

INVERINATE FOREST HISTORY.

Section I. General. Inverinate Forest consists of two separate blocks. These are called Inverinate and Dorisduan and both blocks are in the parish of Kintail in the County of Ross and Cromarty. Both blocks are near Loch Duich which is a sea loch. Inverinate block rises from the North shore of Loch Duich; Dorisduan is some two miles inland from the head of the loch. (See also section III - Physiography.)

The name "Inverinate" was taken from the adjacent estate of the same name. It was from this estate that most of the forest area was acquired. There is a small village also called inverinate which adjoins the forest. The origin of the name is not certainly known. A large burn enters Loch Duich near Inverinate Lodge, this burn being locally called the Inverinate Burn, but this burn was probably formerly called "Inate", and thus Inverinate would refer to the ground near the mouth of that burn.

Ratagan Forest is 6 miles from Inverinate by road.

Section II(a) Area and Utilisation of Land. The lands now forming Inverinate Forest were obtained by the Forestry Commission as follows:-

In 1926	Inverinate Wood Dorisduan Block	139 acres) 611 acres)	by feu from Major Sir K.A. Fraser, Bart.
In 1927	Lands to the West of Inverinate Wood	267 acres	----- do -----
In 1929	Lands to the East of Inverinate Wood, called Kintail Glebe	215 acres	{ by feu from the Church of Scotland, General Trustees.
In 1950	Land on the shore of Loch Duich, South of Inverinate Wood	1.5 acres	{ by feu from the Church of Scotland, General Trustees.

The total area of Inverinate forest is thus 1233.5 acres.

This is divided into (1) Inverinate block - 621.0 acres

(2) Dorisduan block - 511.0 acres

(3) Housing Site - 1.5 acres.

The details of land utilisation are as follows:-

(a) Plantations	Acres	Percentage
Acquired	-	-
formed by P.C.	1034.0	83.85
(b) In hand, awaiting planting	-	-
(c) Nurseries	-	-
(d) Agriculture. No. of tenancies-1. (Sheep grazing)	22.2	1.78
(e) F.W. Holdings	-	-
(f) Unplantable land in hand		
(i) Not used for any purpose, Too steep to plant or graze.	175.8	14.24
(ii) Forest Housing Site	1.5	0.13
	1233.5 acres	
		100 %

Note)- The land not used for any purpose is steep and rocky, and is mainly above 700 feet in altitude, and exposed.

Section II (b).

Utilisation of Adjoining Lands . Sheep farming is the main local occupation. The sheep are pastured on the high mountain slopes during the spring, summer and autumn. They are driven down to the low ground for clipping, dipping, and during bad weather in the winter.

Inverinate Block is formed of lands formerly grazed by sheep but the block is not now affected by the surrounding grazings. Dorisduan Block was little affected by sheep farming until this year, when proposals were made to increase the stock of sheep on the slopes above the plantations. A low grazing of 22.2 acres is leased (for periods of 11 months) to local sheep farmers, and

Section II(b)- (contd.)

and/

a passage connecting this grazing with the upper slopes has been requested. In bad weather a deep gully entering the upper boundary of the forest prevents sheep reaching lower and more sheltered ground. A request has been made to the Commission for a re-alignment of the boundary fence at this point to allow sheep to skirt the gully. A total of 2.5 acres of plantations will be lost if sheep passages are provided. Sheep are frequently found in the Dorisdan plantations but they have done little damage, even to checked crops.

Deer are shot on the high ground above both ~~xxxxxx~~ Forest Blocks.

Rights of way through Dorisdan Block were reserved by Inverinate Estate at the time of Acquisition to give access to the high ground.

Very small areas of arable land and cattle grazing occur on low ground but do not affect the forest.

Section III

Physiography. The contour map ~~and the sections of both~~ ^{III. MAP No 1)} ~~Forest Blocks~~ illustrates the physiography (Appendix ~~III~~).

It will be seen (Map I) that Inverinate Block rises steeply from the Glenshiel-Dornie road forming its Southern boundary. This block faces S.S.W. The slope varies from steep to medium and there are occasional small gently sloping areas. There are frequent rock outcrops. The hillside is cut by descending burns which ^{formed} have ~~cut~~ deep gulleys.

The average elevation of Inverinate Block is approximately 450 ft. above sea level; most of the planted ground lying between the 100 & 800 ft. contours. The highest planted land is at 1400 ft.

Section III (contd).

III

Dorisduan Block (Appendix ~~III~~, Map I~~4~~) extends along the North side of Glen Choinneachain and North into the subsidiary glen of the Allt an Leoid Ghaineachaich. It will be seen from the map that the aspect varies considerably. Slopes are mainly medium with a tendency to be concave. Steeply sloping ground occurs mainly near the higher boundaries and along the burn sides. The average elevation of the planted ground is approximately 500 ft. above sea level; most of the planted ground lying between the 150 & 900 ft. contours. The highest planted land lies at about 1300 ft.

Section IV. Geology and Soils.

(a) Geology. At Inverinate the bulk of the country rock is schist. This is undifferentiated and outcrops frequently. Occasional erratics appear, mainly towards the foot of the Inverinate hillside. These are either granitic or quartz-olivine. Occasional pieces of black basalt occur. The steep slope readily gives rise to screes and most of the ridges running up and down the slope are found to be old screes, when opened. Bouldery soils are frequent and extensive, especially towards the Western end of Inverinate Block.

At Dorisduan the geology is very similar. Basalt fragments are more numerous. Mica schist occurs in patches but the bulk of the country rock is foliated schist or gneiss with little or no mica. Screes are again common and give rise to very freely drained ridges in an otherwise wet area. Occasional fragments of garnetiferous schist have been found.

The schist which underlies both Inverinate

Section IV. (a) Geology. (contd).

Inverinate/

and Dorisduan does not weather easily, and it is impervious, hence peat forms very quickly if surface drainage is impeded.

One further fact is of importance at Inverinate, and this is ~~that~~ the presence of yellow-brown, fine, compacted clays at the foot of the slope. The origin of these clays is probably glacial but they are of fine and uniform texture.

The lower slopes of Dorisduan show the common type of glaciated moraine.

- (b) Soils. At Inverinate soils show great differences as the slope is ascended. The soils at the foot of the slope are ~~xxx~~ entirely colluvial. They are deep (up to 6 ft.) and are loams for the most part, containing small boulders. These are the best forest soils and growth on them is invariably good. As the slope is ascended the soil shallows, and rock outcrops and un-covered screes become more frequent until, near the upper planting limit, the soil is patchy, shallow and gravelly, and bare rock in scree or outcrop form is extensive.

At Dorisduan the slopes are not steep enough to give rise to deep colluvial soils. Whereas peat is rare at Inverinate, ~~xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx~~ peaty layers occur on almost all soils at Dorisduan.

At the foot of the slopes the glacial moraines have impeded drainage and peats have formed. These are rarely deep, the deepest measured being 3'6", but they are continuous and have proved difficult to aerate. Blanket peats cover much of the intermediate slopes also. These are very variable in fertility, in the worst cases spruces having checked severely for 20 years in spite of increasingly intense draining treatments. In Glen Choinneachain the plantation is almost entirely formed on peat of varying depth. The Western end

Section IV (b) Soils.(contd)
end/

of Dorisduan and the central part (Compartment 14, 15 and 16) show a better soil. It is deeper (up to 24") and peat is absent. This area is restricted to the medium slopes and peat re-appears at the lower ends of these compartments.

Section V. Vegetation.

(i) Inverinate Bläck. Vegetation at Inverinate changes with the soil depth and with soil richness. At the foot of the slope both trees and ground flora are vigorous. The good growth of Douglas Fir, S.S., and A.N. on the lower slope has killed out much ground vegetation, but relics remain in openings and rides. In some cases crops have small blanks due to excessive weed growth and in these the ground vegetation is dominated by bracken or, as is more often the case, brambles. Bracken is frequent. The following list gives some of the variety of species found on these lower colluvial soils.

fruticosus	
Rubus/ fruticosus	Viola spp.
Pteris aquilina	Digitalis purpurea
Dischampsia caespitosa	Hylocomium spp.
" flexuosa	Hypnum cupressiforme
Holcus lanatus	Hypnum schreberi
Molinia coerulea	Other mosses
Anthoxanthum odor	Juncus communis in
Other grasses	wetter patches.
Oxalis acetosella	

Cleanings have eradicated most of the natural tree species but Alder, Birch, Rowan, Hazel, Ash and Elm persist near the banks of the burns where cleaning has been neglected or where no crop has been planted.

The vegetation becomes very rapidly poorer as the slope is ascended. Bracken becomes extensive where light permits. Under Larch, Oxalis, grasses and Digitalis occur with a little heather in the well lighted areas.

Section V. Vegetation. (Continued)

Near the top of the planted slope the ground is largely covered with boulders between which are shallow pockets of soil. In these pockets bracken, heather, and *Erica cinerea* grow with mosses and lichens and only occasional grass species.

(ii) Dorisdun Block.

