FORESTRY COMMISSION

HISTORY

OF

GLENDUROR

FOREST

W (S) CONSERVANCY

F O R E S T R Y C O M M I S S I O N

H I S T O R Y

of

G L E N D U R O R F O R E S T

1920 - 1951

WEST (SCOTLAND) CONSERVANCY

HISTORY OF GLENDUROR FOREST

C O N T E N T S

HISTORY OF GLENDUROR FOREST

CHAIRMAN'S COMMENTS.

Glenduror, with the adjacent forest of Glen Righ, was the cause of much anxiety in the early years. Even at the then level of experience with various species avoidable errors were made; further there was damage by sheep and possibly deer.

After a poor start methods were gradually improved but as late as 1932 it was still necessary to speak of consolidating the poor areas. In that year, after an inspection of Duror, I issued a Memorandum entitled "Spruce Planting (with special reference to Glen Righ, Duror, Nevis and other West Highland Forests)". It shows the state of knowledge (at least of my own knowledge) at the time and was roneoed and presumably circulated to Divisional Officers. For that reason I think it worth attaching to the History of Duror. In the process of consolidation J.M. Murray (Divisional Officer and later Assistant Commissioner for Scotland) put in good work.

It is pleasing to know that by the exercise of so much care and patience such an excellent forest, as Duror is today, has been established.

(Itd.) R.

12.9.51

SPRUCE PLANTING

(With special reference to Glen Righ, Duror, Nevis and other West Highland Forests.)

Unusual patience is required in the establishment of spruce plantations on poor sites. The recuperative power of checked spruce persists over twenty or even more years. Some of our officers who are dealing extensively with the afforestation of poor spruce sites have not witnessed this phenomenon on their own areas, and for that reason I have suggested to the Divisional Officer, North Scotland, that he should arrange for some of his assistants to visit Inverliever and make a close inspection of the development of the older spruce plantations.

Points to note at Inverliever

In examining the Inverliever spruce, it should be borne in mind that they were planted at a time when the importance to the spruces of soil aeration was not appreciated. Plants were notched in deeply and drainage was not as intensive as is now considered necessary. Historically it is interesting to note that at Inverliever there were begun the investigations into the roots of spruce which have led to our present methods of turf-planting, shallow notching, etc.

The following silvicultural points are worth noting in respect of the Inverliever spruce:-

(1) The recuperative powers of both Sitka and Norway after many years of check.

(2) In general the very uneven growth of the spruces on poor sites. Groups of trees start into growth here and there on the better soil, gradually extend in area by awakening the adjoining trees to growth, and in the long run coalesce to form complete canopy.

(3) The possibility of correlating the length of the check period with certain types of vegetation and in some cases at least with the presence of hard pan.

(4) The checking influence of some types of pure heather - more marked in the case of Norway than Sitka.

(5) Generally, the superior growth of Sitka over Norway on the poorer sites and particularly in the more exposed situations.

(6) The improvement in growth of Scots pine after the spruce, which is now associated with it, had begun to provide shelter.

(7) Double crops of plants owing to premature beating up: the best plants are often those which, though first planted, were thought at the time of beating up to be incapable of growth;

and as regards management the following points should be looked at:

(8) The process of consolidating the best parts of the older plantations where the plants are still in check or have failed.

(9) The limitation of the scale of work under (8) by a definite annual expenditure.

There are doubtless other points as well to which the Divisional Officer, South West Scotland, will draw attention.

Developments in Spruce Planting

It is not necessary to detail the developments which have taken place since the earlier Inverliever plantations were made as all of our officers should be conversant with them. The main developments are:-

1. Effective drainage
2. Turf planting

} Both of which improve the aeration of the medium in which the roots are placed.

3. Slagging, which reduces the initial check period and even gets plants away in sites where they would otherwise remain indefinitely in check.

4. Seedlings may frequently be used instead of transplants. For complete success the plants must be sturdy and planted late, the turfs good, and the weed growth not too rank.

Future Procedure with regard to Spruce Plantations

Summarising our experience, the following procedure is indicated:

A. Establishment of new plantations

1. At the first, planting ground which is in any way "doubtful" should remain unplanted. Under the head of "doubtful" is included land which requires slagging.

2. Sufficient drainage should be done on the unplanted land to cut off the main seepage of water. The drainage is to be completed when the planting is done and will thus provide the necessary turf.

3. The original planting will be consolidated when the first planted trees are well out of check. Slagging may be used sparingly on the worst parts of the second planting, but should not be the rule.

4. Be very careful of "heather ground". At low elevations it may well be better to plant it with pine (taking care that pine is not put into the adjacent soft ground). At higher elevations it should be regarded with suspicion and omitted until we know more about the development of Sitka and contorta on such sites.

B. Treatment of existing unsatisfactory Plantations.

The areas for treatment having been selected (see below):-

1. Drainage: first get the drainage right. (Many of our earlier plantations are defective in this respect) and

having done so give the drains time to work before proceeding to slagging, etc.

