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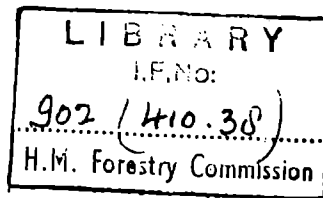
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HISTORY
OF
ROTHBURY

FOREST
NE(E) CONSERVANCY

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FORESTRY COMMISSION

HISTORY

of

ROTHBURY FOREST

1921 - 1951

NORTH EAST (ENGLAND) CONSERVANCY

HISTORY OF ROTHBURY FOREST

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HISTORY OF ROTHBURY FOREST

CHAIRMAN'S COMMENTS

There is much of both local and general interest to be learned from the History of Rothbury.

It was one of the earliest of the Commission's acquisitions (1922) and was of a general type which none of the technical officers had had experience in handling. Most of the former woodland had been cleared before the Commission came on the scene and the remnants gave little guidance as to the productivity of the poorer ground. The bare land available for afforestation included types which were obviously difficult and even today, with nearly 30 years' experience and improved techniques, call for circumspection.

In such circumstances a small initial planting programme, expanding as experience was gained, would have been the better procedure. Further undue optimism in the use of species such as Sitka spruce, Japanese larch and Douglas fir, which were reckoned as highly productive but were locally untried, was out of place. Rothbury emphasises a point which I have been constantly making over the years, namely that to go outside one's definite experience in large scale work (as opposed to experiment) is to court failure.

The forest was relatively small and somewhat off the beaten track, and for those reasons perhaps did not receive adequate attention from the higher supervisory officers. I find, for example, that I paid only five visits of inspection between June, 1922 and June, 1942; the later ones were necessarily brief and related only to the main block which formed the first acquisition.

As regards silviculture it is correct to say that in the earliest stages doubts were expressed as to the value of Scots pine. The slight evidence on the upper ground held out little promise of success with that species, though admittedly it was poor evidence; further rapid development of heather was not foreseen. On some sites weeding of strong bracken meant conversion to heather; I know of no other area where this change has been so marked. Gradually from further experience here and elsewhere the true role of Scots pine began to be better appreciated. By 1927 beating up of spruces was restricted to Scots pine or Corsican pine. By 1937 Scots pine /Sitka spruce

mixture was regarded as a good one and by 1942 it was thought that Scots pine would do best pure on the lower ground and mixed with Sitka spruce on the higher.

I have not been able to visit Rothbury since 1942, but reading the brief summaries of subsequent work I am not happy that all the lessons of the past have been fully assimilated and applied.

R.

Jan. 18th, 1952.

HISTORY OF ROTHBURY FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation and former ownership

Rothbury Forest consists of four blocks of forest land, all situated within 10 miles of Alnwick. Thrunton, the largest of these blocks (1257 acres) was the first Forestry Commission property acquired in Northumberland, and lies immediately west of the Morpeth - Wooler road, 6 miles north of Rothbury, in the Parish of Whittingham. The name "Rothbury Forest" is an ancient one, and was applied to the rough forest land lying both north and south of Rothbury. The lands of Whittingham were a royal demesne after the conquest, and were granted to the de Flammaville family in the early 13th Century, and later became incorporated in the Eslington Estate. This was owned by the Hesilriggs in the mid-14th Century, and passed into the possession of the Collingwood family in the first half of the 16th Century. Thomas Collingwood forfeited this estate for his part in 1715 rising, and it was bought by Sir Henry Liddell of Ravensworth in 1719, and has remained in the possession of the Ravensworth family since then. At first the land was leased to the Forestry Commission in 1921 on a 50-year lease, but this was extended to a 999-year lease in 1927.

Swarland, acquired in 1938, consists of 386 acres of former old woodland, lying 3 miles north-west of Felton, and 6 miles south-east of Thrunton, in the Parish of Felton. It is worked as a section of Rothbury Forest. Owned in the 18th Century by the Davidson family, Swarland Hall Estate passed to the Riddells of Felton Park. It was bought in 1902 by a Mr. James E. Woods of Newcastle, and finally the estate was acquired by the Fountains Abbey Settlers Association Ltd., soon after the 1914-1918 war. This association built what is now Swarland Village, and sold the old woodland to the Forestry Commission in 1938.