At Dorisdun the ground vegetation is dominated by heather except where Larch crops have eradicated the heather or where successful Spruce crops have killed out all the ground vegetation.

Among the lower morainic knolls the common succession from *Erica tet.*/*Scirpus*/*Myrica* in the hollows to almost pure *Molinia* on the slopes and heather on top of the knolls occurs frequently. Areas of pure *Molinia* are rare in Glen Choinneachain and in Glen Leoid Ghaineachaich, the *Molinia* patches always having some *Scirpus* through them.

Bog asphodel occurs on the wet, lower areas, as does *Myrica gale* and, occasionally, *Eriophorum vaginatum*. The lower slopes and hollows with this vegetation show poor tree growth.

Grasses and herbs occur in the rides in Compartments 14, 15, 16, and 17 where the slopes are steeper than gentle. Bracken areas are not frequent now but Compartments 10, 11 and 12 show an abundance of bracken in better lighted areas and in particular, beneath S.P..

There are areas of pure heather and areas where the heather is vigorous and dense. These occur mainly at the top of Compartments 12 and 13.

Section VI. Meteorology

(1) Winds. There is moderate shelter against the prevailing winds from the West and South-West. Westerly gales are frequent in winter but have done very little damage. There is good general shelter to both Blocks against East winds but Easterly gales have caused slight damage.

There is effective shelter against North and South winds.

(ii) Rainfall. Readings for Inverinate Forest are not available but readings which were taken at Ratagan Forest (the Ratagan gauge is some three miles from Inverinate Block) apply. Readings were taken at Ratagan from 1939 to 1944 inclusive and the average rainfall in each month over this six year period is given below in Table No.

Table No. 1

Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
6.12	6.31	4.69	4.72	3.34	4.63	6.39	7.28	5.75	9.14	8.98	9.00

Average No. of inches of rain for each month for period 1939-1944.

The average annual rainfall by the Ratagan readings is 76.4 inches. Readings at Ratagan also show that the rainfall increases with altitude at the rate of about 3 inches annually for an increase in altitude of 1000 feet.

(iii) Snow Falls of wet snow are frequent in winter except on low ground but very little damage has been caused.

(iv) Frost. Frosts are infrequent due to proximity to the sea, but they can be severe at Dorisdun. Frost damage has been slight except where S.S. and N.S. have long been in check and even here frost damage is not serious.

Very early and very late frosts are uncommon.

Section VII. Risks.

(i) Fire. (a) Inverinate Block. Fire risk is slight. Possible sources of fire are, (1) Tourists on the main Dornie - Glenshiel Road and (2) Muirburning on adjacent ground. Successful growth of crops at Inverinate Block has reduced the ~~xxx~~ probability of heavy losses from internal ground fires. ~~Thnx~~

The extent of possible losses by crown fire is, however, increased. The chief danger now lies in external ground fires entering the plantations and starting a crown fire. This danger is aggravated where checked patches occur at the edges of the plantation and connect the ground to the crowns with a layer of inflammable material. Protective measures aim at:- (1) preventing ground fires entering the plantations and, (2) dividing the Block into three sections by means of two 80 feet, clear-felled fire rides.

(i) (b) Dorisduan Block. Fire risk is slight. Possible sources of fire are:- (1) Tourists passing through the Block by right of way en route to the Falls of Glomach, and (2) Muirburning on adjacent ground. As at Inverinate Block the greater danger is fast becoming that of a crown fire and similar precautions to those at Inverinate Block are being taken.

No fires have occurred at Inverinate since acquisition by the Commission.

(ii) Animals.

Red Deer. Damage by Red Deer was reported in 1928, 1929, 1930 and in 1931. Both Blocks are deer-fenced and the fences are still being maintained.

Under the terms of the 1927 Feu Charter the ~~shank~~ shooting of game within the forest is leased for 25 year periods to the owner of Inverinate Estate. This lease has

Section VII Risks Continued./has/

been renewed for a further 25 years as from 1952. The lease includes red deer and the ~~trapper~~ forest trapper cannot shoot them. This arrangement is unsatisfactory and in the past the Commission has complained when the Estate keepers have failed to shoot red deer found in the plantations.

Most of the crops in both Blocks are now too well advanced to suffer serious damage from red deer, but some damage still occurs to checked or slow growing crops, particularly at Dorisduan.

Most of the perimeter fencing of both Blocks is of iron and maintenance has been inexpensive. It is probable that all crops will be too large to suffer damage from red deer before fence upkeep costs become excessive.

Roe Deer. The forest trapper shoots roe deer. The roe population is not now heavy and the last serious damage was reported in 1930 and in 1931. Recent slight damage has been done at Dorisduan to Scots and Pinus contorta.

Sheep. Sheep from neighbouring ground frequently get into the plantations, especially at Dorisduan, but no damage has been done by them.

Goats. Wild goats still occur in the district. Eight or nine of them have recently been seen at Dorisduan but no damage has been observed. Heavy damage was, however, caused to young crops in 1929, 1932 and 1934. They were shot in 1933 and 19³₄ and their numbers much reduced.

Rabbits. Rabbit damage to the early plantings (particularly the first in 1927) was ^every heavy but the rabbits were killed off and little damage has occurred since.

Section VII. Risks. Continued.

Voles. Heavy damage was caused by an unusually high vole population in 1929 but little or no damage has occurred since.

Insects. Weevil damage was reported in 1927 and 1928. No other attacks have been reported. The following pests are present now :- *Neomyzaphis*, *Chermes*, *Hylobius*, *Hylastes*, *Synex* *gigans* (and *Rhyssa* *pursuasoria*).

Fungi. There are no serious attacks now and none have been reported.

Section VIII. Roads. Both Forest Blocks have always been accessible and the development of roads has had little effect upon silviculture. Work on the internal road systems was started in 1948 and is still going on; the total programme is now more than half completed. Road construction work delayed thinnings in F.Years 50 and 51 but these delays have nowhere caused damage to crops.

Section IX. Labour. Local labour has been employed. The squad fell to 6 or 8 men after planting but has been increased during post war years to 15. This total includes 2 gangers. No foreman is employed. Application has been made for an ex-school ganger and the squad will be increased by 4 men when the new houses are occupied.

Section X. Silviculture.

(i) Preparation of Ground prior to Planting.

(a) Previous and Acquired Woodland.

The area first acquired and known as Inverinate Wood originally carried a mixed conifer crop, (S.P., E.L., and N.S.) but this was felled in 1907. This wood covered about 140 acres in the centre of the present Inverinate Block. In 1912 8 acres of the felled area were replanted with a mixture of E.L., D.F., S.P. and N.S.. This small wood was acquired by the Commission but was felled ^{in 1939/40} and replanted in 1942.

A few old E.L. relicts of the original Inverinate Wood are worth mention, they are of very poor form but are still growing steadily.

Thus with the exception of 8 acres of replanted woodland, the whole Forest was formed on open land, and about 140 acres of this land had, at Inverinate Block, been under conifers until 20 years before planting.

(b) Treatment of Vegetation.

Bracken was the most serious vegetation problem. This was especially true of Inverinate Block where felling of the old conifer crop, mentioned above, had probably encouraged the establishment of dense bracken. The bracken was generally cut the year before planting. In 1928 the whole of the P.29 area had to be cut over. The problem at Dorisduan was less acute, but here also considerable areas had to be cut. ("Patches of bracken in P.29 stood about 6 feet high."- Annual Report. 1929).

Some gorse and broom were cut at the West end of Inverinate Block.

Some Birch was scattered over Dorisduan Block but it seems to have been dense only in the gulleys

Section X (1) (b). Continued. Treatment of Vegetation.

gulleys/

formed by the streams. In these gulleys it was thinned but treatment of birch was not an extensive operation in the preparation of ground for planting.

There is no trace of any burning of vegetation being done. Heather was planted through with S.P., J.L., and E.L. without special treatment.

In the 8 acres of felled woodland replanted in 1942 the only preparatory work necessary was the burning of brushwood.

(c) Treatment of Soil.

All planting areas required draining.

There is evidence that the first drainage was not sufficiently intense. Repeated "Drainage, New Works", appears in the records for the same areas. The P.23 area was drained by 5 to 6 chains of drain per acre and this intensity was maintained through 1928 and 1929. In 1930 and 1931 the intensity was increased to an average of 10 chains per acre. In 1932 to 20 chains per acre.

By 1932 turf planting was being used extensively in wet areas.

The early plantings in 1927 and 1928 were mainly at Inverinate Block and on areas of free natural drainage where new drainage need not have been intense, but later plantings were on wet peats at Dorisduan where intense drainage was necessary. Much of this necessary draining was done after planting. In 1936 and 1937 new drains were still being cut in the P.28 and P.29 areas.

Section X. Silviculture. Continued.(i) Preparation of Ground prior to Planting.(d) Fencing.

Fencing of both Blocks against deer was necessary. The whole perimeter of Dorisduan was finally deer-fenced, as was most of the Inverinate perimeter. Certain of the fences were in position at the time of acquisition. The Acquisition Report states, "Inverinate Wood is entirely fenced in, partly with good high rough stone dykes, partly with a strong wire sheep fence on iron standards 2 and partly with a post and wire fence". "Dorisduan is fenced against deer along its Western boundary". This Dorisduan fence was retained and repaired but at Inverinate the perimeter fence was almost entirely new.

