. On the right the hills rise up steeply to the summit of Ben Lawers 1,214 m. a mountain famous amongst botanists as an Alpine Refugium. In winter skiers come from Edinburgh and Glasgow to make use of the fine snow-fields.

At Killin the party will stop for tea. There is an attractive waterfall or series of rapids - the Falls of Dochart - where the road crosses the R. Dochart. Three miles farther on there is a gap in the hills on the left. This is Glen Ogle through which pass the road and railway to the south. The next ten miles up Glen Dochart are typical of much of the southern Grampians. The land is rather too high and the soils too poor for extensive forestry. Although we shall see mostly sheep, this country was used until 150 years ago for extensive cattle raising and especially the droving of cattle from the West Highlands and Islands.

This country was the region over which Roy Roy MacGregor - the leader of a well known band of freebooters - held sway during the troublesome times between 1690-1734. His exploits were legion, but he managed to survive to a quiet old age and is buried at Balquhiddy (which is over the top of the hills on the left).

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 Chuilc - 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.