Hepburn Wood (245 acres) lies at the western end of Hepburn moor, 9 miles north-west of Alnwick, in the parish of Hepburn. Spelt "Hepburn" on the Ordnance maps, this Scots form of name is inappropriate, as from the 13th Century onwards it has been spelt "Hebburn". The name is reputed to be derived from the Old English "Hehburh", meaning a fortress, which

presumably refers to the Ros Castle stronghold just to the north of the wood.

The area was owned by Simon de Montfort at this time, but was forfeited after his rebellion, and passed to a family bearing the local name of Hebburn, in whose possession it remained until 1808, when it was sold to the Earl of Tankerville, and became part of Chillingham Estate. Between 1935 and 1938 it passed through various owners, and was finally bought by the Creswell Estate trustees, from whom it was purchased in 1946 by the Forestry Commission. It is at present managed as a section of Rothbury Forest.

Little is known of the past history of the latest acquisition, Birsley Wood (188 acres). This forms a section of Rothbury Forest, and is situated $\frac{1}{4}$ mile to the north of the village of Edlingham, in the parish of that name, $1\frac{1}{2}$ miles east of Thrunton. It was purchased in 1951 by the Forestry Commission from John Thompson of the adjoining farm of Lumby Law.

Area and Utilisation

A high proportion of the total area 1976 acres is old woodland, some of it of great antiquity. The woods of Hepburn date from the 13th Century at least, and there are good reasons to suppose that much of Swarland has also been woodland for several centuries. Thrunton was largely grazing land, until 1850 or thereabouts, when the old Thrunton Crag and Black Cock plantations were established. Some of the Howmoor woods were much older, however, dating from the late 18th Century at least. All these old woodlands were maintained or established largely for amenity and sporting purposes. No system of continued management was carried on at any time.

From	By	Date	Plantations Acquired	Plantable Excl. Col. 4.	Nurseries	Agricultural.	F. W. H.	Unplantable Excl. Col. 4.	Other Land			Total	
									Land Permanently transferred	Description	Acreage		Land temporarily transferred
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Eslington Estate (Lord Ravensworth)	Lease	31/7/22	25	1194	-	-	-	38	-	-	-	-	1257
Fountains Abbey Settlers Society Ltd.	purchase	4/11/38	-	276	5	105	-	-	Forester's House	1	-	-	387
Trustees of the Creswell Estates	purchase	4/9/46	-	235	-	-	-	12	-	-	-	-	245
John Thompson and trustees of late Sean Thompson.	purchase	16/2/51	-	88	-	-	-	-	-	-	-	-	88
Total:-			25	1791	5	105	-	50	-	1	-	-	1977

TABLE 2

a) Plantations:
Acquired
Formed by Commission

25 acres
1292 "

1317 acres

b) In hand, awaiting planting
Blanks after felling
Burnt areas
Other land

255
244
-

499 acres

c) Nurseries
d) Agricultural: 1 tenancy
e) F. W. H.
f) Unplantable land in hand
g) Other land:
Forester's house and garden

Total:-

1
1977 "

All the Agricultural ground is at Swarland

Meteorology

a). Rainfall

Lying in the rain-shadow of the Cheviots, Rothbury Forest, in common with the greater part of Northumberland has a moderate rainfall, influenced noticeably by relief; sheltered valleys may have 5 in. - 10 in. less than the surrounding moors. The average annual rainfall over the whole area is between 30 in. and 35 in. with slightly less, probably, on the north slope of Thrunton Crag. At Bellingham, which also lies in the 30 in. - 35 in. region, rainfall is distributed fairly evenly throughout the year, with March, April and May as the driest months and October to January as the wettest, in the period 1920 - 39.