Deer fencing was started two years ahead of planting and completed one year ahead as a general rule. The open sides of the current planting area were closed temporarily against rabbits and stock with a wooden fence.

The deer fence, much of which is of iron, is still in sound condition and is being maintained to prevent serious damage to checked crops.

Section X.(ii) Choice of Species.

The percentages of the main species used at ~~INVERINATE~~ Inverinate are as follows:-

S.S. -42%., J.L.- 14.6%., E.L.- 13.5%., S.P. -9.2%.,
D.F. - 8.9%, N.S. - 7.3%.

Species were planted pure, though sometimes in very small patches.

The acreages planted each year with each species are shown in the following table:-

Section X. (ii), Choice of Species. Continued.

table/.

Table No. 2 ~~Acres of each species planted~~

Year.	S.P.	D.F.	S.S.	N.S.	E.L.	J.L.	P.C.	M.P.	Ts.	Th.	A.N.	A.G.	Total.
27	-	34	9	-	-	-	-	-	-	-	-	-	43
28	28	16	61	1	16	20	-	1	-	-	-	-	143
29	3	36	62	17	2	24	-	-	-	2	2	-	148
30	15	6	75	16	12	25	4	2	-	-	-	-	155
31	26	-	47	12	39	46	-	10	1	1	-	-	182
32	20	-	72	16	24	22	1	9	-	-	-	1	165
33	2.5	-	70	5.5	41	11	-	-	-	-	-	-	130
34	-	-	42.5	3	5.5	4	-	-	-	-	-	-	55
35	-	-	-	-	-	-	2	-	-	-	-	-	2
36	-	-	-	-	-	-	3	-	-	-	-	-	3
42	-	-	1	5	-	-	-	-	2	-	-	-	8
Total	94.5	92	439.5	75.5	139.5	152	10	22	3	3	2	1	1034.

Table No. 2 Acres of each species planted each year.

The species used on the main types of site are as follows:-

Inverinate Block. Lower soils. On the deep bouldery loams of the lower slopes D.F. was used together with a little S.S. in the wetter patches. Other species were also used.

The depth and fertility of these lower soils was realised and a wider variety of species was used here than on any other area in the Forest. In addition to D.F. and S.S.,

Section X (iii). Choice of Species. Continued.

S.S./

A.N., ~~A.S.~~, Th., and Ts. were planted on a small scale.

D.F. was confined to Inverinate Block and within the Block to these lower and middle slopes where the soils are deep and bouldery. Establishment of the D.F. was slow and beating was heavy but subsequent growth has been good and no criticism can be made of the choice of species.

The strain of D.F. used has given rise to trees of mainly moderate form.

Inverinate Block. Middle and Upper Slopes. On the upper slopes S.P. was used whenever soils were gravelly and freely drained. The species was planted on the high screes where heather and bracken predominated. Growth has ^{GENERALLY} been slow but it doubtful that any other species would have grown so well.

The S.P. was replaced by Larch (J.L., E.L. and H.L. were planted) on moist grassy slopes. Most of the Larch has grown well.

Inverinate Block. Peats. On the limited peat areas S.S. was chosen. Growth of the S.S. is moderate due to lack of draining and to frost in the early stages.

Dorisduan Block. Lower flats and moraines. S.S. was extensively used at Dorisduan on low ground. It was planted in wet peat hollows and in blanket peats on the lower moraines. It was not mixed with pine, even in frosty hollows where the use of P.C. or S.P. would have lessened frost damage. The S.S. checked due largely to lack of soil preparation. where the natural drainage is moderately free the S.S. has grown well. ~~Subsequent drainage operations have speeded the establishment of S.S. on the lower flats.~~ Criticisms which may now be stated are that pines should have been included (a) In some of the frosty hollows to give protection to the

the/

S.S. and (B) on some of the more heathery sites to assist in the suppression of heather. In this latter respect, an M.P. crop in Compartment 15 was beaten up with S.S. resulting in a patchy mixture of S.S. and M. P.. Wherever the mixture approaches a half and half one the S.S. have grown rapidly, aided by the suppression of ground vegetation by the ^{M.P.} ~~M.P.~~

Dorisduan Block. Middle slopes. The middle slopes at Dorisduan were planted with J.L., E.L., S.S., S.P., and N.S.. Grassy slopes were used for the larches. E.L. has not done well but L.L. has established itself and grown vigorously in most cases. The L.L. in Compartments 14 and 15 is good. The wide rides in these compartments show a grass-bracken vegetation, the soil is moderately deep and peat is absent. J.L. has been used on a thin blanket peat in Glen Choinneachain with moderate success but E.L. under similar conditions has suffered severe losses and is slow growing.

S.S. has also been used on medium slopes. It has shown delay in coming out of the checked stage but subsequent growth has been satisfactory. S.S. planted in thin peats at the north~~h~~ end of Dorisduan has shown unusually vigorous growth. The peat here is black, amorphous and poorly drained.

S.P. planted on the middle slopes has shown moderate growth, it was used mainly on bouldery screes where drainage is excessively free.

N.S. was planted on northerly slopes with a thin peat layer. It has shown very poor growth. Heather is now dense among the N.S. and is probably delaying growth. The N.S. would have benefitted from a pine nurse.

Section X. (ii). Choice of Species. Continued.

Upper Slopes at Dorisduan. Upper slopes have been planted with S.P. and larch. Some S.S. was~~x~~ used on high ground but this was not on a large scale. The use of S.P. and larch has been successful.

General. The general choice of species has been sound as~~x~~proved by the present state of the plantations. In most of the backward areas the chief cause for slow growth and establishment has been lack of soil preparation rather than choice of species.

Section X. (iii). Planting.

(a) Spacing. The planting distance was 5 feet almost throughout the Forest. N.E. N.S. was planted at 4 feet 6 inches in Compartment 13 at Dorisduan.

(b) Types of Plant Used. Both transplants and seedlings were used. The use of 1+0 J.L. in 1932 is worth noting, they appear to have been as successful as the transplants and were supplied from Altonside nursery. Seedlings used in F.Y.34 were planted in plots to compare their growth with that of transplants planted in the same year. 2 year and 3 year S.S. seedlings and 3 year J.L. were used in the plots. Detailed records of these plots were not kept but the following extracts from annual reports give an indication of progress.

1935, - "The plants are making fair progress".

1937, - "The seedling plots of P.34 require beating up and more draining and manuring"

The bulk of the planting was, however, done with transplants and some of these had spent considerable periods in the nursery, eg. N.S. used in 1930 were 3+2+3's.

Section X. (iii) (b). Continued. Types of Plants Used.

3+2+3's./ The use of older plants had no noticeable effect on establishment. The larches appear to have been big plants, though they were the youngest as a rule, the spruces do not appear to have been unusually large though they were frequently old plants. Details of the types of plants used are given in Appendix No. III Table No. 2

Most of the plants were supplied by local nurseries, the majority coming from Ratagan and Inchnacardoch. Port Clair and South Laggan also supplied small quantities and occasional lots came from outside the district or outside the division.

A list of the supplying nurseries is given in Appendix No. III Table No. 1

(c). Methods of Planting.

In 1927 and 1928 notch planting was used throughout but in 1929 turf planting began on a small scale. S.S. were turf planted in 1929 in the wetter areas. In 1930 some N.S. were also planted on turves and after 1930 turf planting was used on a considerable scale, all spruce in the wet areas being planted in turf. Areas not turf planted were notched.

(d) Annual Rate of Planting. The following table shows the acreages planted in each block in each year.

(d) Annual Rate of Planting. (Continued.)

TABLE No 3.

F. Year.	Acres Planted.			Remarks.
	Inverinate.	Dorisduan.	Total.	
1927	43	-	43	First planting
1928	96	47	143	" "
1930	107	41	148	" "
1931	155	-	155	" "
1932	68	114	182	" "
1933	1	129	130	" "
1934	-	55	55	" "
1935	-	2	2	" "
1936	-	3	3	" "
1942	8	-	8	Replanting after felling.

It will be seen that the bulk of the planting was carried out between 1928 and 1933 during which time an average of 153 acres per annum was maintained.

(e) Manuring. No manuring was done at the time of original planting. In beating up, manure in the form of basic slag or ground mineral phosphates was used both for the new plants being put in, and for treating checked plants. The first mention of manuring appears in the Working Plan for the period 1933 to 1943, prepared in 1932. The plan prescribes the use of S.S. for beating up backward areas of P.28 and adds:- "Try direct slagging of a small area and extend its use if it proves effective."

The use of manures applied at the time of B.U. increased from 1933 onwards. By 1936 most of the S.S. and much of the J.L. and P.C. used in B.U. were manured. L.C., S.P., and Grey Alder were occasionally manured when used for B.U. The rate of application of manures was 2 ozs per plant throughout.

Section X (iii) (contd).