2. Beating up. Bear in mind the wonderful recuperative powers of the spruces and don't beat up any plants which are still alive. The tendency always is to beat up too hard and too soon. Gappy plantations, even 3 ft. to 5 ft. high, can well be beaten up with large plants from turf nurseries.

3. Slagging ought to be our last resort. An ounce of patience may well be as effective as 2 oz. of slag and is very much cheaper.

4. Lifting checked plants has proved effective in some cases, especially when slag is also applied but not in others. It is an expensive method, not yet thoroughly tried out, and therefore to be applied cautiously.

5. Selection of areas for treatment. The better parts should obviously be taken in hand first; that is to say land which we are confident we can deal with. When the census of plantations is complete a definite plan must be got out for the treatment of the unsatisfactory sections, and this plan will detail the order, rate of treatment, etc.

R.L.R.

6th October, 1932

HISTORY of GLENDUROR FOREST

GENERAL DESCRIPTION of the FOREST

Name.

The name of the forest is taken from the glen on whose northern slopes most of the early plantations were formed. The glen was once the home of James Stewart who was executed near Ballachulish Ferry for the murder of The Red Fox of Glenure, a few years after the "Forty-five". The "Appin Murder" is dealt with at length in R.L. Stevenson's novel "Kidnapped". James of the Glen's cottage still exists, though in ruins, in an unplanted field in the middle of the forest.

Area and Previous Utilisation.

Of the 5,300 acres originally proposed for acquisition 2,689 acres for one reason or another were classified as 'Unplantable', and only 2 acres of mixed, poor plantations existed, together with some 135 acres of thin scrub at the northern end of the forest, overlooking Loch Linnhe. The land was under sheep farms, carrying a total of 3,250 sheep and 26 cows with calves. Local tradition has it that the farm of Auchendarroch carried a growth of birch, oak and alder and their usual associates all over the lower slopes: this growth persisted until about the beginning of the nineteenth century, when the demands for sheep grazing led to the gradual clearing away of large areas of the woods. There is still evidence that the whole of the land to well over 1000 ft. had grown both oak and birch, and stumps of both species are regularly found in recent peat during draining. However, steady grazing by the sheep had removed by 1920 all traces of the living trees except in inaccessible corries, where some scrubby remnants can still be seen.

TABLE 1. ACQUISITION DETAILS.

Acquisitions From or Disposals to (1)	By (2)	Date (3)	Plantations Acquired (4)	Plantable excl. Col.4 (5)	Nurseries (6)	Agricultural (7)	F.W.H's (8)	Unplantable excl. Col.4 (9)	OTHER LAND				Total Acres (14)
									Land Permanently Transferred to D.O.A.S.		Land Temporarily Transferred to D.O.A.S.		
									Description (10)	Acres (11)	Description (12)	Acres (13)	
From Mrs. Ethel Blakiston-Houston or Macalpine	Purchase	1921	-	1184	2	1¼	-	70	-	-	D.O.A.S.	3119	4376¼
From ditto	"	1927	-	1207	-	41	6¼	1998½	-	-	D.O.A.S.	720	3972¾
From A. Warren	Excambion	1/1/48	-	-	-	12½	-	-	-	-	-	-	12½
To A. Warren	"	"	-	-	-	41	-	-	-	-	-	-	41
To A. Warren	Feu		-	-	-	1¼	-	-	-	-	-	-	1¼
TOTALS			-	2391	2	12½	6¼	2068½	-	-	-	3839	8319¼

TABLE II.

Utilisation of ground at 30.9.51.

	(acres)	(acres)
(a) Plantations:		
Acquired	Nil	
Formed by Commission	2241	2241
(b) In hand awaiting planting:		
Blanks after felling	Nil	
Burnt areas	Nil	
Other land	150	150
(c) Nurseries		2
(d) Agriculture: No. of tenancies	Nil	
(e) Forest Workers' Holdings " 3		6¼
(f) Unplantable land in hand		2081
(g) Other land (transferred to Dept. of Agriculture for Scotland)		3839
	TOTAL -	8319¼

Topography.

The planted area of the original (Duror) section of this forest lies on the lower south and south-west concave, glaciated slopes of Beinn a' Bheither (anglicised to Ben Vair) - 3362 ft. - whose upper heights are very precipitous and rocky. There are fairly large expanses of peaty flats at the head of the glen, where it broadens out into almost a basin. Typically, numerous streams run almost straight through the plantations to meet the main river at right angles.

Geology and Soils.

The rocks underlying this area consist mostly of quartzite schist, with granite forming much of the mass of the upper slopes of the mountain. The geology is exceedingly complex, and in addition to the two main series of rocks mentioned, there are limited areas of mica schist, clay, limestone and slate. As an indication of the complexity of the system, it may be mentioned that within the forest there are large quartzite, and both grey and black granite quarries while just outside the forest area slate and dolomite are quarried.