b). Snowfall

The number of days on which snow falls and the duration of snow-cover varies a great deal with topography. Figures for Bellingham, at an elevation of 849 ft. are as follows:-

Greatest number of days with snow	64
Greatest number of days of snow lying	74
Smallest number of days with snow	26
Smallest number of days with snow lying	12

Most of the snow falls between December and March, with January, February, and March having the highest frequency.

c). Temperature and Frost

July and August are the warmest months, January and February the coldest. The highest frost frequency is in January and February, but severe frosts may occur in March and into April. At Bellingham, the temperatures between 1909 and 1923 were as follows:-

January	maximum	41 ^o F.
"	minimum	32 ^o F.
July	maximum	65 ^o F.
"	minimum	58 ^o F.

Late spring frosts occasionally occur, on clear nights with slight cooling breeze. The conditions for frost formation vary greatly with topography. Early autumn frosts are rare.

d). Wind

The prevailing winds are westerly and are followed in frequency by south-westerlies, north-westerlies and southerlies. These blow on most days in autumn and winter. Whilst northerly, north-easterly, and south-easterly winds blow on most days in spring and early summer.

Topographical influences are marked, and sea-breezes occur in summer and autumn, and are felt occasionally 20 miles inland, though normally their penetration is only a mile or so, but they may reduce or reinforce the existing wind. Many places, on the higher ground especially, have katabatic winds at night, at speeds from three to ten miles per hour.

Gales are less frequent on the north-east coast than on the west. Westerly gales predominate, the highest frequency being in January and December, followed by October. The north-east has a high percentage of northerly and north-easterly gales, compared with the rest of the country. Number of gales averages about five per year, but varies between one or two and eight or ten.

Winds descending from the Cheviot valleys have a distinct 'fohn' effect. The break-up of cloud masses passing eastwards over the Till-Breamish valley, and re-formation over the higher ground of Hepburn and Kylee is readily observed.

THRUNTON

Physiography.

From the central east-west ridge of Thrunton Crag, the ground slopes moderately steeply to the south where the basin of the Blackcock opens to the east. The Crag ridge continues at a lower altitude round the west and south-west sides of this basin to the Coe Burn which forms the southern boundary of the forest. The aspect of this area is generally south east, locally east.

To the north of the main ridge, rock outcrops to a steep slope, at the foot of which lies the area of the Howmoor, on a moderate slope with an eastern aspect. The Crag aspect is north-west, locally north, and easterly at its eastern end.

Elevation varies from 350 ft. at the north-east boundary to 900 ft. at the west end of the main ridge. The Blackcock area lies mainly between 400 ft. and 600 ft.

The ridge is fully exposed, but elsewhere the area is relatively sheltered.

Geology and Soil

The greater part of Thrunton lies over Fell Sandstones of the Tuedian Carboniferous Limestone Series. These are massive coarse false-bedded, white to dark brown Sandstones, highly weathered; their composition appears quartzose, with possibly calcium carbonate when fresh. Faulted into the Fell Sandstone mass is a belt, approximately $\frac{1}{4}$ mile broad, of the Scremerston Coal Group, brought in by a branch of the great Bolton fault, and which consists of Sandstones, Shales, and Limestones, with apparently thin coal seams. This belt runs from High Blackcock, south west through Black Walter. According to the Geological Survey, some of the old shafts on the the area have been in limestone and coal.

The whole area apart from the very steep and rocky slopes is covered with glacial drift of varying texture and depth, which is of much greater importance than the underlying rock. When the drift is heavier, e.g. the lower drift around Coe Hill and in the Blackcock hollow in general, it is moderately rich in nutrients, but relatively poor elsewhere. Drift in the Blackcock basin area is usually a sandy wash of variable depth over more compact and tough boulder clay.

Dr. A. Muir classified the soils into six main groups, with sub-groups based on the nature of the surface organic matter.

