FORESTRY COMMISSION

HISTORY

of

BENMORE FOREST

1925 - 1951

WEST (SCOTLAND) CONSERVANCY

HISTORY OF BENMORE FOREST

Contents

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GENERAL DESCRIPTION OF THE FOREST

Situation

The present Forestry Commission property known as Benmore Forest comprises three old estates which passed through the hands of various owners from the days of clan warfare until the second half of the last century when they were brought under single ownership and possibly assigned the name of Benmore.

These estates were:-

Bernice, now the northern portion of Benmore. It was a hunting ground of the Duke of Argyll until the unrestricted grazing of sheep interfered with stalking; the next owner was a Ewing who in turn disposed of it to a Fletcher of Dunans.

Kilmun, the southern portion, which has a very ancient record in Scottish history and was the domain of the Lamonts of Cowal. The Campbells had an early footing in Kilmun and from 1442 when the Black Knight of Lochow was granted a place of sepulture for the burying of his son, they extended their possessions until the whole estate was in their hands.

Inisninrusg, which is now Benmore proper, the land between the rivers Massan and Echaig was in possession of the Campbells of Ballochyle; it was sold to Thomas Harkness (An Call Ruadh) who was apparently the man to begin the practice of allowing sheep to graze at large on the hills. The estate changed hands many times until 1863 when it was purchased by an American, Mr. Patrick.

In 1870 all three properties were acquired and united into one estate by James Duncan a sugar refiner from Greenock and he was responsible for much of the present lay-out and for all the older woods. He planted the Cruach, Stonefield, Rashfield, Finnartmore, Uig and Gairletter woods, approximately 1,100 acres, between 1870 and 1880. Of these old woods only the Cruach, the arboretum and the strips along the Duncon - Arrochar road remain. Planting was at the rate of about 4,000 plants per acre so that tremendous numbers of plants must have been purchased. The species chiefly used were larch, pine and spruce (which included Douglas fir) some hardwoods

and ornamental conifers. High plantations all died back to about the 900 foot contour, pine showing the poorest results.

In 1890 the estates were acquired by the late Mr. H. J. Younger who was succeeded by his eldest son, the donor of the estates to the Forestry Commission. These owners also did a considerable amount of planting, the larger blocks being the Corragh Wood and Cot House Wood which were thinned for the first time in 1947.

The estate of Benmore was gifted to the Forestry Commission by Mr. H. G. Younger in 1925. The gift included the mansion house of Benmore and three piers on the Holy Loch and Loch Long, but excluded the feus of the villages of Kilmun, Strone and Blairmore. Subsequently Mr. Younger formed a trust called The Younger (Benmore) Trust, to which he gifted the income from the feus from these villages, to be devoted to running the gardens at Benmore. The management of the gardens is in the hands of Sir William Wright Smith, Royal Botanic Gardens, Edinburgh. The mansion house is used as a Forester Training School.

The forest occupies the land round the southern portion of Loch Eck, the western slope of the Loch, the north slope of Glenmassan and the eastern slope of the peninsula formed by Loch Long and the Holy Loch. The central point of the forest is seven miles from Dunoon in the County of Argyll.

Area and Utilisation

The following table shows the areas (in acres) of ground as acquired with dates:-

TABLE I

From	By	Date	Plantations Acquired	Plantable (excl. Col.4)	Nurseries	Agricultural	F.W.H.	Unplantable	Total
H.G. Younger	Gift	1925	810	2776	2	444	-	5012	9044
Mrs. J.A. Dow	Purchase	1945	-	380	-	19	-	244	643
TOTALS			810	3156	2	463	-	5256	9687

Statement of areas as at end of F.Y.51.

TABLE II

(a)	Plantations -		
	Acquired	447	
	Formed by Commission	1852	2299 acres
(b)	In hand awaiting planting - Other land		1304 "
(c)	Nurseries		18 "
(d)	Agriculture. Number of Tenancies	3	5903 "
(e)	F.W.H. and other Tenancies		48 "
(f)	Unplantable land in hand		115 "
			9687 acres

Physiography

The forest now comprises two separate blocks, the first extending from Bernice on the west side of Loch Eck southwards to Strone point and along Loch Longside to Gairletter with a branch westwards along Glenmassan; the second a small compact block on the north side of Glenlean. All slopes are steep and the forest will eventually consist of the western Loch Eck slope, the north Glen Massan slope, the north Holy Loch slope extending to the Inverchapel Estate march and the south Loch Long slope to Stronchullin where Benmore marches meet with Glenfinart. The forest is not a regular compact block but an elongated stretch of hillside with all aspects and generally a stiff degree of slope.

Geology and Soils

The bedrock is mainly quartzites and schists with some igneous intrusions. The metamorphic rocks were originally sediments such as impure sandstones, shales, limestones, etc., but their mineral composition and structure has been greatly altered due to intense heat and pressure. They may be recognised by the presence of marked cleavage or foliation which causes them to split very readily in one direction.

The main soils are:-

(a) Deep fine loams derived direct from the parent rock.

(b) Gritty or rocky loams and clays of glacial original.

(c) Peats generally shallow over gritty or rocky loams and clays.

Vegetation

Soil type (a) carries a vegetation of scrub bracken and the finer grasses, type (b) Calluna and hill grasses, and type (c) Molinia/Juncus associations if of better quality and Scirpus, Erica and Vaccinium if of inferior quality.

Meteorology

The climate is typical of the western seaboard of Scotland with no extremes of heat or cold and very high rainfall. Annual figures show the average rainfall to be between 80 in. and 90 in. Snow is infrequent and does not generally lie long below 1,000 ft. Any hard dry weather is generally experienced in the spring thereby increasing the danger from fire. Late frosts are frequent and damaging. Winter gales are common and are to be feared from the thinning stage onwards due to the heavy rainfall and proximity of rock to the surface.

Exposure on western slopes can be very severe due to Atlantic gales and the western position of the district. There is no land mass between the majority of forests and the Atlantic Ocean and therefore no break to the strong prevailing winds coming directly off the sea. The limit of planting is thereby much reduced in comparison with eastern localities and it is seldom possible to plant higher than 900 ft. even when the quality of the ground above that altitude is sufficiently good for conifers.

Risks

The main risk for many years was from fire but this has decreased now as plantations near roads are reaching the thinning stage and have almost all been brashed. In the early stages, danger from fire in the spring months could be very acute due principally to tourist parties, picnic parties and holiday makers generally, and to heather burning by neighbouring farmers. The forest occupies a position in a popular holiday district and is in addition a unit of the Argyll National Forest Park, and special precautions are necessary on account of the frequent presence of large numbers of the public.

Rabbits were never plentiful in this region due to the wet climate and nature of the ground. They occurred locally on drier slopes but were comparatively easily dealt with at the time of afforestation. They have been almost entirely exterminated.

Deer, both red and roe, have always been moderately abundant in this region and have to be constantly watched. They move over the entire Cowal peninsula at the dictates of the weather and food supply. Damage from these animals is not serious, due principally to constant patrol by two trappers but they are still to be met with regularly in the forest which now affords them useful shelter.

One of the chief troubles now is intrusion of sheep. As the fences are now very old and difficult to maintain, sheep trespass from adjoining ground is difficult to prevent and is at its worst in the early spring when grass on the hill is bare but is more plentiful in the vicinity of plantations.

Danger from wind has now to be feared when much of the area is at the thinning stage and where the ground is soft and peaty. Planting has been done almost entirely with spruce and the lack of other species, scrub belts and mixtures makes plantations much more vulnerable to wind

Damage from insects and fungal pests is practically negligible; spruce Aphis occurs locally but is never severe, probably on account of the very heavy rainfall.

Roads

Benmore Forest is generally well served by the County roads although access from these roads to the forest is over very steep ground and the absence of side roads, tracks and paths greatly increases the difficulty in working the forest. The west side of Loch Eck, Cruach, Coirantee and Bernice blocks, are reached by a forest road which stops at Bernice house; it is proposed to carry this road further along the north side to link up with the Glenbranter and Loch Eck forest road. The Glenmassan area is served by the County road as are also the Uig, Rashfield, Kilmun and Blairmore blocks.

Until the Engineering Branch was established these roads referred to above comprised the entire system. Very little has been done so far to augment this or to provide the necessary tractor tracks and side roads. A branch road has been built from the Bernice road part of the way through the Cruach Wood; it is intended later to carry this road on towards the Glenmassan County road. Some 500 yards of road have been constructed in the forest garden at Kilmun, partly for use of timber extraction from the

Garden and from the Rashfield block and partly to facilitate people in getting round the different species plots in the Garden. This road is not yet completed.

Labour

The labour force at Benmore had small beginnings, rose quickly, fell during the war years (1939 to 1946) and subsequently was built up tediously from generally poor quality types of men to a bigger number than ever before. The original squad was composed mainly of workers who had served Mr. Younger before he handed the estate to the Forestry Commission and the majority of these men occupied houses on the property; several of these are still employed at Benmore Forest. The balance were recruited locally from the neighbouring villages of Kilmun, Strone and Sandbank. These men were generally of a good type, country bred and accustomed to out-of-door work in a bad climate and the early planting programmes were got through due to the hardihood and energy of this local staff.