(f) Success of establishment. From assessments made in the years 1932, 1935, 1938 and 1947, the progress towards establishment can be gauged. These figures are as follows:-

Year of Assessment	Established acres.	Not Established acres.	Total Area acres.
1932	61	784	845
1935	473	550	1023
1938	755	279	1034
1947	935	99 ^{\$}	1034 ^{\$}

(^{\$} - The Census figures are 109 & 1044 acres respectively. These are wrong. The source of those figures is not known.)

The most backward of the unestablished areas have been treated since 1947. All the unestablished areas are slowly but steadily improving and it appears at present that something very near to 100% establishment will be reached. There are still patches of S.S. in severe check, but canopy is slowly being formed and is extending in the usual way. Norway spruce at Dorisduan is the most backward crop of all but even this will ultimately form a crop if present progress is maintained.

The above table certainly indicates that progress towards establishment has been satisfactory so far.

Section X. (iv) Ploughing.

No ploughing has been done at Inverinate.

Section X. (v) Beating up.

Beating up was on a considerable scale at this forest. Losses in the early years (roughly up to P.30) were mainly due to such causes as damage by vermin or adverse weather conditions. From P.31, onwards, planting was on poorer ground and losses were largely due to lack of drainage.

Beating up, up to F.Y. 1930, comprised the replace-

Section X. (v) Beating Up. (cont'd).

replacement/

of casualties only. From then onwards, beating up

was usually done together with such additional work as increased drainage, planting on turves or manuring or with a change of species.

As shown by the following table, the area beaten up annually increased fairly steadily until 1935, and then dropped to a level involving the use of some 25M. plants per annum until 1943 when it stopped except for very occasional small areas:-

TABLE No. 4.

Year of B.U.	Area. (acres)	Plants used. (thousands)	Year of B.U.	Area. (acres)	Plants used. (thousands)
1928	41	17	1936	83	28.5
1929	-	-	1937	61	34.5
1930	74	?	1938	88	46.5
1931	176	57	1939	122	32.5
1932	81	42	1940	18	20
1933	?	63.5	1941	47	23
1934	?	114	1942	25	18
1935	?	94.1	1943	42	33.5

The species used in beating up operations are shown in the following table in the form of percentages from 1932 to 1943. (The figures of plants used in 1928 and 1931 are not very reliable). Annual percentages are taken to the nearest whole figure; percentages for the period are given to the nearest half percent.

TABLE No. 5.

Year of B.U.	Species.											
	SS.	NS.	DF.	SP.	PC.	JL.	EL.	LC.	OA.	CA.	GA.	Be.
1932	24	17	12	47	-	-	-	-	-	-	-	-
1933	55	-	2	25	-	-	-	-	-	-	-	47
1934	45	5	-	2	-	15	24	4	-	-	-	5
1935	36	-	-	20	4	17	15	6	-	-	2	-
1936	30	-	-	17	2	17	12	-	23	-	-	-
1937	36	-	-	10	-	21	10	20	-	-	3	-
1938	61	-	-	17	-	9	2	11	-	-	-	-
1939	82	-	-	6	-	-	-	-	-	6	6	-
1940	90	-	-	-	10	-	-	-	-	-	-	-
1941	74	-	-	-	22	-	-	-	-	4	-	-
1942	72	-	-	17	11	-	-	-	-	-	-	-
1943	45	28	-	21	6	-	-	-	-	-	-	-
Average percent.	54.0	4.5	1.0	15.0	4.5	6.5	5.5	3.5	2.0	1.0	1.0	1.5

A detailed statement in tabular form showing the species and quantities used in beating up each year, and the P. Year area in which the beating up was done is given in appendix No. III Table No. 4.

The table above shows that S.S. was the species most used in beating up and its continued use reflects its success. N.S. was tried but its use discontinued in 1935, probably due to severe and prolonged checking. D.F. was used only in the early years, and this was because, in the sequence of planting, all the ground suitable for D.F. had been planted by 1929, and when these areas had been beaten up and become established, there was no further place for D.F. in beating up operations.

S.P. was the species most favoured after S.S., and was used in almost every year. It is worth noting that M.P. was not used at all. M.P. used in first planting did not do well and this may account for its being avoided in beating up. P.C. was used on a small scale in 1935 and 1936, and then again on a fairly big scale from 1940 to 1943. S.P. was used to replace losses in original plantings of that species, and this is generally true also of the larches. P.C. was used to replace losses in P.C. and to beat up N.S. at Dorisduan. Very small amounts of P.C. were used to beat up S.S. and J.L..

L.C. was used mainly in small patches and with some success, notably at Dorisduan where it was used to beat up S.S. in the P.34 seedling plots. The alders were used in small quantities and mainly on wet sites; they have generally failed and few now remain. Beech was occasionally used for beating up, mainly in larch. It was not very effective though some beech of a poor form still persists.

The wide range of types of plant used for beating up is shown in Appendix III Table No. 3. The table shows that old plants were generally used and that seedlings were never used for beating up. The plants were found to be generally satisfactory. In 1937 the Annual Report states that, "A stocky 2+1 plant is the most suitable type of S.S. for beating up on turf." Large J.L. plants (3+1) were found to be too big; they were turf planted and

Section X. (v) Beating Up. Cont'd.

and/

gales following beating up blew them over.

The methods of planting in beating up changed in 1930 from notching alone to a combination of notching and turfing. In 1931 and in later years the use of the upturned turf was extended. After 1933 consolidation work comprised beating up, new draining, turf planting and manuring. S.S. was the main species planted in turf and P.C., J.L., S.P. and L.C. were also turf-planted in some cases.

A policy of beating up with the planted species was followed until 1931. This was a successful policy since early losses were not due to ~~an~~ the use of unsuitable species. After 1931 the policy changed and new species were used in many cases.

The species used to beat up existing species are outlined below:-

D.F. - was beaten up with D.F. and with a little S.S.

S.S. - was beaten up with S.S., and with S.P. on heathery sites.

a very small amount of P.C. was also used. S.S. on low and

wet sites was occasionally beaten up with L.C.

S.P. - was mainly beaten up with S.P..

Larches - were beaten up with larches mainly, S.S. was used in the wetter patches and alders were also used on a small scale.

S.P. was occasionally used. Beech was rarely used, as was Tsuga.

N.S. - was beaten up with P.C. and with S.P.. It was also beaten up with N.S.

The results of beating up are discussed more fully in Sections X(vii) and XII ~~and can be noted in the descriptions of selected stands which are appended.~~ It should be noted here however, that beating up was generally successful as judged by subsequent growth and that where new species were used in beating up the change has usually been justified.

Section X. (viii). Mixture of Species.

Mixtures were not planted as such at Inverinate and such mixed crops as are now present arose from a change of species in beating up. Examples from the more extensive mixed stands will best be detailed as follows:-

- (1). D.F. P.27 in Comp. 24.- beaten up with S.S. in 1928 and 1933.

The result of beating up is a matrix of D.F. with small groups of S.S.. Occasional single S.S. are found in the D.F.. The two species have grown at the same rate for the most part and where one has outgrown the other it is usually the D.F. which has outgrown the S.S.. Thinnings have been marked without difficulty, as in a pure crop.

- (2). J.L. P.29. in Comp. 28.- beaten up with S.S. and Ts. in 1931 and with S.S. in 1932, 1933 and 1935. The J.L. grew satisfactorily except in the wet patches where it failed and was replaced by S.S.. Small groups of S.S. occur in a larch matrix. The S.S. has grown well but the surrounding larch has not suppressed side branches on the S.S. on the perimeter of the groups and these trees are now heavily branched. The Tsuga was more scattered and a small amount of Thuya (not recorded) was included. The Ts. and Th. have fallen behind and are now well below the larch canopy. They are of poor form and are heavily branching.

- (3). N.S. P.31. in Comp. 13.- beaten up with P.C. in 1941, 1942 and 1943. P.C. is scattered through the N.S. which is still checked or growing very slowly. The proportion of P.C. has been greatly reduced by deer damage and only about 10 per cent of the crop is now P.C.. The P.C. show steady growth (average height about 10 ft.) but they have had little effect on the surrounding N.S..

- (4). M.P. P.31. in Comp. 15- beaten up with S.S. in 1934, & 1936 andx
The M.P. fared badly and now occurs in small groups in a matrix of S.S.. S.S. has grown satisfactorily where the M.P. persist but has been slow growing where it occurs pure. (Inspection report- visit of the Chairman in 1950 - refers to this mixture.)

Section X. (vi) Weeding.

Weeding was almost entirely confined to bracken cutting. The areas planted first were those requiring most attention and available records show that the P.27,28,29 and 30 areas were extensively weeded for two and sometimes three years after planting. Weeding rose from 87 acres in 1929 (on P.27, 28 and 29 areas) to 168 acres in 1932. The weedings for 1933 and 1934 are not recorded but in 1935 weeding was confined to beat up areas of previous years. After 1935 weeding was on a small scale (weed growth on P.32, 33, and 34 was not heavy). The area of felled woodland which was replanted in 1942 was weeded the first year after planting.

In the P.27 to P.30 areas, bracken was usually cut three times a year during the first two years after planting and twice during the third year.