- | | | |
|-----|---|-----------------|
| a). | Normal podsol, with or without pan | |
| | (i) with dry <u>Calluna</u> raw humus | P and Pr |
| | (ii) with bracken, etc., litter. (common) | P ^B |
| b). | gleyed (Az) podsol with pan - iron or humus | |
| | (i) with greasy raw humus, passing into peat in places. | PL |
| | (ii) with bracken, etc., litter (uncommon) | PL ^B |
| c). | gleyed podsol without pan (sometimes probably straight gley) | |
| | (i) with greasy <u>Calluna</u> raw humus, becoming peaty in places. | P ^G |
| | (ii) with bracken etc., litter (common) | P ^{GB} |
| d). | deep grey, bleached (?) sand | |
| | (i) with greasy <u>Calluna</u> raw humus | S |
| | (ii) with bracken etc., litter (common) | S ^B |
| e). | peat gley on Howmoor and elsewhere, peat variable but usually thin. | M |
| f). | flush soils. (bracken and/or rush) | F |

Vegetation

Four vegetational types are found on Thrunton. These are:

- 1). Calluna dry moor. This consists of almost pure Calluna, with occasional Erica tetralix and Empetrum nigrum, and the mosses Sphagnum spp., Polytrichum, and Catherinea spp. This type extends over large areas on the rocky slopes and wherever drainage is reasonably good.
- 2). Calluna wet moor. Found where drainage is retarded, and is confined largely to the peat areas on the high ground above the crags in Compartments 51 - 56. Calluna is dominant, with Erica tetralix, Eriophorum, and Scirpus.
- 3). Bilberry/Calluna. This is found on the old woodland areas of the crag and on the Howmoor. A transitional type, the dominant Vaccinium of the open old woodland is gradually reverting to Calluna dry moor following clearance of the old crop. Beneath the old Scots pine on the Howmoor, bilberry is completely dominant still. Other species present include occasional mosses, Dicranum, Hylocomium and Hypnum spp.
- 4). Grass - bracken: This occurs in types 1) and 3) as flush streaks, with widely varying amounts of grass (Agrostis and Nardus chiefly) and bracken, with rush patches, mainly Juncus communis and Juncus articulatus. Some Calluna occurs, also Potentilla, and occasional Vaccinium. A more pronounced form of this type occurs on parts of the Howmoor and on parts of the low ground at the foot of the crags, where bracken and grass are dominant, with Scilla, Trientalis, Galium saxatile, and Oxalis also occurring, with a few Calluna and Vaccinium patches.

There is no doubt that the vegetation of this area has undergone a profound change since 1921. The felled woodland at that time appears to have had a much more promising vegetation than now, as the reversion of the woodland types of (4) and (3) would not have progressed so far towards Calluna. Much of the P.24 and P.25 areas were under grass/bracken, according to reports at this time, and choice of species was based on this. This area had been grazed until 1923, under the terms of the lease, and thus the heather and Vaccinium would suffer more from grazing than the sheathed species grass and bracken.

Where sufficient light is available, as under the older Japanese larch crops, vegetation is a relatively stable form of bilberry/Calluna, (type 3). Elsewhere under closed-canopy crops vegetation is non-existent or confined to mosses of the Dicranum - Polytrichum type.

Risks

Fire

Fire risk is not high at Thrunton, the chief danger being from moor-burning, on the west and south boundaries, and from chance passers-by and picnickers, who are not numerous. Occasional fires have occurred, which caused little or no damage, and appear to have been the result of moor-burning or carelessness in burning protection fire-breaks.

By 1942, an artillery range had been established at Rimside Moor, and another small-arms range at Callaly Castle, on the western boundary of the forest. At 3.15 p.m. on the afternoon of May 6th, 1942, a fire was observed by the Forester, burning on the moor outside the west boundary, some 800 yards away, and approaching the forest, fanned by a strong west wind. Some troops were attempting unsuccessfully to put it out, and it became apparent that reinforcements were necessary. As many local men as possible were summoned, and Alnwick National Fire Service and the Military at Broome Park and Glanton were summoned, in accordance with pre-arranged procedure.