During the war years, the squad had to be considerably reduced; men were called to the Colours and to the production side of forestry work. Labour was sufficiently plentiful between the wars but since 1946 it has been difficult to get the numbers and the quality of labour which is desirable. A hostel was opened at Kilmun in 1947 but it has seldom carried its full quota of men and these, being largely recruited from the city, have not the skill or the hardiness of the rural worker. They require training and they are very inclined to change jobs at frequent intervals.

In the last few years the position has been improved by the erection of eight Swedish houses at Deerpark and two timber houses in the Courtyard at Benmore. Three wooden houses were also purchased from Messrs. D. & H. Ferguson, Timber Merchants, on their completing the timber contract on Uig and Rashfield hill. Generally now the forest is fairly well staffed and the sale of thinnings standing has eased the shortage but with the large planting and nursery programmes which now obtain, the squad is stretched to the limit and it is not always possible to get through the amount of work per annum which, in the interests of good forestry, it is desirable to do.

A sizeable amount of the work at Benmore is undertaken by the apprentices attending Benmore Forest School. These young men get a share of all operations which may be in hand. They are supervised by the School

Foresters who are assigned the various tasks by the Forester in charge of Benmore.

SILVICULTURE

At the time of acquisition, the area under woods of 20 years of age or over was approximately 1,100 acres. The principal plantations and dates of planting are as follows:-

Stonefield Hill	37	acres,	planted 1873-74
Uig Wood	322	"	" 1871-72
Cruach Hill	100	"	" 1878-79
The Arboretum	2	"	" 1871-72
Rashfield Wood	100	"	" 1873-74
Finnartbeg Wood	111	"	" 1875-76
Finnartmore Wood	200	"	" 1872-73
Flagpole Avenue, Strone	12	"	" 1881
Black Wood	24	"	" 1877
Gairletter Wood	25	"	" 1877
Craigmore Wood	176	"	" 1878

These plantations were all formed by the late Mr. James Duncan between the autumn of 1871 and the spring of 1881. The total area planted by him is put at 1,622 acres, but that figure appears to have been if anything on the high side. The difference between the present area and that planted is accounted for partly by felling during the war years. Considerable areas in the Finnartmore and Finnartbeg Woods also have died out above the 900 foot line. Unfortunately there appears to have been a succession of foresters during the time that planting operations were in progress and a correct estimate of the numbers of plants used is difficult to arrive at, but in the Highland and Agricultural Society's Transactions of 1883 there is a very interesting description of the estate by Mr. Donald Stalker, then head forester. The total area planted, as already mentioned, was 1,622 acres in 31 separate enclosures, and the total number of plants used was approximately 6,488,000 or at the rate of 4,000 per acre, a figure which at the present time would be considered excessive.

The total cost of the planting is estimated at £12,165, or £7.10s. per acre, which at that time was looked upon as unusually high, but an item of

£3,000 for fencing accounted for one quarter of the total expenditure. The size of this item is explained by (first) the number of different enclosures necessitating 27 miles of fencing and (second) that both sides of the Dunoon - Arrochar road, where it passes through the estate, were fenced with continuous wrought-iron flat bar fences which after fifty-five years were still in a very good state of preservation. These fences cost from 2s. 9d to 3s.6d per lineal yard, owing to the state of the metal market at the time of erection.

The numbers of trees of each species planted were approximately:-

Larch	2,850,000
Scots pine	2,130,000
Spruce	1,350,000
Ornamental conifers	128,000
Hardwoods	30,000

Generally speaking larch and spruce have done well, ornamental conifers exceptionally so, whilst the Scots pine has been moderately successful. Probably what induced Mr. Duncan to plant this type of tree so extensively was the flourishing condition of a clump of old Scots pine in close proximity to Benmore House, some of which are still standing, growing upon a slope on a gravelly sub-soil. The fact that the species is indigenous may also have been a further inducement. Whatever the conclusions which led to so large a proportion of Scots pine being planted they have not been justified, and with few exceptions this species is now only of inferior growth and has been far out-stripped by the larch and spruce. The main reason for the failure of the Scots pine is probably due to its having been planted on the poorest soil, which, in places where the failure is most pronounced, is of a peaty formation, and notwithstanding the draining done, this soil, owing to the excessive rainfall, has got into such a waterlogged condition as to make it impossible for the trees to thrive. It is not asserted that the cause of the failure ascribed above is the correct one, but it seems to be the most likely, and is further emphasised by the fact that the spruce under similar conditions has done much better and now forms trees of marketable size.

Hardwoods, which apparently were planted in clumps, have been suppressed with the exception of one or two stands of sycamore, which the

moist climate seems to suit.

It will be noticed that the number of ornamental conifers planted is given as 128,000, but as the predominant species in Cruach Wood of 100 acres is Douglas fir it must be assumed that the above-mentioned figure does not include Douglas, and as their numbers are not given separately by Mr. Stalker in his list they have probably been included under the total of 1,350,000 spruce. The inference would seem to be that Douglas fir in "the seventies" had passed beyond the stage of being regarded merely as an ornamental tree.

The genera and species of coniferous trees planted were very representative, as may be judged from the list given in Appendix VII. Many of the species named have done exceptionally well, the most notable being the Douglas fir, Noble fir, Sitka spruce, Tsuga albertiana, Thuya and the Sequoias. A large number of the trees are now all over one hundred feet high, and they are seen to full advantage grouped along the slopes of the Dunoon-Arrochar road.

An outstanding feature of the policies is the avenue of Wellingtonias, 280 yards long, formed of trees of uniform symmetry and height, between which are planted the choicer rhododendrons and desfontaineas whilst either end is guarded by two huge bushes of Rhododendron arborea.

Thuya and Chamaecyparis both thrived so well that they have been employed fairly extensively in conjunction with Japanese larch and Douglas fir in forming new plantations. On the whole the results have been somewhat disappointing as both the Douglas and Japanese larch are inclined to outstrip the Thuya and Chamaecyparis before the tenth year. Still, in the case of the Japanese larch mixture, practically all the Thuya, although suppressed, are alive and may yet become marketable trees. Probably with wider planting the mixture would stand a better chance of success. The outstanding specimen trees among the conifers belong to the species Abies grandis and Abies lowiana. The former is one of the tallest trees on the estate and is now about 120 ft. high.

Succeeding to the estate in 1913 Mr. Younger, in addition to forming the collection of shrubs already mentioned, planted about 120 acres and these young plantations are now fully established and doing well. That the ground in many parts is admirably suited for natural regeneration is shown by the frequency with which seedlings come up in any area which has

been enclosed. One plantation in particular, that near the Golden Gates entrance lodge on the Kassan side, appears to lend itself especially to this, and in the space of a few yards seedlings of the following seven species have been counted, Scots pine, Norway spruce, Douglas fir, Thuya gigantea, European larch, Tsuga albertiana and Abies procera.

These woods present a valuable guide as to what species are likely to succeed in the district, and for that matter, on the west coast of Scotland; also as to what to avoid, the height to which marketable timber can be grown, whether the crop should be left to maturity or cut earlier, and many other matters. No more suitable area could have been found which would fulfil so admirably and in so many ways the purpose for which the gift has been made.

Preparation of Ground

There has been no change in the methods of preparing ground for planting nor of the type of ground being dealt with during the years in which afforestation has been done by the Commission. Benmore differs from the other forest areas in the Cowal district in that it has a larger proportion of dry ground which does not require turfing and can do with less drainage. Much of the Kilmun, Uig and Rashfield areas have been afforested by direct planting and few planting areas have required the full turfing which is a common feature in other forests.

The areas of scrub to be dealt with in preparation of ground have been nowhere extensive and have presented no unusual difficulties. Blocks of scrub have not been large enough to make it possible to lay out any satisfactory system of shelter belts or screens. Generally work had been confined to a heavy thinning or girdling of the worst trees, leaving the straight and better shaped as nurses, to be removed later, and planting has been done in lines directly through the scrub so dealt with. In the Bernice area, some of the heavy old hardwood ground was so planted but the old oak and beech were not interfered with. As a result there has been a large loss of the underplanted conifers. In the Glenmassan area much of the lighter birch scrub which was retained at the time of planting will now have to be removed.

In recent years rhododendron growth has become the most serious problem in preparing ground. Now that planting areas are in close

proximity to the policies and are on woodland cleared during the war, the heavy rhododendron growth, foolishly introduced by landowners for game cover, is being met and has to be subdued sufficiently to allow of planting. On the steep ground, at this forest, tractors cannot be employed for pulling out roots and the greater part of the growth, having been coppiced, cannot be pulled by hand. Cutting out of groups on all but the rocky ground has to be resorted to, and burning, but fresh growth and seedlings can be hauled out by root. On his visit on 18th August 1951, the Chairman suggested that rhododendrons might be pulled out in small groups and these patches planted with large strong plants of species such as Tsuga, Douglas fir and Norway spruce which would assist in suppressing the growth of the surrounding rhododendron.