The extensive weedings were largely confined to Inverinate Block. Practically no weeding was needed at Dorisduan after 1932.

There is no record of damage to crops due to weeds.

Growth following establishment has been generally satisfactory at Luveminate. There are areas of S.S., planted in 30, 31 and 32 at Dorisdwan which have not yet closed canopy; these areas are small however and are "coming away" steadily. S.S. has shown rapid growth on the lower peats at Dorisdwan once it has formed a canopy.

Measurements from the most satisfactory stands are given in the following table. The general growth and form shown by the various species are as follows:-

Douglas Fir. Has grown rapidly on the better soils of Luveminate Block. Form is very varied but generally poor. There is a tendency in most D.F. at Luveminate to sway and to branch heavily at an acute angle.

Sitka Spruce:- Growth has been at variable rates but is generally rapid ^{on stand of} S.S. has shown the most rapid growth of any species. Its form at Luveminate is moderate to good.

Scots Pine:- Has grown slowly but steadily on the upper, very freely drained slopes to ~~see~~ which it was largely confined. Form is moderate.

Pinus contorta:- Has grown slowly but steadily. The form is good generally though the earlier planted P.C. is often of spreading form.

Mountain Pine. Has grown slowly after a heavy initial losses. It has been efficient as a killer of ground vegetation largely because of its spreading form.

Norway Spruce. Rate of growth has varied but is generally slow. Form is moderate.

European Larch. Growth has been generally slow and form is moderate.

Japanese Larch. Growth has been generally rapid and form moderate or good.

Hybrid Larch. Growth has been generally rapid and form moderate or good.

Lawson's Cypress. Growth has been slow and form is generally poor.

Thuja plicata. Growth has been slow and form is moderate.

Abies nobilis. Growth has been generally rapid and form good except for the pronounced taper usually found with *Nobilis*.

Measurements taken from the best stands of each species are given in the following table. $\frac{1}{2}$. The current annual height increment is obtained ~~by~~ ^{aver} from the last 5 years height growth. The age of the various species is reckoned to the end of the 52 season. In fact the measurements have been taken at the commencement of the 52 season and the values for Mean Height + Mean Annual Height growth therefore give a conservative tend to be low.

PLANTMENT	SPECIES	Y. YEAR	AGE	GEOLOGY	SOIL	VEGETATION	ALTITUDE	ASPECT	SLOPE	EXPOSURE	MEAN HEIGHT OF DOMINANTS.	MEAN ANNUAL HEIGHT INCRE- MENT. (dominant)	CURRENT ANNUAL HEIGHT INCRE- MENT. (dominant)	MEAN Q.G. H. (dominants)	NOTES.
11	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	Feet. (12)	Feet. (13)	Feet. (14)	Q.G. inches. (15)	(16)
10	S.S.	28	24	Shistose gravel over foliated Schist.	Depth 12 to 20 ins. Black, peaty soil. Impeded drainage	[Grass spp. and Nid. bracken in adjacent nets]	550	North	Gentle	Sheltered	61	2.54	2.5 (estimated)	92	Fern good.
9	P.C.	34	18	Schist Boulder Scree.	Gravelly brown earth - Depth 8-14 ins.	Calluna vulg. - a Molinia - - - - a Erica cin. - - - a Moss spp. - - - f. Grass spp. - - - o.	550	West	Medium	Moderately sheltered.	25	1.39	1.4	33	Fern poor.
14.	J.L.	31	21	Schistose Boulders and Gravel.	Brown, forest soil. Bouldry. freely drained. Depth 12-20 ins.	Molinia - - - - f Ara flex - - - - a Polytrichum - - - f Oxalis acut. - - - f Rumex - - - - o Moss spp. - - - a	480	South- East	Medium	Moderately exposed.	44	2.09	2.2	60	Fern good.
16	N.S.	32	20	Schistose Boulders and compacted gravel.	Shallow brown forest soil. Depth 8-15 ins. freely drained.	Nid. [Ara flex, Digitalis, Juncus and moss spp. in adjacent nets]	450	South East	Gentle	Moderately sheltered	33.6	1.68	1.35	51	Fern moderate.
29	D.F.	29	23	Schist.	Deep brown earth. with boulders and small stones. Depth 30-40 ins. freely drained.	Sporae. Digitalis p. - f Rumex - - - - o Moss spp. - - - f	200	South West	Medium	Moderately Exposed.	51	2.22	1.66	72	Fern poor.
19	E.L.	31	21	Schist.	Brown earth with frequent boulders and stones. Depth 22-28 ins. freely drained.	Bracken - - f Grass spp. - - a Scilla twigs - - f Digitalis purp. - o Rumex fluitans - o Moss spp. - - - f. Oxalis - - - - o.	220	South West	Gentle.	Moderately Sheltered.	45.6	2.18	2.2 (estimated).	52	average volume per acre of flowering field Spring 1952 - 2.1 cubic per stem. Fern moderate.

COMPART- MENT	SPECIES	P-TEAR.	AGE.	GEOLOGY.	SOIL.	VEGETATION.	ALTITUDE	ASPECT	SLOPE EXPOSURE	EXPOSURE \$	MEAN HEIGHT OF DOMINANTS.	MEAN ANNUAL HEIGHT INCREMENT OF DOMINANTS.	CURRENT ANNUAL HEIGHT INCREMENT OF DOMINANTS.	MEAN HEIGHT & G. B.H. OF DOMINANTS	NOTES.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
16	SP.	32	20	Schist with medium mica content.	Brown earth - Some stones and bracken - slight occasional pod solifluction. Depth 12-18 ins. Freely drained.	Bracken - - - - - Sagittaria - - - - - Vallis - - - - - Viola - - - - - grass spp - - - - - Moss spp - - - - -	300 ft.	South East.	Gentle.	Moderately shaded.	Ref. 33.5	Ref. 1.7	Ref. 1.8	us. 42	Foru moderate.
30	A.N.	29	23	Fine schistose calcareous gravel and sand. Some granite and quartz diorite fragments.	A brown earth with a heavy lichen coverlet over a sandy brown earth devoid of lichen. Depth 10-16 ins.	Moss spp. only.	110	South West.	Gentle	Moderately shaded	41.8 f	1.81	2.2.	7	Foru good.
28	H.L.	29	23	Proton earth with many small stones. Depth 14-18 ins. Mica Schist.	Proton earth with many small stones. Depth 14-18 ins. Freely drained.	Digitalis purp. - - - Viola - - - - - grass spp. - - - - - Moss spp - - - - -	450	South West.	Medium	Moderately Exposed.	57	2.48	2.7	80	Foru moderate to good.
5	L.C.	38	14	Schist.	A bog myrtle - Melaleuca peat. average depth 3 ft. over schistose granite	Myrica gale - - - - Melaleuca - - - - - Calluna vulg - - - - Moss spp - - - - - Other grass spp - - - R.	200	-	None	* Shaded.	22.5	1.68	1.5	50	Foru moderate. The L.C. were used in 1938 to beat up in 194. 5.5.

Section X. Sylviculture. Continued.

(ix) Past Treatment of Established Plantations.

(a) Cleaning. The first cleaning was done in 1940. The following is an extract from the sylvicultural notes for that year:- "Cleaning was fairly extensive. In P.32 and "P.31, J.L. was pruned or removed where interfering with " S.S. . . . In P.28, 28 acres of E.L. and H.L. were pruned and 'wolves' removed".

The removal of 'wolves' was almost always amongst the first tending operations at Inverinate and was frequently combined with cleaning and brashing.

Very little cleaning was done in 1941, but from 1942 until 1946 an annual programme averaging some 60 acres was maintained. From 1946 to 1949 the annual programme dropped to an average of some 15 acres and in 1950 rose to 94 acres. 36 acres were cleaned in 1951.

There was nothing unusual in the method of cleaning which comprised the removal of weed tree species and the felling of 'wolves'. This latter operation was included as cleaning in the records and not as thinning.

Details of cleaning are given in Appendix. III Table. 5.

(b) Brashing and Pruning. There are no records of normal ~~pruning~~ high pruning at Inverinate but it was the practice between 1938 and 1942 to high prune single trees if their side branches were suppressing neighbouring trees. This was done to prevent D.F. damaging S.S. in P.28 in 1938 and to prevent S.P. damaging S.S. in P.30 in 1940 for example. Apart from this high pruning brashing has been done to a height of 6 to 8 feet.

100% brashing was not done, selected trees only being brashed (except along some roadsides where all trees were brashed for fire protection.). A higher proportion of trees were brashed formerly than is at present the rule. Brashing was ?

(b) Brashing and Pruning. Cont'd.
was/

done on all species.

The first brashing was done in 1933/34 in the 8 acres of acquired woodland in Inverinate Block, but brashing of the present plantations first started in 1938. Brashing was on a limited scale until 1941 when 31 acres were brashed. Since 1941 an average of some 32 acres have been brashed annually. Details of brashing since 1941 are given in Appendix. II Table. 5.