The front of the fire was too fierce to break, and the forester concentrated his forces on the flanks, to keep control as far as possible. More military assistance arrived, and by midnight the fire was extinguished, at the east end of the Crag.

In all, 340 acres of plantations were destroyed, in the oldest part of the forest, the P.21 to P.25 area. A further 60 acres of unplanted ground were also burned over. The fire was apparently started at a rifle range approximately half a mile from the forest, by men of the 312th. Battery, 129th. Field Regiment R.A. Several spent tracer bullets were found at the point where the fire started. A claim was submitted to the War Department Claims Commission, and the compensation received amounted to £14,495. It was the opinion of the forester that 5 men, at the most, could have got the fire under control before it ever reached the top of the moor.

Animal

Some rabbit damage was sustained in the years 1921 - 25, but since then they have been kept well in hand and have not been a serious risk. Hares are rare but have done occasional damage. Sheep have caused little damage in the forest, though lately there have been three or four persistent trespassers, as a result of the hunting wickets being left open. Roe deer are few, and have caused some small damage. Their numbers fluctuate, and normally 6 or 7 are killed annually. The population is probably 12. Black game, however, have until recent years been plentiful, and caused considerable damage in early years, especially in the Blackcock area. This area was so named in the mid-19th Century, when the original plantations were established, because of the abundant black-game in the neighbourhood. Insect attack has never been a serious risk, though in 1934 Lophyrus pini caused a severe defoliation of Scots pine. Hylobius abietis appears to have caused some damage in the early twenties, where Scots pine had been planted on recently cleared ground.

Climatic

Frost hollows occur on parts of the Blackcock basin, and some damage appears to have been sustained by spruces and Douglas fir in the early stages before canopy closure. Some damage has also occurred on the flats of the Howmoor at the foot of the crags. All this damage is the result of late frosts.

Wind damage has also taken place on the Howmoor, but only on a minor scale.

Exposure effects are seen on the remnants of the old Scots pine and European larch on the high moor, in Compartment 56, in stunted growth and poor form. These do not give a true indication of the site potentialities, however, as stocking was undoubtedly poor. Elsewhere exposure causes little damage.

Other: Honey fungus (Armillaria mellea) has occurred in the Blackcock area, from old stools, and Douglas fir and Sitka spruce have been attacked: it has never reached serious proportions. Larch canker (Dasyscypha Willkommii) has been prevalent in European larch in the past: little European larch remains however, and what there is, is vigorous and quite free from canker.

Roads

The area was originally divided into 50 compartments, on a modified grid system. The 133.7 acres of unplatable ground on the moor to the west of High Blackcock was compartmented in 1948, adding a further 6 compartments. The layout has proved satisfactory in the Blackcock and Coe Burn areas, but on the Howmoor, the original compartment boundaries are difficult to trace.

When the area was first acquired, the only road was an old coach road which runs down the eastern boundary of the forest, and though a county road, is not maintained any longer. There were a number of old unmetalled cart roads, used by Lord Ravensworth, principally in the Howmoor Plantations. The policy has been to maintain and improve the best of these, and to supplement them where necessary by new works. When the woods on Thrunton Crag were felled by the Office of Works during the 1914-1918 war, a light railway of 2-foot gauge was run along the foot of the Crag and through Thrunton Farm to Bridge of Aln. Extraction was by chutes from the steep slopes, and on the plateau by dragging to the railway by way of the Crag-top cart track. This track and others of its type were sufficiently good in the early years of the forest for normal cultural operations; at that time fire protection placed more emphasis on fire-breaks and control burning, not on access routes and water supplies as at present, and as a result little road work was done until 1938, when a small part of the Blackcock loop road was begun. This road was completed in F.Y. 50.

A loop road on the Howmoor was constructed, partly by A. Miller, for extraction purposes, and improved and resurfaced by the Engineering Branch. This followed old cart tracks for the greater part of its length, and was completed in 1950.