Choice of Species

In the planting programmes carried out by the Forestry Commission quite a variety of coniferous trees has been planted. The main species used have been Norway and Sitka spruce, Japanese and hybrid larch and Scots pine with lesser quantities of Douglas fir, Tsuga, European larch and Corsican pine, and small quantities of Thuya, cypress, silver firs and contorta pine.

In the 1927 and 1928 areas fairly large compact blocks of Japanese, hybrid and European larches, Douglas fir, Scots pine and Corsican pine were planted on the dry lower slopes of Kilsam Hill. Practically no spruces were used during these years. All species mentioned have formed very satisfactory stands, now being thinned, with the exception of the European larch which suffered severely from die-back and canker and is still in very poor shape and appears to have very little future. Part of the area under this species was heavily opened out in 1949 and interplanted with Douglas fir. The Corsican pine block is the sole area of this species in the forest and has progressed very satisfactorily. On this block too is the only area of pure Abies procera, a promising crop which has had one recent thinning.

In the Coirantee block, planted in 1929, the main species selected was Sitka spruce which has done moderately well. It has not shown here the fast growth that is so prominent a feature of its behaviour in other localities in the neighbourhood, probably on account of the shallow soil

and sour nature of the ground; in this stand growth has been only moderate and the crop has at this date had one cleaning only. A belt of European larch has behaved in much the same way as the Kilmun lot; Japanese larch on the high ground has done very well and the Douglas fir established along the lower slopes is moderately good. The same species selected for the Bernice block in 1931 and 1932 have done very well. Sitka spruce is faster here on superior ground and Norway spruce on the cleared scrub ground on the bottom slopes is very promising. Norway spruce and Sitka spruce were mainly selected for the Blairmore block in the same years and on this soft grass-rush ground both species have done extraordinarily well. Japanese larch was chosen for the harder ribs on the hill and progressed well. These small blocks have now been twice thinned.

In 1934 and 1935 the species planted were practically entirely the spruces again which, on the soft fertile ground in Stronchullin, have made good growth. Planting was thereafter for several years on Inverchapel (now part of Loch Eck Forest) where a large proportion of Japanese larch was used and from 1941 to 1946 programmes were very small and were mainly of pure Sitka spruce in the lower Glenmassan area. In 1947 larger programmes were again initiated and were mainly of spruce in Glenmassan but a return to the high ground in Kilmun and Blairmore enabled a larger choice to be made and pine and larch were again planted in quantity and small amounts of the heavy shade-bearing conifers could again be used.

Planting

The spacing of the spruce was generally five and a half feet but in later years this was brought in to five feet for most species. Pines were planted at four feet by four feet and this spacing is still adopted.

No seedlings have been used except a small experimental lot of one year Sitka spruce seedlings from Devilla wasteland nursery on turves in the P.49 area. Generally pines were planted at 2+1 years, spruce and silver firs at 2+2 years and larches at 2+1 years. Much of the pine and larch was grown in Benmore nursery; others were imported from Glenfinart, Tulliallan and other West Conservancy nurseries.

Planting was almost entirely done with the circular spade, the Schlich notching spade and the garden spade. Mattocks were not often used. The notching spade was used for both turf and flat planting but in later years

the nursery spade was found to be more satisfactory for turf planting. This spade is also used for some of the pit planting done on scrub ground.

The annual rate of planting since acquisition of the estate by the Commission has been as follows:-

F.Y.26	6 acres
F.Y.27	99 "
F.Y.28	38 "
F.Y.29	196 "
F.Y.30	28 "
F.Y.31	206 "
F.Y.32	129 "
F.Y.33	143 "
F.Y.34	124 "
E.Y.35	148 "
F.Y.42	46 "
F.Y.43	35 "
F.Y.44	36 "
F.Y.45	44 "
F.Y.46	38 "
F.Y.47	73 "
F.Y.49	163 "
F.Y.50	112 "
F.Y.51	188 "
Total	1,852 acres

Of this total, 500 acres were replanted felled woodland, 231 acres replanted scrub and 1,121 acres afforested bare ground.

Ploughing

No ploughing has been possible at Benmore due to the very steep nature of the hill slopes and to the amount of outcropping rock.

Beating up

This operation was most necessary on the Coirantee and Bernice blocks of the forest, planting years 1929, 1931, 1932, and was due principally to vole damage to the original plants. Successive years of attack by voles meant continuous beating up over a period of three years; the same species as those originally planted were used, mainly Sitka spruce, Norway spruce and Douglas fir.

Elsewhere beating up was not abnormal and was particularly light in P.years 1942 to 1947. In the 1950 and 1951 areas, some vole damage again prevailed, chiefly in pine areas, and damaged plants had to be replaced.

Weeding

In the early years of the forest, weeding of grass, bracken and rushes was very intensive. Vegetation between the plants and between the rows was closely cut and this was often repeated three times during one growing

season. In later years it was advised, correctly, that this intensive cutting was unnecessary and extremely expensive and gradually weeding was brought to the brief freeing of plants as is the practice today. It is obvious now that the spruces develop all the better by having an erect growth of vegetation around them during the early and middle summer and that the principal object in weeding these is to prevent their being covered by a mat of decaying vegetation in the autumn and winter. The larches and pines require more freedom in the growing season and some of the heavy shade-bearers such as Abies grandis and Tsuga heterophylla become very soft and are mechanically injured by weeds if not given access to light before the end of the growing season.

Mixture of Species

Very little mixing of species was carried out at Benmore Forest. Planting was almost entirely confined to pure blocks of the different common conifers, generally large blocks of spruce and smaller compact blocks of pines, larches and Douglas fir. In the 1916 planting done in the Corragh Wood by Mr. Younger, a mixture of Sitka spruce, Douglas fir and silver fir was established and generally these three species have competed well with each other and none has suffered entire elimination. The Sitka spruce has been the most aggressive of the three and is now the dominant species and the Douglas fir has lagged most, but all three species are vigorous and the mixture is still intact. In the same wood, spruce and Douglas fir were mixed with cypress and Tsuga but the last named species has fallen behind badly and now more or less forms a second storey.

In the Corragh Wood, Japanese larch which had been planted in 1916 was underplanted with silver fir before any thinning had been done in the larch. The fir established themselves but put on practically no height growth until 1947, the year in which the larch received a heavy first thinning. Thereafter, the fir increased in height rapidly and a second thinning now being made in the larch will benefit them still further.

A small area of mixed conifers in Compartment 55 in the P.35 area is growing satisfactorily and in recent years a mixture of Scots pine and European larch has been tried.

Rates of Growth

Sitka spruce has generally been successful over those parts of the

forest in which it has been used but its rate of growth has not equalled plantations on the neighbouring units of Loch Eck and Glenbranter. It is at its best on the middle slopes of the Corragh Wood and Glenmassan and in the Blairmore and Stronchullin blocks, on soft rush ground. Its rate of growth over such areas is approximately 2½ ft. per annum from a height of 12 ft. onwards. On the Blairmore block, P.32 area, some of the best trees are 30 ft. high with a girth at breast height of 4 in.

Norway spruce has not been used extensively in afforestation at Benmore and the largest areas of this species are in the P.32 and P.33 blocks at Blairmore; in the P.34 block at Stronchullin and in the P.32 block at Bernice there are lesser areas of the species. Growth has been generally good, in keeping with other Norway spruce plantations in the locality and in Blairmore, where some of the oldest trees are, the average height is 30 ft. with a quarter girth at breast height of 3½ in. There has been no planting of this species on high and exposed areas as had been done at Glenbranter and other forests in Cowal.

The following table gives some examples and indications of rates of growth in the Forest:-

Species	Age (Years)	Geology and Soil	(a) Altitude (b) Aspect (c) Slope (d) Exposure	Mean Height Dominants (ft.)	Mean Annual Height Increment (in.)	Average Girth (true) at 4'3" (in.)
S.S.	66	Mica schist rocky, grey leached loam	(a) 700' (b) S.E. (c) Irregular (d) Moderate	92	16¾	44½
J.L.	28	Mica schist light loam	(a) 250' (b) S.W. (c) 28½° (d) Moderate	51	26½	22
H.L.	28	Mica schist light loam	(a) 250' (b) S.W. (c) 27° (d) Moderately exposed	53	27½	23½
A.N.	28	Mica schist black light loam	(a) 300' (b) S.W. (c) 10° (d) Moderate	43½	22½	20½
D.F.	28	Mica schist light loam	(a) 300' (b) S.W. (c) 21° (d) Moderate	48	26	22½
C.P.	28	Mica schist light loam	(a) 350' (b) S.W. (c) 34° (d) Moderate	33	17¼	18
S.P.	28	Mica schist light loam	(a) 400' (b) S.W. (c) 34° (d) Moderate	31	16¼	14½
D.F.	66	Mica schist sand and slight humus	(a) 360' (b) E (c) 33° (d) Fully exposed	113	20½	52½
J.L.	38	Mica schist peaty humus dark sand	(a) 75' (b) E (c) 10° (d) Mod'ly exposed	68	24	34
J.L.	23	Mica schist peaty humus sandy gravel	(a) 50' (b) S.W. (c) 14° (d) Mod'ly sheltered	58	24¾	25

Past treatment of Established Plantations

From the time of establishment the major operations which have been carried out by way of maintenance are brashing, cleaning and thinning and repair of drains. Due to the extensive areas which were afforested each year, much of this maintenance work has fallen into arrears and the labour position during the war years and the years immediately following has aggravated the position. In particular drain repair work was neglected in the years before closing of the canopy and as a result many plantations have reached the first thinning stage without any attention to drains. The position has now been considerably improved and in addition thinning is always followed by attention to the drainage system.