(c) Thinning. The acquired plantation was twice thinned before it was felled in 1939/40, but with this exception thinning did not start at Inverinate until 1939 when D.F. in P.27 and P.29 was lightly thinned to help S.S.. This first thinning was only carried out where the poor form of the D.F. warranted its removal.

There was no thinning in 1940 or in 1941. In 1942 D.F., E.L., and J.L. in P.27, 28 and 29 areas were given a first thinning and thinnings have been carried out annually since this time. The annual area thinned has usually been 90 to 100 acres. Little thinning has yet been done in the P. 32 and P. 33 areas. The area suitable for thinning is increasing steadily and it is estimated that the area thinned ^{per annum} must likewise be increased to 150 acres/by 1954 to maintain a 4/5 year cycle.

Before 1950 there was no thinning cycle. Thinnings were prescribed for 5 years ahead as areas approached the thinning stage. Since 1950 a 4 to 5 year cycle has been used generally.

There appears to have been nothing unusual in the methods and grades of thinning used. Crops are now of normal density. It must be noted that, in the recent severe gales, windthrow at Inverinate was on a very small scale.

(c) Thinning. Cont'd.

Details of thinning at Inverinate are given in Appendix. III Table No. 6. The general scale of thinnings is shown in the following table:-

TABLE. 6

F. Year.	Acres thinned.	F. Year.	Acres thinned.
1939	8	1946	104
1940	0	1947	53
1941	0	1948	97
1942	50	1949	91
1943	30	1950	28
1944	107	1951	81
1945	82		

The table includes first and second or subsequent thinnings.

approximately 150 acres have been thinned twice or more than twice and 307 acres have been thinned once. The total area over which thinning operations have been carried out thus amounts to about 450 acres; this is ~~half~~ almost half of the total plantation area. The average age of the whole forest is twenty years (i.e. approximately the same area was planted before as after 1931.) so that progress from establishment to the thinning stage has been generally satisfactory.

Extraction has been mainly by horse and lorry. In many cases small sized thinnings which were not readily accessible were left lying. The internal road system now enables almost all material to be extracted. The present policy is to construct lorry roads into the Forest wherever the ground allows such construction at reasonable cost, and to sell timber at the forest roadside. Over difficult ground pole waggon tracks are being built and, in the more inaccessible areas, chutes or cables will be used.

Until 1950 produce was sent from the Forest to consumers direct. Such produce was usually as mining timber - much going to the shale mines. In 1950 a

(c) Thinning. Cont'd.

1950 a /
 contract was made with a timber merchant under the terms of which most of the thinnings for a three year period are supplied to the merchant at the forest roadside. This contract covers both Ratagan and Inverinate Forests. The timber is milled by the merchant and resold as mining timber, boxwood and fence material. Produce not sold under this contract is used for fence material or sold as firewood.

The total volume to be supplied under the present contract is estimated at 92000 cubic feet(H).

Annual production was between four and five thousand cube in 1944, 45 and 46, rising to about ten thousand cube per year in 1947 and 48 and to seventeen thousand cube in 1949. In 1950 ten thousand, six hundred cube and in 1951, thirteen thousand, five hundred cube was produced.

Section XI. Research. There have been no Research Branch experiments at Inverinate. ^{Two} sample plots ^{were} laid down in ^{one of these} 1949. The records ^{is} of ~~this~~ plots ~~are~~ reproduced in full in Appendix .V The use of seedling plots during planting in 1934 has been mentioned, ~~one of these plots has been selected for measurement and a description is given in Appendix~~ . Little information as to the relative advantages or otherwise of using seedlings in planting can be obtained from these plots because ^{they were} ~~it~~ ^{was} beaten up with transplants.

The choice of species at Iwerinate has ^{generally} been proved correct by subsequent satisfactory growth. Mixtures could have been used to advantage in some cases. P.C. among S.S. in peaty hollows and flats and P.C. or SP. among SS. and N.S. on the poorer, heathy knolls and slopes would probably have speeded the growth of the spruces.

The growth of H.L. and J.L. crops has been good but E.L. has shown moderate results in most cases. Great care in selection of ground for E.L. is indicated in areas similar to Iwerinate.

Initial draining appears to be more beneficial to S.S. than subsequent draining. In checked S.S. areas at Dorisdun, intensified draining carried out before and since the war has had little noticeable effect. Where areas were intensively drained and turfed before planting there has been very little severe checking of S.S.

The importance of killing out ground vegetation among S.S. is demonstrated at Dorisdun where M.P. has suppressed heather with obvious benefit to intermixed S.S.

The form of D.F. at Iwerinate is bad. Branching is acute, branches thick and nodes are frequently swollen. Sway and quick taper are also common. Since the sites on which this species has been used are apparently very suitable and as volume production is high, the bad form is probably inherited and there is a case for selection of strain within D.F.

Beating up at Iwerinate was successful for the most part. Where a change of species was used in beating up the change has been justified in most cases. S.S. used to beat up harch has grown well, the S.S. was used in the better patches. The need for pines in the poorer spruce areas was realised and P.C. was used for example, among N.S. at Dorisdun. The contorta have been damaged by deer, the animals damaging only the contorta and leaving other species untouched in the area. The contorta were used when the N.S. were in severe check, the N.S. is still checked though the contorta are now large enough to affect the ground vegetation. The present practice would be to plant the N.S. and P.C. together and thus shorten the checked period of the N.S.

Inverinate Forest.

Notes on Visit of 21/10/28 by Sir John Stirling Maxwell and
Assistant Commissioner with Divisional Officer.

P.27.

The Douglas Fir in this section are now a promising looking crop in spite of their bad start. There are many examples of multiple leaders owing to the original leader having died back. This was beaten up last spring and the newly planted trees were subjected to a long dry spell which caused several deaths. These will be replaced next spring. The soil is a good reddish loam and the plantation should do well. The Sitka Spruce planted in P.27 are making progress but have to contend with a luxuriant surface vegetation, heavy cleaning has been necessary on account of the plants being small in size.

P.28

The Douglas in this section also the Larches to a lesser extent suffered from the long dry spell which ensued after planting. As the percentage of failures is fairly heavy these groups will receive treatment in the ~~early~~ ^{early} spring coming spring. Of the spruces little can be said at present.

Sir John commented on the rigid lay out of rides and remarked that in some instances on this area, advantage should have taken of the presence of what would obviously be good extraction paths. Another defect of the rigid parallel system was demonstrated by one of the rides terminating in a rock outcrop. The use of Sitka Spruce for planting the ride edges should be discouraged as this species would probably grow very vigourously and intensify the effect of a rigid system of rides.

Appendix II Supervision.

Censurers.

J. Fraser 1946 continuing

State Forest officers.

J. A. Dickson 1951 continuing.

Divisional officers

F. Scott	1927 to 1931
J. Fraser	1931 to 1939
D. Spraggan	1939 to 1942
A. Watt	1942 to 1945
J. T. Fitzherbert	1948 to 1949.

District officers

J. Meldrum	1927 to 1929
H. C. Pease	1929 to 1935
D. Spraggan	1935 to 1939
A. M. Fraser	1939 to 1946
A. L. Orr Elving	1946 to 1947
D. S. Spraggan	1947 to 1949
R. O. Drummond	1949 cont. 1951
R. A. Innes	1952 -