The need for a road to the south side of the crag summit became apparent and the "Tanks road" was built in 1951 along the line of another cart road. This was a fairweather road, and it is intended that it be extended out on to the high moor and eventually linked to the Coe Burn road. This is also a fairweather road constructed in 1951, and branches off the Blackcock loop road southwards, and follows the Coe Burn to the south-west corner of the forest. This latest road was made at the same time a fairweather road built to the north of the crags, again following closely an old cart track. This road was linked to the Howmoor loop road.

Labour

The number and quality of men employed has varied considerably; no records are available of the numbers employed between 1921 and 1935, but it is certain that these men were inexperienced in forest operations. The extensive failure of certain of these early plantations is undoubtedly due, in part at any rate, to the poor quality of the workmen. Planting was completed by 1933, and the maintenance work in the period 1935 - 39 was done by a labour force of 3 men, later reduced to 1 in 1940 - 41. Prisoner-of-war labour was available in 1946 and 1947. The forest labour force has steadily risen from 8 in 1944 to 20 in 1951. Lack of labour in the years 1946 - 1948 resulted in the use of European Volunteer Worker labour, which proved an expensive and not very satisfactory undertaking, and the thinnings done by them were not as profitable as more recent ones have been.

It has not been easy to build up a force of skilled forest workers at Thrunton, and this is partly due to the scarcity of houses in this neighbourhood. There are no Forestry Commission houses on the area, although it has been in our possession for 30 years.

The provision of a forester's house at Thrunton has been proposed since 1933, and though scheduled for building in 1951, has still not been constructed. The lack of such a house has made supervision a difficult task.

SILVICULTURE

Preparation of the Ground

Of the 1257 acres of Thrunton which were acquired in 1921, some 761 acres were old woodland; the greater part of this was on the Howmoor - Thrunton Crag, the rest being the remnants of the Blackcock plantations. 150 acres of the old woodland were still standing, and consisted of Scots pine, aged 40 - 45 years old, some very good European larch, and a certain amount of beech and oak. The latter were very poor and rough. The remaining 600 acres were devastated, scrub, or felled, having been cut over during the 1914 - 18 war by the Timber Supply Department, who removed the best and left the unsaleable birch, large rough beech and scrubby Scots pine, along with a large amount of slash still uncleared. This was piled and burned, and a certain amount of heather burning prior to planting was also done, especially on the crag face and summit. The area was fenced against rabbits, but this does not seem to have been completely effective, as some damage was caused

in early years. The grazing of the Blackcock area up till 1923 had the effect of suppressing the heather and Vaccinium. Unfortunately this was not realised when species selection for P.24 and P.25 was done.

After the 1942 fire, the burnt crop was cut, and any trees remaining alive were also cleared away. What little lop and top there was, was allowed to remain on the ground, and planting was done among it.

Choice of Species

In the acquisition report, Mr. Long put forward the following proposals:

Scots and Corsican pine over the major part of the area.

Larch on better and deeper soil at lower elevations, as indicated by bracken.

Sitka spruce on the plateau

Silver fir on the north-west Vaccinium slope, where soil is stiffer.

These proposals were amended in 1922, when Mr. Roy Robinson (now Lord Robinson) remarked that European larch should do well on dry ground at low elevation, and Japanese larch at higher elevation. A fair proportion of the lower ground should also be planted with Douglas fir and Corsican pine should be planted more, especially on the higher ground.

A working plan for the area was prepared by Mr. A. D. Hopkinson, the Divisional Officer, in 1923, and approved. Planting proceeded in accordance with its provisions, but little record of these exists, apart from the fact that it was subsequently changed from Norway spruce to Corsican pine over some 200 acres.

Norway spruce was planted on 82 acres, in P.22 and P.24, principally on the crag face. Large areas were also planted with Sitka spruce on the crag face, and on the Calluna ground in the Blackcock basin. No Scots pine was planted between P.22 and P.27, and Corsican pine was neglected until P.26, when 134 acres were planted on Coe Hill.

By F.Y.28 Scots pine far from being planted on the major part of the area, was confined to Thrunton Crag End, and occupied 109 acres, and Corsican pine covered 188 acres on Coe Hill, whereas Sitka spruce had been planted on 287 acres mostly on Calluna/Vaccinium ground in the Blackcock basin, and Douglas fir on 154 acres, mostly on the uneven Howmoor area.