Brashing has been a time consuming and tedious job. In spruce areas such as those at Benmore, brashing is a major operation and no subsequent work can be done until this operation has been completed. The work is very much heavier here than in the pine and larch areas of the east and due to the preponderance of unskilled labour, the hand pruning saw is almost universally used. This, combined with the density of the stands and the need for at least 80% brashing to ease extraction on these steep hillsides, slows up the work considerably and marking of thinnings, both for felling by the forest squad and for standing sales, cannot be attempted until brashing is complete.

In the years when brashing was in its early stages, it was the custom to clean 50% of the trees only and as time went on to clean 60% and 70%, but experience has shown that insufficient brashing merely increases the costs of marking, felling and extraction and current practice is to brash all but the very suppressed. Timber merchants too, are averse to offering for a partially brashed lot and there is no doubt that their offers for lots are enhanced by the appearance of a well brashed and cleaned plantation where the stems and extraction lines are better shown up.

Until F.Y.46, thinning of plantations in Benmore was carried out only on a small scale in the more advanced and more accessible areas. Thinning was light, little more than a heavy cleaning; only dead and suppressed trees were removed and there was practically no interference with the canopy. As a result thinning had little or no effect and at the beginning of F.Y.47 it could be said that no thinning of any real consequence had

been done over the entire forest.

Prior to F.Y.47 the average area of ground gone over in thinning was 33 acres. In F.Y.47 as a result of a slightly better labour position and a reduced planting programme in 1947, 1948 and 1949, thinning was done on a larger scale. Increased planting programmes later brought the thinning area down again.

The figures to date are:-

	First Thinning	Subsequent Thinning	Total
Prior to and including F.Y.46	220 acres	173 acres	393 acres
F.Y.47	31 acres	20 acres	51 acres
F.Y.48	69 acres	67 acres	136 acres
F.Y.49	44 acres	66 acres	110 acres
F.Y.50	33 acres	59 acres	92 acres
F.Y.51	17 acres	70 acres	87 acres
TOTALS	414 acres	455 acres	869 acres

The average figure thinned per annum over the twelve years during which thinning had been done prior to 1947 is therefore 19 acres first thinning and 14 acres subsequent thinning approximately, a very much lower figure than in the succeeding five years. Much of the early thinning was carried out in mature and semi-mature woods established by previous owners of the estate and the work was thereby of a very different nature from the forest operation of first thinning which is the chief type of work now necessary on the later afforested areas.

In F.Y.47 the thinning of these fast growing plantations was still being done rather on the light side, less than 300 cu.ft. per acre being removed from Sitka spruce areas. It was not sufficiently realised how fast the trees were growing and how quickly the canopy closed; in addition, many plantations were being entered for thinning at a very late date and should normally have been receiving a second or in some cases even a third

thinning at this time. This was particularly the case with the P.27 and P.28 plantations on Kilmun Hill where the larch had gone very far ahead and was in urgent need of relief. Various sections were thinned at a two years' interval to avoid a too sudden removal of a large proportion of the trees.

From 1948 onwards thinnings were marked on a heavier scale and appended are some figures showing the volumes per acre being removed as calculated for the circular silvicultural thinning plots:-

Compt. 48 P.28	Scots pine	-	first thinning	260 cu.ft.
" 34 P.27	Hybrid larch	-	fourth thinning	500 " "
" 39 P.27	Douglas fir	-	second thinning	420 " "
" 39 P.27	Corsican pine	-	first thinning	390 " "
" 34 P.27	Japanese larch	-	second thinning	356 " "
" 35 P.27	Abies procera	-	first thinning	431 " "

No extensive thinning has yet been carried out in the large spruce areas established from 1932 onwards.

Much of the thinning work at Benmore has been done in older woods formed by the previous owners, Mr. Duncan and Mr. Younger. These woods are chiefly in two age classes, 70 to 80 years and 30 to 40 years. The bulk of the former class forms the Cruach Wood on the steep slopes behind the mansion house, a moderately regular stand of mixed conifers, Douglas fir, silver fir, larch and a little Norway spruce. Planting was carried up to a greater height on this exposed part than we should now attempt with these species and, as a result, the higher part of the wood is badly blown and is of very inferior growth. On the middle and lower slopes, the growth of the Douglas fir and silver fir has been excellent. Thinning has been done both departmentally and by merchants during the last few years and the following figures may be of interest:-

From the Research Branch plot in Douglas fir:-

1932, aged 53 years

No. of trees per acre after thinning	235
Average height of crop	94½ ft.
True girth at 4 ft. 3 in.	45 in.
Volume per acre under bark	6940 cu.ft.
Volume removed in thinning	350 cu.ft.

1935, aged 56 years	
No. of trees per acre after thinning	210
Average height of crop	96½ ft.
True girth at 4 ft. 3 in.	47 in.
Volume per acre under bark	6937 cu.ft.
Volume removed in thinning	358 cu.ft.
Periodic mean annual increment	118 cu.ft.
1940, aged 61 years	
No. of trees per acre after thinning	185
Average height of crop	105 ft.
True girth at 4 ft. 3 in.	50 in.
Volume per acre under bark	7550 cu.ft.
Volume removed in thinning	425 cu.ft.
Periodic mean annual increment	174 cu.ft.
1946, aged 66 years	
No. of trees per acre after thinning	155
Average height of crop	111½ ft.
True girth at 4 ft. 3 in.	52½ in.
Volume per acre under bark	7324 cu.ft.
Volume removed in thinning	940 cu.ft.
Periodic mean annual increment	143 cu.ft.

These figures may be compared with the following which were computed at the time of marking small standing sales in 1948, 1949 and 1950.

Figures are per acre:-

First Sale	
Area	6 acres
No. of trees marked	46
Volume removed	2166 cu.ft. over bark
Average tree removed	45 cu.ft.
No. of trees remaining standing	90
Volume remaining standing	6750 cu.ft.
Average tree remaining standing	75 cu.ft.

Second Sale

Area	4 acres
No. of trees marked	127
Volume removed	1500 cu.ft. over bark
Average tree removed	12 cu.ft. over bark
No. of trees remaining standing	153
Volume remaining standing	5660 cu.ft.
Average tree remaining standing	37 cu.ft.

Third Sale

Area	8 acres
No. of trees marked	82
Volume removed	1487 cu.ft. over bark
Average tree removed	18 cu.ft. over bark
No. of trees remaining standing	137
Volume remaining standing	7124 cu.ft.
Average tree remaining standing	52 cu.ft.

These figures may be compared with the Research Branch sample plot which is on the lower slope and is comparable with the first sale. The second and third sales were on higher ground. Over the last four thinnings in the sample plot 2303 cu.ft. per acre were removed. This compares very well with our 2166 cu.ft. removed in the first sale as it was really the removal of several thinnings in one operation.

As an example of thinning figures for one of the middle aged stands in the forest, the Japanese larch in the Boat House Wood, Compartment 98, may be taken:-

Age 42 years	
No. of trees per acre	115
True girth at 4 ft. 3 in.	36½ in.
Removed in last thinning	5 trees per acre
Average height	61½ ft.
Volume removed	52 cu.ft. U.B. per acre
Volume remaining standing	1500 cu.ft. U.B. per acre (approximately)

Thinning work in the older and middle aged stands is up to date and in the older Forestry Commission planted areas is in hand but large areas of plantation planted between 1930 and 1933 have still to be thinned, particularly spruce.

RESEARCH - Note by the Research Branch

Benmore Forest Garden originated in 1930 when some 250 acres on the hillside above the Holy Loch were laid aside for testing small blocks of as many species of forest trees as could be made available It is thus a form of arboretum, but designed to test trees as forest crops rather than as individuals. From its inception until 1938 the Forest Garden was managed by the West Scotland Conservancy, but during the war it was decided to place it under the care of the Research Branch. There was some unavoidable neglect during the war years but, within the last few years, much has been accomplished in the way of tidying up the plots, of which there are now more than 150 comprising some 90 species, removing weed species, brashing, clearing paths, checking the records, tallying plots, re-identifying doubtful species, and so on. A start has also been made in recording volumes in the older plots as they reach the thinning stage.