The mineral soil is derived partly from the weathering of the underlying morainic clay and the granite boulders contained in it, and partly from weathered material eroded from the granite tops of the hill: apparently owing to its high degree of resistance to weathering, the contribution of the quartzite schists to the soil is very slight. The larger part of the area carries a peaty soil, generally overlying a rather thin sub-soil, or even bare rock, but pockets of deeper soil occur frequently, and the character of the soil often changes within a few feet. At the head of the glen, there are considerable areas on the flats of deep, infertile moss peats.

Meteorology

The rainfall is high, ranging from 75 in. to 80 in. at the nursery to over 130 in. at the upper reaches of the glen. In the gauge there 149.01 in. were recorded in F.Y.50. Temperatures are generally moderate, with cool, moist summers and open winters snow rarely lying for more than a day or two at altitudes under 1000 ft. Exposure to wind is rather severe on the upper westerly face of Beinn a' Bheither even at elevations under 800 ft. but is less severe within the glen itself. Late frosts sometimes occur, but are not abnormally frequent.

Risks:

(a) Fire

Although the actual rainfall is so very high in the spring of the year, a few days of dry easterly winds can bring on severe fire danger with extraordinary rapidity.

The railway which skirts the edge of the forest, especially where it is on the landward side of the shore road constitutes a severe risk and in 1924 thirteen acres of P21 were destroyed. Replanting was then kept back one hundred yards from the railway and the intervening strip thrown open to grazing with, as yet, successful results as far as fires are concerned. A double 6 ft.

fire trace is screefed annually along most of the railside plantations and in the Ballachulish section the original hardwood scrub was left unplanted to act as a fire break. No fire breaks were planted as such but fortunately most of the roadside north of the ferry was planted with Japanese larch and this now serves as an effective fire break.

Apart from the railway and the main road the only other real danger is from the hikers traversing Glenachulish to obtain access to Beinn a Bheither, the mountain separating the two sections of the forest.

(b) Other

Rabbits are uncommon but vole, red and roe deer frequently enter the plantations from the surrounding hills. The extensive deer fences appear to provide little obstacle to red deer driven down from the hills by snow in winter. No abnormal attacks of pests or diseases have been noted so far.

Several acres of plantations have been lost through landslides on the steep mountain slopes. These landslides and the very frequent falls of rock and boulders as well as miniature avalanches in winter damage many of the trees making adequate maintenance of the fences running across hillsides almost impossible and sheep frequently obtain entry. As grazing above the planting limit is leased (partly to the Department of Agriculture for Scotland) it would be difficult to dispense with these troublesome hillside fences.

SILVICULTURE.

Early Years.

Planting began in 1921, using "large Norway spruce plants from Windsor nursery, large Japanese larch from Barcaldine, 2 year seedling European larch from Windlestrawler, as well as 2+2 larch from other sources." Very little draining at all was done, and of course all planting was on the flat, with considerable screefing of vegetation (particularly for small plants)

and apparently notch planting. The same techniques were used for the next two years, but in 1924 screefing began to be discarded. Planting was all "late in the season - January onwards", but it was then considered that autumn planting, except for wet hollows, was more desirable, and in the 1924 Working Plan December and January were rejected as planting months.

The European larch seedlings mostly failed and were heavily beaten up later with Sitka spruce and some Norway spruce. In the badly drained and high altitude Norway spruce areas, the plants suffered severe check, and even the opening of more drains on the most exposed areas did little to improve them. Sitka spruce was not used at all until P.23, and was then reserved for the better and lower-lying ground, as it was considered that " ..... experience of (Sitka) under windy conditions on the west coast is not sufficient to warrant using it freely where this factor has any great influence ....." It was not until 1933, in fact, on the adjoining Ballachulish Section, that it was realised that Sitka was more suited to exposure than Norway.

In the early years, much attention was paid to the planting of shelter belts across the line of the prevailing wind; but to date, these do not seem to have been of great service - where they have not failed completely, the trees of the shelter belts are now well sheltered by the plantation they were supposed to protect! They may, however, prove to be of some value in the next rotation.

These shelter belts, 30 ft. wide and planted normally at 5 ft. spacing with sycamore, grey alder, or mountain pine (according to soil) are planted on ridesides at intervals of 25 - 50 chains. They are confined to the Duror Section. They were planted to provide shelter indiscriminately to the rest of the plantation as they stretch along the whole length of the straight up and down rides which they adjoin.

It was early realised that extraction would present difficulties, and the line for a road to the head of the glen was laid out and left unplanted.

Choice of Species

Scots Pine

This species was not planted until 1931 and then only to a limited extent on the better Calluna sites. There are no very successful plots of this species to-date: possibly the provenance of the crop was unsuited to the wet west coast conditions. Its low value as a volume-producer is a strong argument against it when there are other, faster-growing species which could be planted on typical Scots pine sites, but it would certainly be worthwhile to try a few small plots raised from seed of guaranteed west coast origin.