97 acres of European larch had been planted, mostly on the Calluna ground of the Blackcock. The majority of the Japanese larch which occupied 137 acres, was on the Crag End area.

Though Mr. Long's original species proposals were optimistic as regard European larch and Japanese larch they were undoubtedly correct in the choice of Scots pine as a major species. This was later realised, and Scots pine used widely in beating-up.

After the fire in May, 1942, the question of species selection again arose. The Chairman, on a visit in June 1942 considered that pure Scots pine ought to do well on the area, but higher up on the more peaty areas it ought to be mixed with Sitka spruce. Growth data from the burned crop supported this view.

The species used in F.Y.46 - 48 for the replanting of the Crag face were Scots pine in mixture with Sitka spruce and Douglas fir. In F.Y.49, a wartime felling in Compartments 9 and 10 on the Howmoor was replanted with pure Sitka spruce. Sitka spruce was also used, along with Scots pine in planting the high moor in P.50, originally considered unplantable, and the P.51 area mainly planted with Scots pine with Japanese larch, Corsican pine and Sitka spruce on the flush areas at the foot of the slopes.

It is now considered that the use of Sitka spruce on Calluna ground where peat is absent or very shallow is a mistake. The poor success of Sitka spruce on the P.46-49 areas bears out the lessons of the P.22 - 28 planting, and it is proposed that the worst Sitka spruce areas be 50% replanted with Scots pine and only Scots pine with Pinus contorta and Pinus montana for exposed plantation edges, be planted in P.52 and 53.

Planting

a). Methods

A number of different planting methods have been tried from time to time for the different species, but most of the early planting appears to have been done by Schlich spade, a simple vertical notch method being used. Some mattock planting was also done. Screefing was carried out on the surface vegetation only, and no cultivation of the soil done, until around F.Y.33, when more care was taken in planting. Turf planting was not done until F.Y.27, and then only on a limited scale; it does not appear to have been completely understood.

P.46 - 49 areas were planted by notching, with the surface vegetation screefed off. The P.50 planting was done on turves cut from Cuthbertson furrows at 15 ft. apart, the plants being planted with a semi-circular spade. The P.51 area was planted using a modification of the screef - and - notch method, in which the soil is stirred and broken up slightly, to give extra cultivation.

Apart from a mulching experiment, described later, no manurial treatments were done until F.Y.51, when an application of ground mineral phosphate, at the rate of 1 oz. per tree was given to P.51 Scots and Corsican pine.

b) Spacing

Spacings used have varied only a little from those in current use today. The very good stand of P.33 European larch in Compartments 2, 3 and 4 was planted at $4\frac{1}{2}$ ft. though elsewhere $5\frac{1}{2}$ ft. was used for larches and Sitka spruce up to P.28: after this date 5 ft. became usual for Sitka spruce. Douglas fir has been planted at 6 ft. for the most part, though in P.23 and 25 $5\frac{1}{2}$ ft. was used. Douglas fir planted in P.46 - 48 was spaced at 5 ft. A 5 ft. spacing has been used throughout for Corsican pine and for all Scots pine planting except P.27 and P.33, when 6 ft. and 4 ft. spacings were used. P.22 Norway spruce was spaced at $4\frac{1}{2}$ ft. and 5 ft. was used in P.24. Since F.Y.46, 5 ft. x 5 ft. has been a standard spacing for all species.