Among the most interesting species may be mentioned several species of Abies now reaching the thinning stage including Abies amabilis, Abies concolor, Abies lasiocarpa, Abies magnifica; Cryptomeria japonica, Picea omorika, and the very excellent Japanese larch (super Q.C.I). Among the hardwoods Acer macrophyllum is outstanding while the rapid growth of several species of hybrid Tasmanian Eucalyptus planted only in 1949 is already exciting interest.

The first permanent sample plot to be established at Benmore was No.84 in January 1930. This was in 50 year old Sitka spruce growing at an elevation of 700 feet in Crunch Wood. At that time, the plot was densely stocked with 586 trees, having a basal area of 208 sq.ft. per acre. Five thinnings since then have removed 3974 cu.ft. Q.G.U.R. per acre and brought the main crop down to 148 trees. Crowns are inclined to be shallow and flattened and their response to thinning has been slow. Now at 72 years of age the top height has reached 100 ft. and the quality class is V.

Douglas fir plot 98 established in December 1932 is in the stand which was measured by Nisbet in 1911. Tops are becoming deformed through

exposure but height growth increases by 1 ft. per annum and is now 116 ft. at 70 years of age, thus placing the crop in Quality Class II. The 140 trees remaining in the present main crop average 50 cu.ft. Q.G.U.B.

The Japanese larch in Plot 99 were planted in 1907 in equal mixture with sycamore. These were removed as they soon overtopped the larch, and when the plot was established in December 1932 the crop was pure Japanese larch. Heavy low thinnings have resulted in an evenly distributed stand of 115 trees per acre with symmetrical, well formed crowns. Top height at 42 years of age is 72 ft. The stand is thus Quality Class I.

In 1932 and 1933 a trial of various species was commenced on an exposed peat covered knoll on the hillside above Loch Eck. Pinus contorta and Japanese larch have been the most successful choices. European and hybrid larch have done well. Sitka spruce, Scots pine, Corsican pine and Picea omorika have also done relatively well. Birch and alders were not successful.

In 1935 an experiment was commenced to test the effect of spacing drains at from 9 ft. to 21 ft. apart on the growth of Pinus contorta, Sitka spruce, Japanese larch and Oregon alder, the last species failed. The differences were extremely small and in 1951 the experiment was extended to include the effect of deep drains. Records of the level of the water table are being maintained.

In November 1949 seven permanent sample plots were established in 23 year old Finnartmore Wood.

The plot numbers and species are as follows:

210	Japanese larch
211	Hybrid larch
212	Abies procera
213	Douglas fir
214	Corsican pine
215	Scots pine

The hybrid larch record the best top height of 53 ft. compared with the lowest of 31 ft. by the Scots pine. Excellent current growth is however being made by the Scots pine and they are in Quality Class I.

A light crown thinning in the Abies procera promises an outstanding plot, for the elite trees are already well distributed and their understorey is vigorous and distinctive.

At present this plot, with a main crop basal area of 147 sq.ft. per

acre is the most heavily stocked of the series. All these plots are due for thinning at the end of 1952.

In 1950 a trial was made of a proprietory chemical rabbit repellent. The plants were dipped in the solution at planting or alternatively planted and then sprayed or painted. Several concentrations were used. There were no differences between the plots thus treated and control plots and it must be concluded that the repellent was ineffective.

The same year a free growth experiment was commenced in an existing plantation of Sitka spruce, some 30 pre-dominant individual trees per half-acre plot were selected and half of them were isolated from all competition. The subsequent rate of growth and form of the isolated trees will be studied in comparison with that of trees of the same initial size left to face normal competition.

Benmore nursery has long been the site of seedbed and transplant experiments. It is of particular value in this respect because of the extremely wet climate of the area. Under these conditions the effect of many nursery operations and of fertilizers differs from results obtained in the drier parts of Scotland. Partial soil sterilization has been very effective at Benmore on occasions, but the soil is not often in a fit condition for steam sterilization. Good results have more often been obtained from the use of formalin, which in certain cases has shown considerable residual results.

A site for a heathland nursery was selected just outside the forest above Strone Point in 1948. The growth of conifer seedlings was very good, as in other heathland nurseries, but it is extremely hard to find a suitable site for a heathland nursery in the west of Scotland, because pure heather is rarely found. There is almost always an intermixture of Molinia or other grasses, and the freedom from weeds characteristic of successful heathland nurseries cannot then be attained.

M.V.E. and A.M.

March, 1952.

Conclusions

In the light of experience gained the main conclusions to be drawn from a study of Benmore Forest are:-

1. The old planters of 1860 to 1880 were very close to the mark in their selection of species and have to be credited with the formation of some excellent woods. They unfortunately planted too close which made neglect of thinning more serious but their groups of Douglas fir, silver fir, European larch and Norway spruce did very well on the whole and where in mixture, the most suitable species went on to make the final crop.

2. The mixing of conifers on this loose ground, even where all species are not entirely suitable as regards soil conditions, leads to greater stability against windblow and probably to better development of the final crop trees.

3. Direct planting with very little draining and no turfing proved satisfactory on these steep slopes.

4. It is satisfactory to note that more use was made of conifers other than spruce which is the predominating forest tree in all plantations in neighbouring forests.

5. Little attention was given to the lay-out of forest roads and rides when planting was being done. Very few rides are of any use for access and extraction and rides were not laid out so as to be easily converted to roads.

6. More of the original scrub might have been reserved for amenity and protection and it was a mistake to underplant the heavy hardwoods in the P.31 and P.32 areas at Bernice.

Apart from these points, it appears that the main work of bringing into being a large area of softwood timber has been successfully accomplished and at Benmore there are now some very good stands of all common conifers. The greater part of the forest is progressing very well; it is in a healthy and thriving condition and with proper maintenance it should yield in time to come a large volume of good quality timber.

The principal work to be done from now on is to get approximately 1,000 acres of available ground afforested, to get arrears of thinning undertaken and to keep thinning up to date. Strict attention will have to

be paid to the drainage system on all blocks immediately after cleaning and thinning, to keep the forest stable and, for the same reason, care will be needed in thinning and breaking of margins. Road work, the formation of tractor tracks principally, will have to be pushed ahead to keep up with extraction and to make standing sales possible. The aim will be to carry out first thinnings departmentally, to offer second and subsequent thinnings for sale standing and to reserve blocks of the old woods for amenity training of the School apprentices and as a timber supply for the forest sawmill.

(signed) S. M. Petrie,
14th January, 1952.

APPENDIX I

Notes from Inspection Reports

The following extracts from reports are those of chief interest and which have most bearing on the Silvicultural History of the Forest:-

From a report on the visit of the Chairman, Messrs. Murray and Gosling on 28th September 1933:-

"A visit was paid to Cruach Wood. The work carried out, viz: cleaning, some thinning and the pruning of the Sitka spruce, sample plot was inspected.

"It was decided to continue pruning of selected stems only. The best stems on the lower slopes might be pruned, by the trainees, to a height of fifty feet.

"A considerable quantity of produce will be cut during the continuance of thinning operations this winter. Reference was made to the difficulties of disposing of this produce and the Chairman wished every possible market to be explored. The Divisional Officer undertook to approach the Glasgow Poor Law authorities regarding the possibility of selling firewood to them. It was also suggested that the Ministry of Labour might be asked to send men from the camp at Glenbranter to cut the wood into fire-lighters if a suitable market could be found.

"In a later discussion the Chairman intimated that the Commission might be prepared to assist a good local man to erect a sawmill. This assistance might take the form of a loan at a guaranteed rate of interest or the Commission might join in the formation of a company. It was considered that it would be better to provide assistance in some manner to a local man than try to run an estate sawmill. It was stated that there was a man at Benmore who would probably be glad of financial assistance to extend his sawmill plant and business. This man will be tentatively approached on the subject.

"A visit was paid to Corragh Plantation P.1917. The growth of Abies grandis in mixture with Sitka spruce (2 Sitka spruce to 1 Abies grandis) was noted. There were some very good Abies grandis but in general the Sitka spruce were better. A small "checked" patch in the plantation was inspected.

It was decided that attention to the drains was necessary but no beating up."

This spruce sample plot has now had several thinnings and the figures to date are:-

Age	70 years
No. of trees per acre	148
True girth	47½ in.
Volume removed per acre in thinning carried out in 1949	287 cu.ft. under bark, per acre.

It will be noted that there was then more difficulty in disposing of produce. The establishment of a mill by a timber merchant is now being considered.

From a report on the visit of the Chairman and Mr. Murray on 1st October 1933:-

"The specimens of Pinus contorta scattered through a crop of Douglas fir and other species near the Benmore Forest School nursery were inspected. It was decided to preserve the Pinus contorta as specimens and to thin the crop with this object in view.