Corsican pine

Two small areas of this species were planted on an experimental scale; 2 acres in 1927 and 4 acres in 1928. Its success suggests further trials, but these might best be limited to small areas on the lower altitudes, where, although it has had an attack of Brunchorstia some years ago, the present crop has thrown off the infection almost completely, and compares very favourably with adjacent Pinus contorta.

European larch

It is a pity that the relative failures of the first two or three years' planting, mostly on unsuitable ground, were allowed to frighten off further plantings of this species. Especially where planted in mixture, or where Sitka spruce was introduced soon after the first planting, European larch is now showing signs of producing an excellent crop, and all existing plantations have now thrown off canker and die-back attacks. The very heavy thinnings of the early 1940s appear to have been a major factor in the recovery of this species.

Japanese larch

Japanese larch has grown exceptionally well at Duror, and the rather rough appearance described in the earlier reports has been removed almost completely by the third thinning. The younger crops in the Ballachulish section are much straighter than the early plantings must have been in their youth - probably because the early plantings were on sites considered to be too rich for this species today. It is difficult to understand why this species was ignored completely from 1924 to 1933 inclusive, since the report of a 1925 inspection singled out Japanese larch as the most successful species planted up till then. The height growth of this species, at Duror, begins to fall off noticeably about the 25th year, from which age the annual height growth gradually falls away from an average of over 2 ft. to about 18 in. Indications are that height increment will continue to decrease after the 30th year. In yields from early thinnings, the species is second only to Sitka spruce but, after 25 years of growth, the yield from Sitka spruce is appreciably greater than that of Japanese larch

Hybrid larch

Hybrid larch was not tried until 1940, although this species is even more successful than Japanese larch at other forests in this region, and has a far straighter stem: "Harry Lauder walking-sticks", quite common in Japanese larch are almost unknown in hybrid larch. If possible, hybrid larch should always be used in preference to Japanese larch if seed can be obtained, and the latter species can still be used for fire belts.

Douglas fir

Douglas fir was planted with caution, generally on moist ground heavily covered with bracken. Wind-blows were frequent, and some staking was done. The P.23 plants used contained an admixture of blue and green varieties, of which the blue variety proved considerably inferior in resistance to

diseases, and has been cut out almost completely in thinnings. Douglas fir has not been planted since 1928.

This species shows distinct promise, as long as (a) it is not planted on soft, heavy bracken ground, but is kept for the best deep, dry sites, and (b) only the green variety is used. Small, well-rooted plants appear to be desirable, and best of all is a mixture with Thuya plicata.

Norway spruce

Norway spruce was originally regarded as the species most suited to severe exposure, and was the principal species used until 1928, when it was ousted by Sitka. It was frequently planted with little or no drainage, and always flat-planted. By 1925, it was already noticed that, when planted in a moist flush without adequate drainage, the species suffered from a check which it did not experience on better drained sites. Norway spruce was also planted to a very considerable extent on heather ground where it remained in check for a great many years. (It is still in check in some areas).

It is surprising to note how resistant to adverse factors this species has been: it has survived being planted on hard heather knolls: at high altitudes: and on peat hags, on the latter, with the help of deep draining and extensive slagging. Naturally, it has suffered severe check on all these sites, but even after "hanging" for 20 years, this species has frequently come out of check and is now making good growth. At high (1000 ft.) elevations, on the better types of soil, Norway spruce is closing canopy after 25 years, and the timber may well be of better quality than the faster-grown Sitka spruce. On the more suitable and sheltered sites, Norway spruce can hold its own with Sitka - an annual height growth exceeding 3 ft. is not uncommon.

Sitka spruce

It was in 1923 that Sitka spruce was first planted to any great extent, since when it has tended more and more to oust Norway spruce - and indeed all other species - as the chief species. Until P.34 (on the adjoining Ballachulish Section) it was regarded as more tender than Norway spruce and was always planted at the lower elevations: but from that date onwards, it has been recognised as the best spruce for the more exposed sites. Attacks by the spruce aphis were noted in the earliest years, but so far practically every tree has survived injury from these insects. Late frosts in a few limited areas have kept this species in check for over 20 years. Sitka spruce is now quite rightly regarded as the major and more accommodating species planted at Duror Forest; the only limiting factors, as long as drainage is adequate, appear to be Calluna and spring frosts. There does not seem to be any silvicultural reason why this species could not be planted several hundred feet above the existing limit of the plantations, as long as the soil is suitable and exposure not too severe: but future difficulties of extraction and maintenance must always be borne in mind.