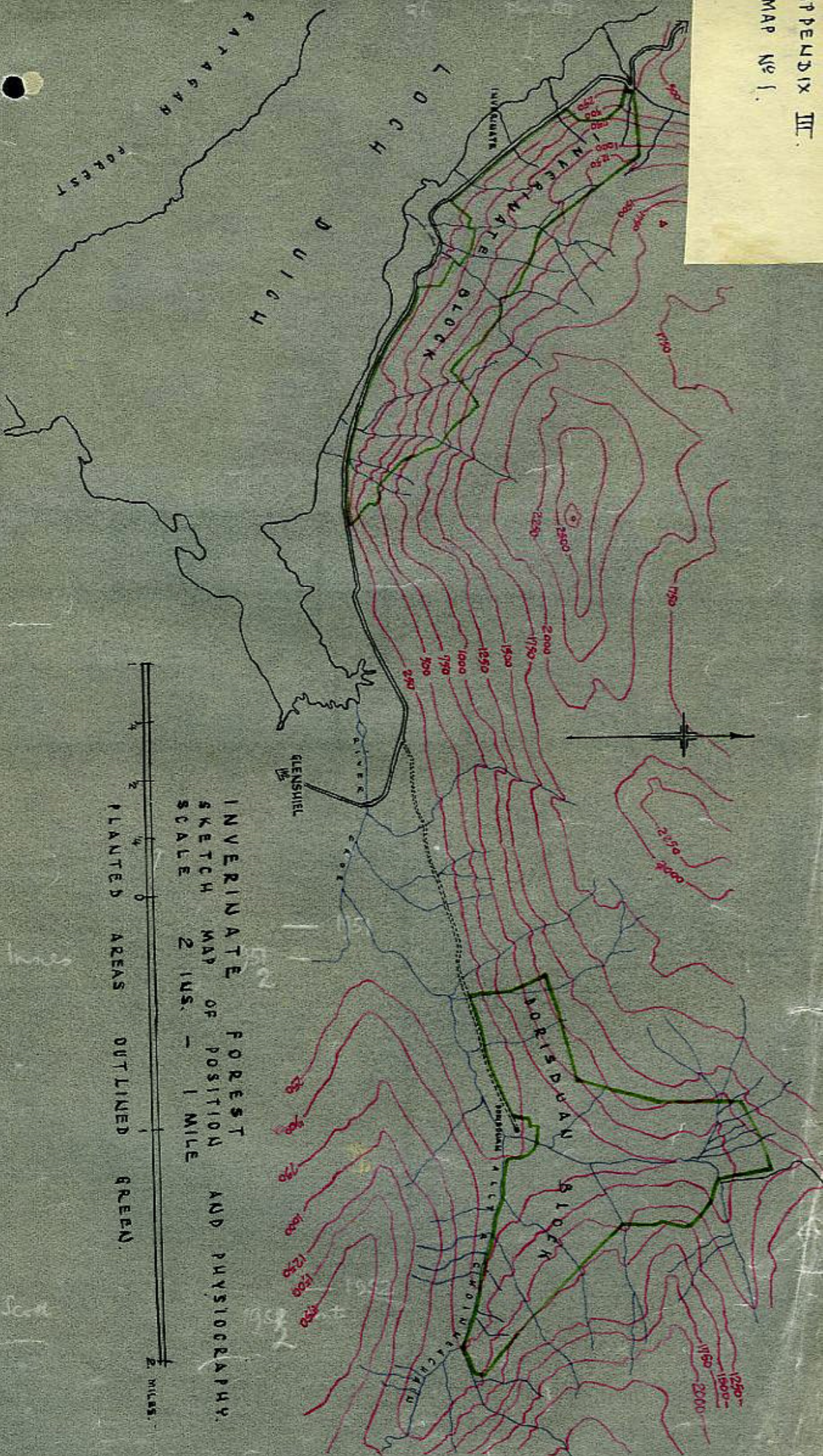
Foresters and Foremen in Charge.

J. M. Ferguson	1928 to 1934	(Foreman in charge).
A. Murray	1934 to 1936	(" " ")
W. Mr D. M. McLeod	1936 to 1937	(" " ")
W. Murray	1937 to 1939	(" " ")
W. Murray	1939 to 1946	(Forester I).
W. Murray	1946 to 1949	(Head Forester).
C. O. Mackintosh	1949 cont. 1952	(Forester II).
M. P. Scott	1952 cont	

FOREST weeks to

NATURE OF WORK	Unit	Current.....						Total Quantity to Date
		Quantity	Cost of Labour			Cost per Unit		
			£	s.	d.	s.	d.	
(b) New Works, viz. :—								
(c) Upkeep, viz. :—								
(1) Plants and Carriage, &c.								
(2) Prep. Beds and Sowing	100 sq. yds.							
(3) Weeding Beds	100 sq. yds.							
(4) Protection of Beds	100 sq. yds.							
(5) Lifting, Grading, Packing and Heeling in, &c., of Seedlings	1,000							
(6) Prep. Lines and Lining Out	100 sq. yds.							
(7) Weeding Lines	100 sq. yds.							
(8) Lifting, Grading, Packing and Heeling in, &c., of Transplants	1,000							
(9) General, viz. :—								
(s) Seed Collection, Extraction and Distribution								
Total Nursery Work (excluding Insurance)								

APPENDIX III.
MAP No 1.



A P P E N D I X III

TABLE No. 1

Sources of Supply of Plants for Planting and Beating up.
from 1932 to 1945.

<u>Nursery.</u>	<u>Total No. Plants supplied.</u>
Ratagan	704,000
Inchnacardoch	346,250
Port Clair	121,700
South Laggan	9,000
Guisachan	5,000
South Strome.	1,000
Nurseries outside Division.	16,500
Total	1,203,450

TABLE No. 2

TYPES OF PLANTS USED IN PLANTING.

[illegible]

TABLE No. 3

Year of Beating up	S.S.	N.S.	D.T.	S.P.	P.C.	J.L.	E.L.	L.C.	O.A.	C.A.	G.A.	Ts.	Be.	H.L.
1928	2+2 3+2		2+2											
1930			2+2			2+2+1 2+1 1+1	2+2							2+2
1931	2+3 2+2 2+1			2+2 2+1								2+2		
1932	2+1 2+3	2+2 3+2+1	2+2 2+1+2	2+1+1 2+2										
1933	2+1 2+2		2+1+1 2+2	2+1 2+2		2+1+1							2+2	
1934	2+1 2+1+1 2+1+1+1 2+2 3+1	2+2		2+1		2+1	2+1 2+1+1	2+1					1+2	
1935	3+1 3+2			2+1	1+1	3+1	3+1	2+1			1+1			
1936	2+1 3+2			1+1	1+1	1+1 2+1	1+1+1 3 3+1+1		1+1					
1937	2+1			2+1		2+1	2 2+1 1+1+1	2+1 2+1+1			1+1			
1938	2+1			2+1		2+1	2 2+1	2+2						
1939	2+1 2+2			2+1						1+1	1+1			
1940	2+1				2+1									
1941	2+2			2+2						2+0				

E.L.	L.C.	O.A.	C.A.	G.A.	Ts.	Be.	H.L.
2+2					2+2		2+2
2+1 2+1+1	2+1					2+2	
3+1	2+1			1+1			
1+1+1 3+1+1		1+1					
2+1 1+1+1	2+1 2+1+1			1+1			
2+1	2+2		1+1	1+1			
			2+0				

SPECIES?, QUANTITIES, AND AREAS BEATEN UP.

[illegible]

TABLE No. 5

Areas Brushed by P. Years and R. Years. B.

A. Cleaning.

B. Brashing.

[illegible]

APPENDIX III

TABLE No. 6

Details of Thinning by P.Years, P.Years and Species. (1942 - 1951)

P.Year.	P.Y. 42.			P.Y. 43			P.Y. 44			P.Y. 45			P.Y. 46			P.Y. 48			P.Y. 49			P.Y. 50			P.Y. 51			Total Acreages Thinned in P-Year Areas																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.	EL.	JL.	HL.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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APPENDIX IV

NOTES OF INTEREST.

(1) N.S. Sport. A N.S. in C.16, Dorisduan Block (P.32) shows a strong tendency to produce only terminal buds. Secondary and tertiary branches are few and the tree has a very open crown. At the top of the crown there are signs that the tree is reverting to normal growth. This Spruce is now 18 feet high and surrounding trees have been thinned out to give it plenty of growing space.

(2) Marginal Effect between J.L. and N.S. There are many instances at Inverinate of Larch and Spruce growing together without any apparent benefit being derived by the spruce. This is mainly true for S.S. but there are a few cases where N.S. ^{also} appears to have derived little benefit ~~also~~. There is, however one case where marginal effect is very noticeable. This is in C.13, P.31, at Dorisduan.

The J.L. average about 40 feet in height and are growing in a strip which lies up and down a medium slope with an Easterly aspect. A large area of N.S. is bounded by the J.L. strip and N.S. ~~growing~~ near the larch strip has grown more rapidly than that well clear of the strip.

Two straight lines were chosen at random. These lines run from the centre of the J.L. strip well out into the N.S. Along these lines the distances between trees and the height of each tree were measured. Soil samples were taken along the lines.

In the accompanying graphs the horizontal scale is equal to the vertical. The crowns of the trees are roughly sketched in. A sketch plan shows the position of the sampling lines.

lines/

Trees within 5 feet of a line were measured. The sampling lines were approximately on contours so that the use of a level ground line on the graph gives a reasonably true picture. The points at which soil pits were sunk are marked in red. Descriptions from these pits are as follows:-

SOIL PIT N° 1 (See diagram). (in Japanese hard).

Vegetation :-

Molinia a
Other grass spp. f
Digitalis purp. f
Oxalis acet. o

Soil.

0" - 1/2" leaf litter.
1/2" - 1 1/2" fibrous, loose, humus.
1 1/2" - 12" brown earth - red brown with a few stones.
a crumb structure. Sandy.
12" - 16" increasing mineral skeleton - red-brown, compacted sand.
16" + red brown gravel - compacted.

Drainage free.

SOIL PIT N° 2 (in U.S.).

Vegetation :-

Phlox aqualina a.
Molinia a.
Other Grass spp. f.
Herbs { Primrose
English bluebell.
Foxglove } o
Moss spp. a
Liwertwort o

Soil.

0" - 1" leaf litter.
1" - 2" fibrous humus (largely old bracken stems).
2" - 2 1/2" amorphous humus - light red brown and plastic.
2 1/2" - 5 1/2" leached layer: leaching slight and discontinuous.
light grey brown. Sandy with some bracken roots.
5 1/2" - 10" Slight iron deposition - small stones in a sandy matrix - light red-brown. Many bracken roots.
10" + A dark red brown compacted sandy gravel with stones mainly of schist. Drainage free.

Soil Pit No 3

Vegetation.