"The European larch underplanted with Tsuga and beech in Uig Wood was visited. It was decided to beat up the Tsuga and to underplant a small area with Douglas fir.

"A visit was paid to Puck's Glen. Excellent natural regeneration of Tsuga was noted. The effect of the felling proposals (Uig Wood) on the landscape was pointed out to the Chairman."

From a report on the visit of the Chairman on 26th August, 1947:-

"A short visit was made to the Corragh Wood. Thinning of a mixed stand, Japanese larch, Sitka spruce, Douglas fir and Silver fir planted in 1916 is in progress here. This was examined and the means of extraction by wire rope and metal chute. The Chairman referred to some improvements which might be made as regards extraction and the need for a very small amount of clearing only to make use of the rope. Mr. Jackson explained how the ropeway was set up and operated.

"The party proceeded through the mixture of spruce, silver fir, Thuya and cypress and the Chairman mentioned the desirability of continuing the road begun in the Cruach Wood right through the Corragh Wood and of having a thinning made in the older stands in the Cruach Wood."

The Chairman's remarks were as follows:-

"The Cruach Wood is in urgent need of thinning and will supply much good material of various sizes. It is unfortunate that the road which was begun was left in an unusable state and also not pushed through to its legitimate conclusion. This is the opportunity to finish (and use) it.

"The Corragh Wood is supplying a lot of material but work is handicapped by lack of access roads. The ropeway seems to have been satisfactory. The wood itself is uneven in character and an interesting study of the productivity of species and the unproductivity of some kind of under-planting. On the whole the wood should respond well to the treatment it is getting.

"A proposal to establish a good mill at Benmore is now under consideration. This should please Mr. Webster, with whom I had the interesting conversation recorded in brief by him.

"The natural regeneration of all species in the ornamental woods round the House is most interesting."

Since these words were written, three standing sales have been held in the Cruach Wood and our own staff have thinned a large area of the wood on the lower slopes. The Corragh Wood has been thinned twice and the road has been carried from the existing Benmore - Bernice road as far as the middle slope of the Cruach Wood. The sawmill has been improved by the installation of a 20 h.p. engine and a new bench and is working almost full time on Estate Branch requirements.

An improvement on the gravity extraction rope then being worked is the power operated cable in use at present at Glenbranter.

Little mention has been made of the nursery in the report. The nursery area which amounts to 18 acres is in two portions, the older part at Benmore and the later part at Uig. These nurseries have been in use for many years and have produced a valuable stock of many millions of plants for use in the forest. The following excerpt from a report on the visit of Mr. James Macdonald then Conservator (State Forests) on 24th October 1947 may be of interest:-

"In this nursery manured and unmanured seedbeds were again examined. Sitka spruce rising one year beds received 12 lbs.

superphosphates and 5 lbs. muriate of potash per 100 square yards in two dressings at two months' intervals. In this case separate breaks were treated but as the manured plants are on ground which is inferior to the unmanured break there was little difference noticeable in the treated and untreated beds. One year seedlings of spruce are small, particularly towards the centre of the nursery where drainage is not so good. On the higher margin of the north side there is a distinct improvement in the size and density of the seedlings. It was agreed that additional drainage should be done here and that, as ground comes into rotation for greencropping, additional tiled drains should be laid. It is intended, therefore, after all beds of two year seedlings have been lifted this year, to re-drain the breaks which they at present occupy.

"Two year beds of Sitka spruce were similarly manured and as a result both the manured and unmanured beds now equal in appearance, although previously the unmanured beds had been in advance of the others. 2+1 Norway spruce transplants were manured with 12 lbs. superphosphates per 100 square yards and treated lines were noted to be slightly better but extra weed growth was very heavy. Similar results were obtained on 2+1 year transplants of Sitka spruce."

In discussing the bringing of the nursery ground into good heart it was agreed that certain breaks could advisably be greencropped for two years in succession and it was decided that ground available for lining out should be revised to exclude any breaks which need resting for a further year. It was pointed out that the grass crop is not regarded as a greencrop but is merely intended to enable lining out to be done in wet conditions. In the upper nursery, the ground was generally considered to be in sufficiently good heart for lining out but that tilth was not sufficiently good for seed-beds.

"As no farmyard manure is available, the best way of bringing the ground into good condition is to greencrop regularly and to apply bulky manure such as compost, old straw, bracken and leaf mould and artificials to the greencrop ground. Chemical manures may push up growth for a short spell but to bring the ground into proper order, tilth can only be improved by the addition of humus material.

"A short visit was paid to the Corragh Wood which is being thinned and from which poles are at present being extracted. The chute was seen in operation and methods for improving its efficiency were discussed. The plantations which consist of a variety of species were generally adjudged to have been satisfactorily marked and thinned. It is intended to complete the whole of this block which was planted in 1916. The bulk of the material is being disposed of as long pitwood."

From a report on the visit of the Director (Scotland) on 2nd December, 1947:-

"A brief visit to this area was made to examine Japanese larch, planted in 1932, which was thinned during the spring.

"Extraction difficulties were discussed. It was suggested by the Director that the true boundary of our property be defined on the map, that an idea be obtained of the main lines of extraction and that the Younger Trust be then approached for the acquisition of specific areas for access and stacking of produce.

"The line of the proposed new road was walked. There was some criticism of the alteration of the present entrance and first slope and of the removal of metal from tracks already laid.

"It was agreed that the old stand of mixed conifers on this area should be thinned and that we retain the larch. The Director suggested the offering of an area for sale, standing, where extraction would be less of a problem and that small plots be measured to get a figure of volume. This would be a final thinning.

"In the thinning of the larch and Thuya mixture here, the Thuya should be favoured as much as possible and retained even when under the larch canopy. Too many of this species were being cut out."

The area of larch at Blairmore received a second thinning in 1950.

Regarding the extraction difficulties, the Forestry Commission has now acquired a number of lines of access and stacking grounds from the Younger Trust and these plantations are now thereby much more accessible to the County road.

The altered entrance to the Cruach Wood road was decided upon by the Engineering Branch.

From a report on the visit of the Director General on 30th August 1948:-

"The small area of naturally regenerated spruce and Douglas fir in the main drive woodland was examined and prospects of getting further seeding examined. In looking over the small area of high pruned conifers near the main gates, the Director General made enquiries regarding the methods of disposal of produce. He pointed out the desirability of prop manufacture as against sale of unconverted poles on account of the very much enhanced price obtained.

"A short visit was paid to part of the Cruach Wood. The younger area of Sitka spruce and Japanese larch near the Golden Gates was mentioned for need of a further thinning and would be reserved as working sites for pupils at the Forester Training School. The suggestion was made of laying aside a separate portion of Benmore Forest for sole use of forester apprentices and to be the responsibility of the School but it was agreed that they would require to work outside this area to get experience of all operations.

"Some of the older timber in Cruach Wood was seen and the entrance and part of the line of the proposed road through this area."

The comments of the Director General dated 24th September were as follows:-

"Mr. Petrie has missed the point of my comment about conversion to props. The poles we saw were of good quality and size and had been lying long enough to lose a substantial proportion of their original weight. Tonnage rates (at which I understand they were being sold) yield a poor return per cubic foot for dry material of this quality, compared with props or long pitwood. I therefore enquired if in this particular case the alternative of conversion had been considered.

"I think the loss in weight which occurs after felling even in a wet climate like the West Coast is probably not enough appreciated, e.g. our experiment at Inverliever pre-war showed that with peeled spruce poles it may be as much as 50%. The effect of this on receipts needs constant watching.

"I have no doubt that where there is a reasonable alternative it is generally sound not to expend our resources on conversion, and if

we can get our thinning done satisfactorily and economically by merchants, so much the better. We shall soon gain experience by trials such as those taking place at Glenbranter and Inverliever, as to how best to safeguard our interests. Such trials should be encouraged and extended where good results are being obtained."

Sales of pole length material have, since 1946, always been on a volume basis to avoid the difficulties of securing correct weights of merchants' loads, and to avoid loss by weight due to any possible delay in sale or removal of produce.

<u>From a report on a visit by the Director (Scotland) on 8th March 1949</u>:-

"The first object of the visit was the selection of a suitable site for a large sized sawmill, to be worked full time, with sufficient stacking ground available and possibly house sites adjoining. The site pointed out at Uig on Rashfield farm was considered suitable and entrances and exits could be arranged with minimum danger to main road traffic.

"An estimate of the volume of saw timber and pitwood timber which could be supplied from the District during the next decade was discussed.

"A visit to the existing sawmill in the courtyard was paid. This was considered a suitable forest mill but a bench of 18 ft. would be preferable to the present one of 12 ft."

The Director commented "Not necessarily a large sawmill - rather an experimental mill."

"A visit to the Cruach Wood followed. The road work there, begun some time ago and now renewed, revealed again the need for additional culverts to draw off water from the main roadside drain to prevent scouring. Irish drains across the road surface are also necessary to remove quickly the actual rainfall on road surface.