Pinus contorta

Pinus contorta was not planted until 1931, since when it has been the chief species used for planting and beating up the poorer peat sites and the hard, morainic knolls. It has been used on a limited scale as a nurse-species for Sitka spruce. Pinus contorta has such an ability to thrive on even the poorest of soils, including sour peat hags (if well drained) that one wonders why this species was not used more extensively to afforest the worst sites, even if it was only to be considered as a nurse for a more valuable timber species. No distinction when planting appears to have been made between the coastal (type) and the inland (var. murryana) forms, but it is believed that the

majority of the Duror plantings are of the inland form. On the better peats, this variety is a rapid producer of clean, straight timber, the side branches falling off sooner than any other conifer grown here: this characteristic appears to make the timber eminently suitable for the production of knot-free timber. So far, the danger of wind-throw has been an unwarranted fear - the species is certainly just as, if not more, resistant to wind-blow than Sitka spruce, even on the softest bog sites.

Mountain pine

Mountain pine was used fairly extensively for the planting of shelter belts, but its efficacy (at least, so far as this, the first rotation is concerned) is rather limited by its slow rate of growth in comparison to the trees it was supposed to shelter. The species has also been used for beating up backward spruce areas and as a pioneer on difficult ground, being inter-planted with Sitka spruce at a later date once shelter and improved soil conditions permit. Mountain pine is by far the healthiest species on heathery, exposed knolls and ridges, and should continue to be used as a nurse and soil-improver for Sitka spruce. The most successful method so far tried is to thin out the mountain pine when it is large enough (at about 6 ft.) to give adequate shelter from the wind, and then inter-plant with spruce: by that time, the pine should have brought any heather under control, and aerated the soil sufficiently to allow the spruce to grow without much check. In a very few years, it is believed that the spruce will top the pine (which is worthless from a utilisation point of view) and eventually kill it out. However, the upright form of the species (var. uncinata) appears to have a good enough stem form and height growth to justify its use as a timber producer: the next few years should show whether or not this is a forlorn hope. If the species can grow marketable timber, it would appear to be the answer to the

planting of the very exposed, hard morainic knolls so common in this forest.

Thuya plicata

The quality and vigour of the few trees which remain from the P.21 planting, and in the shelter belt beside the nursery, makes one regret that this species, despite difficulties in establishment due to Keithia thujina, was not used more extensively. Where it has been planted in mixture with Douglas fir in P.23, the resulting crop is outstanding.

Picea omorica

Picea omorica is a species which, on the neighbouring Barcaldine Forest, is growing very satisfactorily on a sour frost-hollow, as well as on thin, hard peat at Duror, where its rate of growth exceeds that of Norway spruce and is comparable to adjoining Sitka spruce. If seed could be obtained more readily, this species could profitably be used much more than in the past.

Abies nobilis and Tsuga.

Abies nobilis and Tsuga heterophylla are two other species which could be used more extensively; the former appears to be able to withstand at least as much exposure as Sitka spruce, and is not so intolerant of heather. It requires a lengthy period of attention to weeding, however, and is rather susceptible to vole and deer damage. Tsuga also suffers from deer, both by browsing and when used as a rubbing post for the removal of the "velvet" from young horns. In adjoining forests in the District, its rate of growth not uncommonly exceeds that of Sitka.

Broadleaved species

The success to date with the limited number of Trichocarpa poplars planted suggests that there is plenty of scope for canker-resistant varieties of poplar on the right sites, but the marketing of the limited number of logs likely to be available eventually may prove rather difficult. Sycamore,

too, can be grown successfully in the more sheltered, fertile mineral soils, and it is a pity that to date it has been used only as a shelter belt/fire break. The underplanting of European larch with beech shows signs of success. Another species which may be worthy of trial is ash, which grows quite successfully (though only in short rotations) in nearby woods, and good natural specimens of pole size occur alongside burns running through the Ballachulish section. Oak is generally too slow-grown to be of much economic importance in these northern latitudes, although it formed a large part of the scrub hardwoods which once covered Duror Forest. Grey alder was also planted as a shelter belt and fire belt on the wetter sites, but generally it has failed.

Errors in Early Years

Species. The major error in the choice of species appears to have been the use of Norway spruce instead of Sitka spruce at the higher and more exposed elevations, in the belief that Norway spruce was the hardier species. This error was not rectified until 1933. European larch was planted extensively the first four years, and the use of seedlings and the choice of sites unsuitable for it owing to excessive soil-moisture and exposure resulted in heavy mortalities and extensive beating up and replanting. Douglas fir even as late as P.28, was planted on soft, heavy bracken ground and has suffered severely from wind-blow.

Drainage in this region of very high rainfall (76 in. average at the nursery, and approximately 120 in. within Duror and Glenachullish glens) was almost negligible for the first year or two, but the need for adequate drainage was recognised by the time the 1924 Working Plan was compiled.