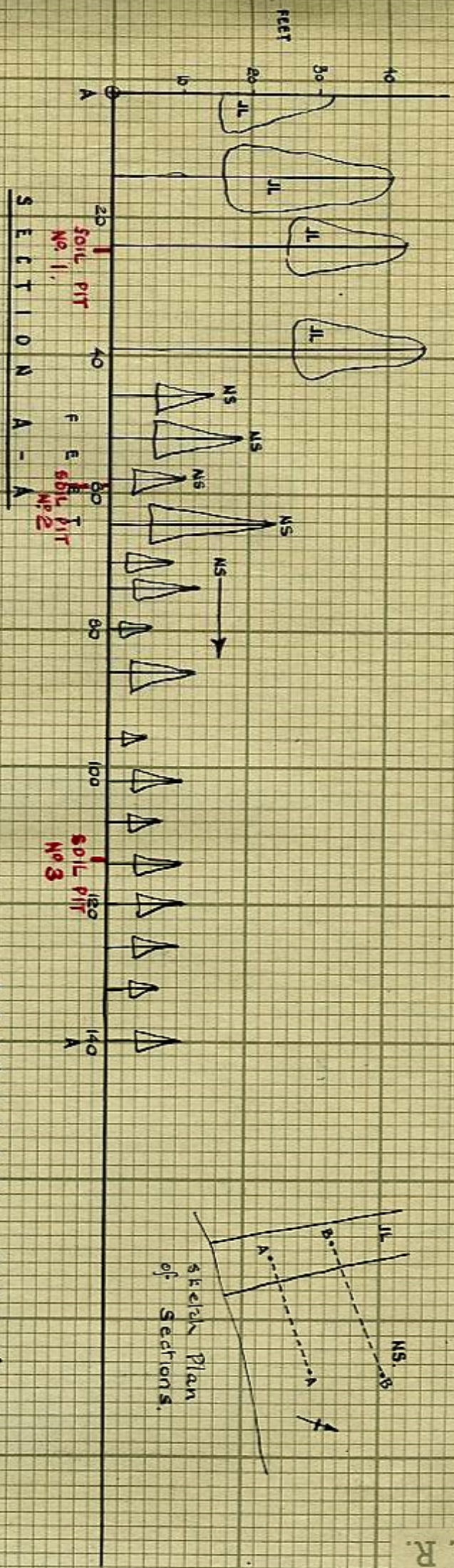
Pteris aqualina ----- a
Calluna vulg. ----- a (2' to 3' tall).
Molinia ----- f
Other grass spp. ----- o
Moss spp. ----- a

Soil.

0' - 1" - leaf litter and heather roots.
1" - 2½" - dark brown fibrous humus (chiefly *Molinia* and heather).
2½" - 4½" - amorphous humus, dark red brown - some roots.
4½" - 6" - light grey leached layer - sandy - continuous - of varying depth.
6" - 12" - light red brown - iron deposition layer - sandy - Some bracken roots - no stones.
at 12" - a second leached layer - discontinuous - maximum depth ½ ins. sandy - purple-grey in colour.
12" - 15" - dark red brown deposition layer - no roots - a few small stones.
15' + compacted schist gravel and boulders - heavily iron stained.
Drainage - free.

Conclusions.

There is evidence that the N.S. have benefited from the nearby J.L. The J.L. were planted on a better grassy slope and the N.S. near the Larch were planted in a better soil than the N.S. some distance away, nevertheless the following facts indicate that the J.L. has increased N.S. growth:- (1). The roots of N.S. near the J.L. have extended much more towards and under the J.L. than in the opposite direction. (2). The increase in annual growth of the better N.S. did not start until the J.L. was some 15 feet high. (3) The marginal effect is spreading into the N.S. where soil and vegetation are poor.

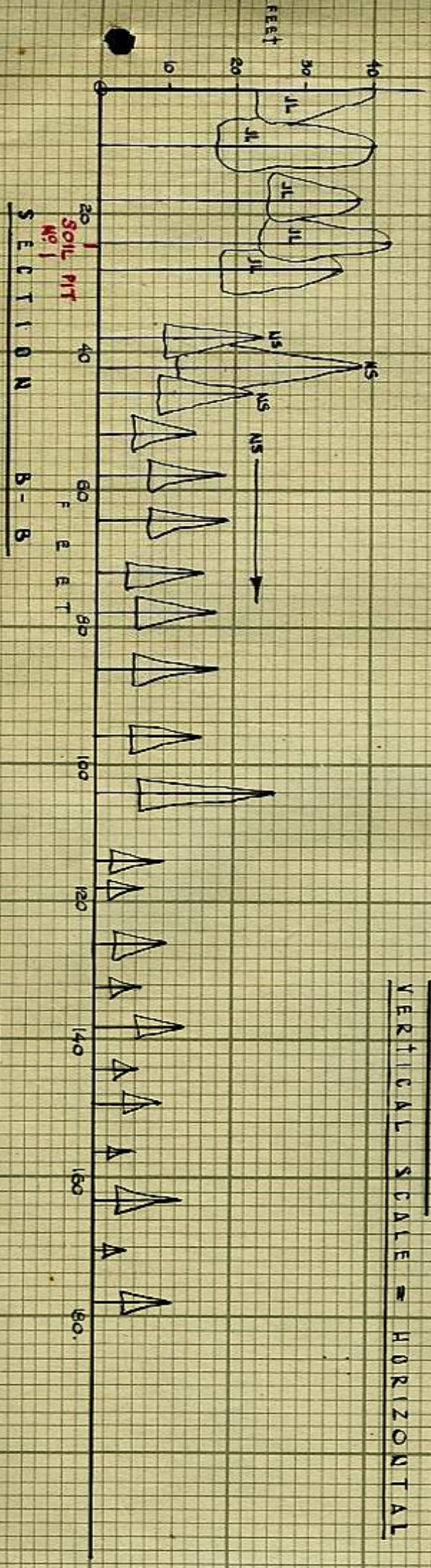


SECTIONS THRU'

J.L. & N.S. - C. 21.

HORISDUN.

VERTICAL SCALE = HORIZONTAL



Research Branch Sample Plot Data.

The records of the sample plot at Inverinate are given in full below. The last measurement was in 1949.

Plot No. S.196. Area. . 0.376 acres. Species. . Douglas Fir.
Quality Class . . II. Site. Cpt. 25 Inverinate Forest, Kintail.
Thinning Grade. . . . C/D.

6 ins. Ordnance Sheet No. 128 N.W. Ross-shire.
1 ins. " " (Popular Edition, Scotland) No. 36.
Owner . . . Forestry Commission. Agent . . Conservator (N).
Elevation. . . 400 feet. Aspect. . South West.
Exposure. . . Moderate. Slope . . 27 $\frac{1}{2}$ °.
Geology and Soil . . (1949). Schist and Granulite. $\frac{1}{2}$ " often absent,
decaying needles and twigs, 5" light brown, slightly stony Medium
loam Many small roots. Slight leaching. 15" Dark reddish brown,
light medium loam, very stony, many roots but growth restricted
by stones. 18"+ Dark yellowish brown light loam, very stony, small
stones to boulders. Few roots.
Vegetation (1949). Nil.

Year of Measurement . . . 3/1949. Age of Crop. . . 22.
Main Crop.
No. of trees per acre after thinning . . 388
Form Factor 0.385.
True Girth at 4' 3" 25 $\frac{1}{2}$ ins.
Average Height of 100 largest trees . . 56 ft.
Average ht. of crop . 52 $\frac{1}{2}$ ft.
Basal area per acre after thinning. . . . 111.1 Q.G.ft.
Volume per acre (U.B.) 2235 qg.cube. Crown % 57%.
Bark % 11.

Intermediate Yield from Thinnings

No. of Trees. . . . 106. Average height. . . . 43 ft.
True Girth at 4' 3" 18 $\frac{1}{2}$ "
Basal area per acre in qg. Square Feet. . . 16.1
Volume per acre (U.B.) in qg. cube. . . . 289.

Total Crop Yield to date.

Basal area. . . 127.2 qg. square feet.
Volume (U.B.) . 2524 qg. cube.

Forestry Commission Scotland
 RECEIVED
 26 AUG 1929
 NORTHERN DIVISION

SECOND EDITION, 1904.

Kintail Glebe.

CXXIV

KEWLAND

Abundant III. 117, 118, 119 to 121, 122 to 126, 128, 129.

Thurso

Great Glen

Sgùr na Seannraig

Sgùr an Airgid

Muir na Dubhannaidhe

Black Wood

Copy—
 This is the Plan referred to in
 the foregoing Charter by the
 Church of Scotland General Trustees
 in favour of the Forestry Commissioners
 dated Eighteenth January Nineteen hundred
 and Twenty nine.
 The Church of Scotland
 General Trustees
 (Signed) J. A. S. Miller, Trustee
 W. Murray Goodall, Clerk

Scale: Six inches to One Statute Mile or 800 Feet to One Inch.

Scale: Six inches to One Statute Mile or 800 Feet to One Inch.

Scale: Six inches to One Statute Mile or 800 Feet to One Inch.