"On completion of the first section of the road, the marking of a standing sale was advised. This would exclude the European larch which will be reserved for our own use. The marking would be light in order that a portion of the crop would be removed in the course of several light thinnings to avoid windbreak in the standing trees, by a sudden opening.

"The absence of regeneration was noted. This is doubtless partly due to presence of sheep and possibly a few rabbits but more likely to wrong light conditions and the scarcity of really ripe seed in the shaded crowns.

"The area already thinned by the forest staff was seen and pronounced satisfactory, although retention of all larch gave the thinning an unfinished appearance. It was advised that a thinning plot of at least a quarter acre area in extent be laid out here to provide a record of yield.

"The Corragh Wood, thinned in 1947, was looked at. Comment was made on the rapidity of growth of the Sitka spruce and the need to make a further thinning after two more growing seasons. Paucity of foliage due to early 1947 blast and subsequent Aphis attack was noted; it is now common over many Sitka spruce areas."

The thinning of the Cruach Wood has been put in hand as already described. So far, in spite of two storms of hurricane force, no windblows or snapping of stems has taken place.

The first area thinned has been fenced to encourage natural regeneration.

On the subject of the road the comments of the Conservancy Engineer were:-

"Scouring at Cruach was occasioned by a blocked culvert.

"The use of open drains across the road surface is not recommended if the water can be diverted through pipe culverts. Any scouring which has taken place in the Cowal area has been caused by a blocked culvert or drain overflowing, not by rainfall on the road surface."

The Director commented on this subject as follows:-

"At Benmore the number of culverts was inadequate. However, many culverts there are, some water will run down the road surface under heavy rainfall conditions in the West and "Irish" drains seem necessary."

From a report on a visit of the Director General on 21st June 1950:-

"The Boat House Wood, planted in 1910, Compartment 24 was described by the Director General as a show piece; a very good stand of Japanese larch well opened out by thinning and with every hope of further development.

"Coirantee Wood, P.29, Compartments 84, 85. Part of this area, mainly a block of Sitka spruce with Douglas fir on the lower slope, a belt of European larch on the upper slope and smaller areas of Scots pine and Pinus contorta was walked and inspected. The plantation was brashed and cleaned in 1949 and had had the drains repaired. The Director General appeared satisfied with the appearance and treatment and referred to the difficulties experienced in the afforestation and beating up of the area."

From a report on a visit of the Forestry Commissioners on 22nd June 1950:-

"By way of the Garden which is managed by the Royal Botanic Gardens authorities in Edinburgh, visitors reached the Cruach Wood where a description of the Wood and its treatment were briefly given by the District Officer. A heavy thinning had been sold standing on one section to a timber merchant who completed operations and volumes of timber standing and removed were supplied. The section had been fenced in order to preserve any natural regeneration and it was hoped that the stand was now in a condition whereby more seedling growth would appear in the course of another year."

This can be noted in connection with the Director (Scotland's) visit of 8th March, 1949.

From a report on the visit of the Chairman on 17th June 1951:-

"Cruach Wood. The Chairman expressed his satisfaction with the appearance of this woodland block after thinning and of work of thinning at present proceeding in the higher area. He asked for and was supplied with figures as to volumes extracted and remaining standing and prices obtained.

"A brief stop was made at Messrs. Wilson's sawmill where the converted timber from the Puck's Glen thinning was examined. The Chairman expressed dissatisfaction with the dumping of sawdust on the low side of the road and suggested that a less unsightly dumping ground be found or that it be made a condition on sawmill sites that a Dutch oven or other sawdust burning equipment be installed with the mill.

"Arboretum. This was walked through and the trees examined, volumes and heights being supplied for various measured trees. There

was some discussion as to whether one species was an Abies concolor var. lowiana or Abies procera and as to the species of a spruce, finally said to be Picea jezoensis. The Chairman was interested in the size and age of the Douglas fir and wondered if by any means information on the origin of the seed and by whom and in which year it was sown, could be obtained, as a good deal of Douglas fir seed was imported and sown in this country about ninety years ago."

Messrs. Wilson have been requested to dump their sawdust in an out-of-the-way corner at Coirantee and have attended to this since the Chairman's visit.

From a report on the visit of the Chairman with Mr. Hugh Dalton on 18th August, 1951:-

"Cruach Wood. The party visited the Cruach Wood where a standing thinning sale is at present being worked by Messrs. Wilson. The type of thinning being done was seen as well as the area which had had the same treatment over a year ago. The latter area was fenced to encourage natural regeneration of the species on the ground and scattered seedlings of Douglas fir and Thuya plicata are to be found. The age, species and nature of the stand were described to Mr. Dalton. The Chairman advised the thinning of the adjoining old stand of pure European larch if it was to be preserved in good order.

"The Chairman expressed concern at the invasion of the older woodlands here by Rhododendron ponticum and advised that it should be dealt with. He mentioned cutting and pulling as the means of checking the weed but referred to pulling as the most satisfactory, as the re-growth from cut rhododendron was very fast and dense. Pulling was tried to see whether it was possible and it was agreed that non-coppiced plants, provided they were not too far advanced in growth, pulled out fairly easily and with small plants, up to four or five feet in height, there was no difficulty. The Chairman explained that in many areas it would seem desirable to pull the rhododendrons out in small groups and to afforest the gaps so made with strong plants of Douglas fir, Norway spruce, Abies procera or Tsuga heterophylla. These plants being of a shade-bearing nature and fairly fast growing would assist in keeping the surrounding growth of rhododendron in

check. It was pointed out that on the P.52 area at Benmore a good deal of pulling of the younger plants had been done but that so much strong coppiced growth occurred that cutting was the only means possible of preparing the ground." The thinning of the larch referred to has been begun.

The fight against the rhododendron menace has been taken up in various parts of the forest; it is particularly troublesome on the F.Y.52 planting area where, being old and having been coppiced, it cannot be dealt with by pulling and has to be cut. In other areas both pulling and cutting are being carried on to check the spread of the weed.

APPENDIX II

Supervision

Conservators

1946 - 1948	A. Watt
1948 to date	J. E. James

Divisional Officers

1922 - 1934	J. M. Murray
1934 - 1938	O. J. Sangar
1938 - 1939	A. H. Gosling
1939 - 1945	J. A. B. Macdonald
1945 - 1946	A. Watt

State Forest Officers

1947 - 1948	J. E. James
1948 to date	H. V. S. Dier

District Officers

1922 - 1927	J. Hunter Blair
1927 - 1931	J. Fraser
1931 - 1938	A. H. Gosling
1938 - 1946	H. Watson
1946 to date	S. M. Petrie

Foresters

1926 - 1935	A. Grant
1935 - 1940	R. Donald
1940 - 1946	J. McLean
1946 to date	J. Jackson

APPENDIX III

Puck's Glen, Rhododendrons and the Mansion House

For rugged grandeur and mountain scenery it would be hard to find anything in Scotland which surpasses this corner of Argyll. The lower or Kilmun portion of the estate is flanked on the east by Loch Long, and on the west by the Holy Loch. The ground along the shores of these lochs has been feued and built upon, and is now divided into the districts of Blairmore, Strone and Kilmun. Behind the feus the greater part of the hill slopes have now been afforested; the whole seen from the Firth of Clyde on a fine day making a very pleasing picture. The western boundary of the estate follows roughly the course of the Echaig to its confluence with the Massan, when the latter is followed for about 2½ miles by Glenmassan; whence the boundary line is over the hills to the north, towards Loch Eck. Both Echaig and Massan are attractive streams, and in season provide good salmon and sea trout fishing which is, however, strictly reserved. Here it may be mentioned that Loch Eck contains the powan or fresh water herring which is found in few other Scottish lochs. These fish are of little sporting value as they do not rise to the fly. The valley of the Echaig used to be known as Strathachie, a name now seldom used, and if reports as to its appearance sixty years ago can be relied upon, there are probably few valleys which have been so altered in appearance by afforestation.

Loch Eck from which the Echaig flows, is 7 miles long, and varies in width from one quarter to three quarters of a mile. Shut in on both sides by steep and rugged hills it presents in all its varying moods a striking picture. The hills on the west side are dominated by Benmore, 2433 ft. This is a popular tourist area, and ample facilities for visiting it are provided in summer months from Dunoon and Glasgow.