Roads. Before planting began, a cart track as far as James of the Glen's cottage existed: this track was planted up almost completely, and a new road line left. Unfortunately,

some of the gradients on the route left are too steep to be negotiated by modern wheeled traffic: part of this road was built by hand labour to relieve unemployment during the depression years, and one stretch of over 100 yards has a gradient of 1 in 4¾. It may be of interest to note here that the present Forester has calculated that the estimated cost of completing in 1925 the 4 miles of road to the head of Duror Glen is less than the amount of walking-time paid to workers during the time they were planting P.25 - P.28: in other words, it would probably have paid to complete that road before a plant was put into those areas.

Planting Methods

The normal method of planting was by notching, using either a Mansfield spade or a planting mattock to screef off the surrounding vegetation. It was early recognised that the soil on hard, gritty knolls was the better for being broken up with the pick end of the mattock before inserting the plant. Hardwoods were pitted, as was recommended for Douglas fir. Turf or mound planting was not introduced until 1927, and even then on only a small scale for the next few years. Mechanical draining has never been used at this forest.

Rate of Planting.

The areas planted by P. years are as follows:-

P.21 ...	140 acres	P.36 ...	66 acres
P.22 ...	127 "	P.37 ...	25 "
P.23 ...	151 "	P.38 ...	- "
P.24 ...	169 "	P.39 ...	10 "
P.25 ...	115 "	P.40 ...	27 "
P.26 ...	107 "	P.41 ...	66 "
P.27 ...	120 "	P.42 ...	2 "
P.28 ...	205 "	P.43 ...	- "
P.29 ...	125 "	P.44 ...	- "
P.30 ...	156 "	P.45 ...	- "
P.31 ...	100 "	P.46 ...	- "
P.32 ...	104 "	P.47 ...	- "
P.33 ...	110 "	P.48 ...	139 "
P.34 ...	100 "	P.49 ...	8 "
P.35 ...	80 "	P.50 ...	- "

Thinning.

Thinning is now the most pressing silvicultural problem. The thinning of Japanese larch in the past has often been more intensive than the then current practice, and has been the subject of "you've ruined the crop!" comments from inspecting officers, but to date every such criticism has been refuted, and continuing heavy thinnings of this crop were recommended in 1941. Heavy thinnings in Sitka spruce also appear to be very necessary if spindly, small crowned and storm susceptible crops are to be avoided. It is not yet known from experience at Duror what the intensity of thinning should be for Norway spruce, but probably a moderately intensive thinning will be desirable. Douglas fir, of course, requires frequent and fairly heavy thinnings, with emphasis on the early removal of wolves.

Where Sitka spruce and European larch are growing in mixture as has happened throughout much of the upper slopes of P.21 because of beating up with Sitka spruce, the problem of which species to favour must be solved. If the Sitka is cut out, the soil and the larch trees will have lost most of their shelter, but if the European larch is sacrificed, the greater (as at present believed) intrinsic value of the larch will be lost. The problem is intensified by reason of the fact that both the Sitka spruce and the European larch are growing more vigorously in this mixture than where planted pure. The immediate intention, therefore, is a compromise: The more promising, better shaped and healthy stems of European larch will be favoured, and all crooked, weakly larch will be cut out.

The total yield of thinnings from all species has reached 69,000 cu.ft., more than half of this figure being obtained from thinnings in the last two years. Thinnings are now being based on a 3 year cycle, a plan which has scarcely been practicable in the past owing to the inaccessibility of much of the areas requiring this treatment.

The first light thinnings/cleanings were made over the whole of the 22 acres of Japanese larch in 1937/38, and total thinning yields to datefor this species has reached 28,272 cu.ft., or two-fifth of the volume for all species. Thinnings in other species did not begin until 1943.

13 acres of pure European larch were first thinned in 1943, and again very heavily in F.Y.44 and 46, in a successful effort to give the crop a good chance of throwing off the canker and die-back from which it was suffering. Almost half of the standing crop was removed in these drastic thinnings. The remaining European larch areas required extensive beating up for many years but the larch in these areas have shown little sign of the die-back formerly so prevalent among the more rapidly established and sheltered blocks. The total yield from the 43 acres of pure European larch has amounted to nearly 14,000 cu.ft.

18 acres of Sitka spruce were thinned in F.Y.43, and yielded 2680 cu.ft. (150 cu.ft./acre). Subsequent thinnings were considerably heavier, and to date 53 acres thinned have produced 18,000 cu.ft. in thinnings. Some stands of this species show a remarkable growth, the total yield reaching over 6000 cu.ft. in 28 years, with an annual height growth of over 3 ft.

Douglas fir has not been a conspicuously successful species at this forest, although the present crop covering 10.5 acres, after one thinning and a very severe "wolfing"/cleaning now looks much more satisfactory and may produce a good final crop. Yield to date from thinnings (excluding "wolves")is nearly 4000 cu.ft. but a great deal of the produce was almost unsaleable except for pulpwood.

By the end of F.Y.50 approximately 145 acres had been thinned and some 100 acres are due for thinning.

Research - Note by the Research Branch

Four permanent sample plots were established at Glen Duror in August 1943. Two of these, Nos. 123 and 124 were placed in

21 year old Japanese larch and two, Nos. 125 and 126 were laid out in 20 year old Sitka spruce.

The Japanese larch are fast growing Quality Class I with a top height of 55 ft. at 27 years of age. Plot 123 has been thinned to a moderately heavy (C/D) grade to contrast with plot 124 thinned to a heavy low (D) grade. Basal area and volume productions have been practically identical in both plots, and although plot 123 has now 344 stems per acre as against 254 stems per acre in plot 124 the total volume derived from thinnings shows little variance, ranging only from 1200 cu.ft. (quarter girth under bark) per acre in plot 123, to 1290 cu.ft. (quarter girth under bark) per acre in plot 124.

Plots 125 and 126 had a pronounced decline in periodic mean annual basal area increment for period 1946-1949 compared with the previous three year period 1943-1946.

The drop was as follows:

Plot	Periodic M.A.I. 1943-1946	Periodic M.A.I. 1946-1949
125	11.3 sq.ft.	7.9 sq.ft.
126	10.6 sq.ft.	8.5 sq.ft.

This decline may be due to the abnormally dry Summer of 1947 (no rain fell during August 1947). Effects of drought and competition for moisture must have been more severe in the light crown thinning of plot 125 with its 1093 trees per acre than in the moderately heavy thinning of plot 126 with 695 trees per acre. On the other hand the Japanese larch in plot 123 maintained their increment while plot 124 registered an increase from 4.1 sq.ft. to 4.5 sq.ft. in the corresponding periods.

These plots are again due for thinning and remeasurement in 1952.

(Sgd.) Alex M. Mackenzie.

Future Problems

Extraction

With the high rate of growth of all the major species, especially Sitka spruce, and the imperative need to thin at least every three years, extraction of thinnings is the chief immediate problem, and existing methods will have to be modified and improved. To this end, at present a road is being driven the whole length of the four mile long Duror Glen, and also well into the Glenachulish Glen, so that lorries can uplift produce as near the stump as possible. Primary extraction from the stump will probably still have to be done by horse, but as this method is slow and expensive for more than the shortest hauls, some way of reducing the length of the drag is required. Present experiments with rolled corrugated iron chuting give promise in this area, where a chute is suitable for most of the extraction from the felling areas to the new roads. After the first two or three thinnings, however, the increasing size of the logs will require a heavier type of chuting or some entirely different method - possibly by heavy wire rope and by power if gravity cannot be used. At present the winch of a sennocke tractor is used for extraction from slopes lying below the level of the road system, but this is necessarily a rather slow and expensive method, and emphasises the need for roads to be sited as far down the hill as possible. Once at the road, the cheapest and most satisfactory further extraction is by the purchasing merchant's own lorry - sending produce by rail always involves another handling and should be avoided if at all possible.

Species.

This is covered in the section on choice of species, but as regards the small areas still to be planted, Sitka spruce will be the main species, in mixture with Pinus contorta where the ground is sour. In Glenachulish, it is proposed to plant in P.52 a further 50 acres in a fertile sheltered valley just

above the present fence line, and again Sitka spruce will be the dominant species.

Natural Regeneration

Natural regeneration is a problem which will have an increasing prominence as the present crop matures. Indications are that, with a very little soil cultivation, such as results from extraction operations, the following species should be able to regenerate themselves: Douglas fir, Thuya, Japanese larch, Scots pine and European larch. The other pines and Norway spruce do not seem to be seeding themselves anywhere as yet, but the profuse coning for the first time of Sitka spruce in the autumn of 1950 should result in a crop of seedlings on the verges of the new roads. The methods and time required for natural regeneration will, of course, require intensive study before the crops mature.

APPENDIX I.

Extracts from selected Inspection Reports

11-9-25. Messrs. R.L. Robinson, J.M. Murray and W.H. Whellens

The earlier plantations have not, with the exception of Japanese larch, developed as well as might have been expected. A good deal of poor ground was planted in the first two years with small spruce plants and with larch, the latter being quite unsuited to the conditions. An extensive beating up and in places more drainage, will be required.

The plantations formed in the last two years are a considerable improvement over the first-formed plantations. There is a better correlation of species with soil conditions, larger plants have been used, the drainage is better and the worst parts have been left unplanted meanwhile.

20/21-9-32. The Chairman.

In P.30 and 31 knolls on which mountain pine and Pinus contorta are planted were inspected. These trees are doing well and should in a short time improve the soil conditions and make it suitable for the insertion of more valuable species.

With regard to future planting, the Chairman advised the planting first of all the best land and to leave second and lower grade lands till later.

18-9-34. Chairman.

Throughout the whole of the forest, there are numerous areas on which the plants have checked.