This short account of some of the features of the estate would be incomplete without mention of what is known as Puck's Glen. This is a striking example of how man working hand-in-hand with nature has made what was once a bare hillside ravine into a very attractive walk. Leaving the Dunoon-Arrochar road near the sixth milestone one follows a bridle path by

the stream which the ordnance survey map calls the Bas Mor, but which is better known as Puck's Burn. Almost at once, shelving banks, which in places are from 50 ft. to 100 ft. high, shut in the stream and path, whilst growing on their slopes are conifers of a dozen or more varieties, rhododendrons, and many of the rarer species of ferns. The path follows the stream through the whole course of the ravine and to do so it has to make many windings and ups and downs. Here and there waterfalls are encountered, and at one of these, steps have been constructed which take one level with the brink of the fall, from which a pleasant view can be got. Later, the open hillside is reached about 1½ miles from the point of entry. Here the path turns sharply north-west and a fine view of the head of the Holy Loch with the whole lower estuary of the Clyde as a background is obtained. Uig Wood is entered and through it the path winds in a gradual descent until the public highway is again reached opposite the site of the old entrance lodge to Benmore policies, and slightly under a mile from the point where it was first left. During the war years the majority of the rustic bridges fell into a state of disrepair and as a precautionary measure it was decided to demolish them. It has now been possible to have them replaced.

Mention was made of rhododendrons; these are a feature of the district and the common Rhododendron ponticum has now in fact become more of a nuisance than anything else. From early May until the end of June the policies are a mass of flower, practically every known variety being represented; indeed there is scarcely one month in the twelve in which one or other of the varieties is not in bloom. They are almost as much at home here as in their native habitats, the heavy rainfall suiting them admirably for the sun does not always shine in the West and Benmore is no exception, the average rainfall being about 85 in. whilst in 1923 it reached 113.25 in.

Built in the Scots baronial style the mansion house of Benmore is pleasantly situated at the base of Cruach hill, and lies sheltered among well wooded policies. In the late Mr. Duncan's time there used to be a picture gallery attached to the house which contained many famous and valuable pictures and this was thrown open to the public on certain week-days. This building was, however, dismantled when the estates were sold. The late Mr. H. J. Younger added considerably to the house, and in addition

carried out various improvements to the estate, a policy which was followed by his son.

The gardens are well laid out, and there is an ample range of glass-houses.

History of Benmore Forest

APPENDIX IV

Argyll National Forest Park

As the result of the recommendations of a Committee set up in 1935 under the chairmanship of Sir John Stirling Maxwell, the Forestry Commission in 1936 commenced to develop the Argyll National Forest Park.

The main object was to make available to the public for recreational purposes surplus and unplantable land on the Forestry Commission Units of Ardgartan, Glenbranter, Benmore and Glenfinart, in the Cowal district of Argyll. In addition to these Forestry Commission Units, a further 7,000 acres at Ardgoil, adjoining Ardgartan, were included through the co-operation of the Glasgow Corporation, to whom Ardgoil belongs.

The land within the National Forest Park area includes the five forests of Ardgartan, Glenbranter, Benmore, Loch Eck and Glenfinart, together with the estate of Ardgoil, the property of Glasgow Corporation. The total area is over 80 square miles.

This was the first experiment of its kind and its success led to the formation of similar Forest Parks in both England and Wales. The popularity of the scheme is reflected in the extensive use of hostels and camping sites which provide inexpensive accommodation for those wishing to explore the areas. The Scottish Youth Hostels Association now have three hostels within the Forest Park and the Forestry Commission have two large public camping grounds, one at Ardgartan and one at Succoth - in addition to three camping grounds set aside for the exclusive use of members of juvenile and other organisations.

APPENDIX V

Benmore Forest School

The School for Forest Apprentices in Scotland was transferred from Beauly in August 1929 to Benmore. The mansion house was divided into two portions - one for the School and the other for a hostel for visiting students studying forestry or allied sciences. Many colonial and foreign officers also visited the hostel.

327 young forest apprentices have received training since the School came to Benmore. Most of them now hold forester posts with the Forestry Commission, a few are Head Foresters on private estates and others are in the Colonial Forest Service. Many of the later apprentices have served in H.M. Forces. The majority of them became N.C.Os. or commissioned officers. Ten of them fell in action. The number at present resident in the School is 28.

Until 1943 the School entrants were recruited from Scotland, an exception being that one or two were admitted annually from Northern Ireland at the request of and at the expense of, the Forest Department of that country. In 1943 the similar Commission School in England closed down and from then selections have been made from Scotland, England, Wales and Northern Ireland.

The course extends over two years.

Much of the training is practical, and in the course of their practical instruction the apprentices do a great deal of the normal work of maintaining the forest and the forest nursery.

APPENDIX VI

Other Notes

The Forest is a unit with Loch Eck, Glenfinart, Glenbranter and Ardgartan Forest of the Argyll National Forest Park.

Farms on the Forest are factored by the Estate Branch.

Two road schemes have been initiated by the Engineering Branch, the Cruach Wood road leading from Benmore into the heart of the old conifers stand on the Cruach Hill and the Forest Garden road which leads from the Kilmun road into the Garden, administered by the Research Branch.

During the past four years ten new houses have been erected, eight of these Swedish timber houses at Deerpark and two British timber houses at the Courtyard. Three small wooden houses on the Rashfield and Uig section were bought from the timber merchants, D. & H. Ferguson Limited, on their completing their timber contract at Benmore in 1947.

APPENDIX VII

List of Species at Benmore, as at 1883

Name Authority: A Handbook of Coniferae Dallimore and Jackson Third Edition 1948	Name According to Stalker Highland & Agricultural Society Transactions, 1883	Common Name
Pinaceae		
Abies alba (Miller)	Picea pectinata	European silver fir
Abies balsamae (Miller)	Picea balsamea	Balsam fir
Abies cephalonica (Loudon)	Abies cephalonica	Grecian fir
Abies grandis (Lindley)	Picea lasiocarpa	Giant fir
Abies lowiana (A. Murray)	Abies lowii	Low's White fir
Abies nordmanniana (Steven)	Picea nordmanniana	Caucasian fir
Abies pinsapo (Boissier)	Picea pinsapo	Spanish fir
Abies procera (Rehder)	Picea nobilis	Noble fir
Araucaria araucana (Molina) K. Koch	Araucaria imbricata	Chile pine or Monkey puzzle
Cedrus atlantica (Manetti)	Cedrus atlantica	Atlas cedar
Cedrus deodara (Roxburgh) Loudon	Cedrus deodara	The Deodar
Chamaecyparis lawsoniana (A. Murray) Parlatore	Cupressus lawsoniana	Lawson cypress
Chamaecyparis nootkatensis (Lambert) Spach	" nootkatensis or Thujopsis borealis	Nootka or Yellow cypress
Cryptomeria japonica (Linnaeusfil.) Don.	Cryptomeria japonica	Japanese cedar
Cryptomeria japonica var elegans (Henkel & Hochstetter) Masters	" elegans	The Elegant cryptomeria
Larix decidua (Miller)	Larix europaea	Common or European larch
Larix leptolepis (Seibold and Zuccarini) Murray	" leptolepis	Japanese larch
Libocedrus decurrens (Torrey)	Thuja gigantea	Incense cedar
Picea abies (Linnaeus) Karst	Norway spruce	Norway spruce
" engelmanni (Parry) Engelmann	Abies engelmanni	Engelmann spruce
" glauca (Moench) Voss	Abies alba	White spruce

Name Authority A Handbook of Coniferae Dallimore and Jackson Third Edition 1948	Name According to Stalker Highland & Agricultural Society Transactions, 1883	Common Name
Picea mariana (Miller) Britton Sterns and Poggenberg	Abies nigra	Black spruce
Picea orientalis (Linnaeus) Carriere	Picea orientalis	Oriental spruce
Picea sitchensis (Bongard) Carriere	Abies Menziesii	Sitka spruce
Picea smithiana (Wallich) Boissier	Abies smithiana	West Himalayan spruce
Pinus mugo (Turra)	Pinus montana	Mountain pine
Pinus nigra (Arnold)	Pinus laricio	Corsican pine
Pinus nigra forma austriaca (Hoess) Aschers & Graebrer	Pinus austriaca	Austrian pine
Pinus ponderosa (Douglas)	Pinus benthamiana	Western Yellow pine
Pinus radiata (D. Don)	Pinus insignis	Monterey pine
Pinus strobus (Linnaeus)	Pinus strobus	White or Weymouth pine
Pinus sylvestris (Linnaeus)	Pinus sylvestris	Scots pine
Pinus wallichiana (A. B. Jackson)	Pimus excelsa	Bhutan, Blue or Himalayan pine
Pseudotsuga taxifolia (Poiret) Britton	Abies douglasii	Douglas fir
Sequoia sempervirens (Lambert) Endlicher	Sequoia sempervirens	Californian Red-wood
Sequoia wellingtonia (Seemann)	Wellingtonia gigantea	Big Tree
Thuja plicata (D. Don)	Thuja lobbii	Western Red Cedar
Thujopsis dolobrata (Linnaeusf) Siebold & Zuccarini	Thujopsis dolobrata	Hiba Arbor-Vitae
Tsuga canadensis (Linnaeus) Carriere	Abies canadensis	Eastern hemlock
Tsuga heterophylla (Rafinesque) Sargent	Abies albertiana	Western hemlock
Pinus cembra (Linnaeus)	Pinus cembra	Arolla pine