These check areas are due either to excess water on the lower ground or to insufficient aeration on the harder slopes and knolls. A scheme of improvement has been in operation for the past 2 years and will continue until the whole of the forest has been treated. Starting at P.21 extra drains have been added wherever there is an excess of water and, on knolls where the soil is hard and compact, contour drains have been made. These are becoming effective in aerating the soil and improvement is noticed on many places where before the plants were yellow and stunted.

Another point is that all beat up plants must be placed on mounds.

The Chairman advised a more liberal use of slag on checked areas, and the Divisional Officer stated that a supply of "semsol" had been sent to the Forester. This was more efficient than slag and according to the Forester's experience more easily handled. Generally a great improvement appears to have taken place over the whole forest since the occasion of the Chairman's last visit. The good clumps are extending and the gaps between, necessarily becoming less apparent.

Chairman's minute:-

The area has greatly improved since my last visit 2 years ago and now shows every promise of filling up and forming a successful forest. The worst parts appear to be those facing the main road.

5-8-41. Chairman

Part of an area of poor ground planted with mountain pine had recently been interplanted with Sitka spruce on mounds with slag. The Chairman considered that it was the right stage at which to do this operation.

Chairman's minute:-

In the interval between the inspections the plantations as a whole have made remarkable progress; Sitka spruce and Japanese larch in particular showing outstanding growth. We can now expect with confidence that the large block of Sitka spruce and much of the Norway spruce in the main glen will close up into a solid block of good plantations.

The hill face overlooking the railway is still very patchy owing to the initial mistake of planting Norway spruce on heather ground and on too exposed sites. This has now been re-drained and beaten up - at least in the lower parts which I saw - and I doubt whether there is anything further to be done except to exercise patience. On this hill the Japanese larch in P.21 has made remarkable growth. It is somewhat rough but the thinning already made indicates that with careful treatment quite a good crop should result. Norway spruce on good ground in the vicinity has also grown very well.

1-9-47. Chairman.

There was a general discussion on current road work. The Chairman was pleased to note the improvement of the Sitka spruce in what had been checked areas and which were now forming close canopy and had improved greatly since his last visit in 1942.

Chairman's minute:-

I was intensely interested in the plantations and in the road development work which is now proceeding.

In its early days Duror was one of our worst "headaches" and we were in great doubt as to its success. Now it is a forest which it is a pleasure to visit. There are still weak spots but nearly all are rapidly closing up. Looking back at old inspection notes I find that this result has been obtained: by improving drainage; by a limited amount of slagging; by the introduction of pines; and finally by the exercise of patience (in an early note on the forest I said "an ounce of patience is worth two ounces of basic slag").

HISTORY OF GLENDUROR FOREST

APPENDIX II.

Supervision

The officers in charge of the forest since its formation to date have been as follows:-

Conservators

1946 - 1948 A. Watt

1948 to date J.E. James

Divisional Officers

1920 - 1922 A.D. Hopkinson

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

1947 - 1948 J.E. James

1949 to date H.V.S. Dier

District Officers

1920 - 1922 A. Graham

1922 - 1925 Vacant

1925 - 1939 W.H. Whellens (Seconded to T.P.D. 1939)

1940 - 1943 J.E. James

1944 - 1946 H.V.S. Dier

1946 - 1947 R.F. Wood

1947 - 1949 J.G. Chrystall

1949 to date S.U. Robertson

Foresters (Main section only)

1921 - 1931 J.M. Reid

1931 - 1947 L. Sinclair

1947 - 1949 R.W. Campbell

1949 to date L. Sinclair

APPENDIX III.

TABLE SHOWING RATES OF GROWTH

P. Year and Compt. No.	P.21 C.8	P.23 C.16	P.23 C.10	P.24 C.18	P.21 C.8	P.23 C.12	P.27 C.6	P.27 C.4
Species	J.L.	J.L.	E.L.	E.L.	N.S.	S.S.	S.S.	C.P.
Average Q.G. B.H.O.B.	7"	6½"	7½"	6½"	5¼"	6"	5½"	4½"
Average Total Height	60'	53'	42'	42'	42'	60'	45'	30'
Average Height to 3" diam.	46'	42'	31'	33'	32'	47'	35'	22'
No. of Trees/Acre	280	320	170	140	860	680	480	900
Vol/Acre. Cu.ft.	2706	2333	1320	724	3870	5549	4134	2200
Vol/Acre Removed in Thinnings. Cu.ft.	1687	1285	705	700	277	525	627	243
Total Yield to Date	4393	3618	2025	1424	4147	6074	4761	2443
Average Annual Height Growth for last 3 years	18"	20"	15"	20"	18"	36"	37"	18"

Glenduror

GLENDUROR FOREST

Scale - Six Inches to One Statute Mile.

H.E EXPERIMENTAL PLOT

1/6/51 mcc.