c). Type of plants

Various sizes of plants have been used. 2+2 Scots pine were used in P.27, 28, and 33, and 2+1 or 1+1+1 plants in P.46 - 48 planting. P.50 Scots were 1+1, and 2+1 in P.51. 2+1 Corsican/^{pine}plants were used in P.25 and 26, and 1+1 in P.51. European larch have been planted as 2+1 for the most part, though occasional 2+2 and 1+1 plants have also been used, mostly in P.24. Japanese larch was planted as 2+1 in P.22 and P.51, as 2+2 in P.24 and 1+1 in P.41. P.22 Norway spruce were 3+2, while 2+2 were used in P.24. 2+1 Sitka spruce plants were used in P.22 - 23 planting, but P.24 - 28 and P.46 - 51 planting was done with 2+2 plants. A variety of sizes have been used in Douglas fir planting; 2+1 have been the most common, but between P.25 and P.28, 2+2, 1+1+1, 1+1+2, and 1+3 have all been used. There are no records of seedlings having been planted.

d). Rate of Planting

Policy in 1920 was that the felled woodland should be planted first, at a rate of 200 acres per annum, then the moorland would be planted. This scheme was adhered to in its essentials, though the rate of planting was slower.

Planting was begun in 1921 on Thrunton Crag End, and by P.23 the whole crag summit was completed. The Blackcock basin was then planted, in P.24 and 25, and Coe Burn in P.26. P.27 area was the Howmoor, and this was completed in P.28. This area was entirely planted up with the exception of the high moor, then considered unplantable. The P.33 planting was on the site of timber reserved by the lessors until 1932. A small area felled for the Timber Production Department during the war was replanted in P.41.

340 acres of plantations were destroyed by fire in May, 1942. The replanting of this began in F.Y.46, and is still in progress. Areas planted in each P. year are as follows:

	Planted	Existing, F.Y.51
P. 21	145.1	10.8
22	191.7	31.2
23	76.6	11.9
24	179.1	132.9
25	178.7	154.0
26	165.0	165.0
27	89.0	89.0
28	14.0	14.0
33	15.0	15.0
41	6.5	6.5
46	24.0	24.0
47	25.8	25.8
48	41.4	41.4
49	69.7	69.7
50	160.0	160.0
51	107.3	107.3

e). Success of Establishment

The planting done in the early years proved to be most disappointing. This failure was due to wrong assessment of a most deceptive site: in the words of Mr. A. D. Hopkinson in 1933, "even those most qualified to judge were deceived by site conditions."

It was not apparent that the soil had been over-assessed until after the bulk of the area had been planted. Little of the area is suited for Douglas fir, Japanese larch, and European larch and losses were very high indeed. Sitka spruce on the dry slopes also failed badly, as did Norway spruce.

The reason for these failures lies in the change of vegetation which occurred when grazing ceased on the area. The P.24 and P.25 areas were covered with pasture grass and some bracken, when they were planted, but within three or four years, the vegetation had become pure Calluna. Larches and Douglas fir only survived on bracken-flush areas, and the spruces went into check and gradually died. It is estimated that 85% of the trees planted up to P.25 ultimately failed.

Scots pine

This species alone has given consistent good results, and has been successful irrespective of vegetation. It was widely used for beating-up other species, and had established itself on the worst ground on the area, on Thrunton Crag. This area was entirely destroyed by the 1942 fire, however.

Corsican pine

This species has been successful on the dry slopes in the Coe Burn area, where drainage is free. It was planted on ground where Scots would have been equally successful, in P.26, and it is noticeable today that failures have occurred wherever drainage has been impeded, on flat Calluna ground. On dry, rocky knolls it has grown particularly well. Corsican pine was planted in P.51 on R.L.R.-ploughed ground, with turves at 5 ft. intervals. It is too early to make an assessment of success or otherwise here.

European larch

The best piece of European larch in the forest is the P.33 area in Compartments 2, 3 and 4, planted throughout with that species on 15 acres of old woodland which had been reserved by the lessors until 1932. This stand has grown satisfactorily since the time it was planted.

Elsewhere, European larch has done poorly, failing on all but bracken-flush sites, and even there they are badly cankered and diseased. On Calluna ground, European larch failed en bloc.

Japanese larch

On bracken/grass flush areas, Japanese larch has been successful, and has done slightly better than European larch on Calluna ground. Of the original 135 acres planted up to F.Y.28, only 35 acres had survived as pure

blocks by F.Y.37. The remainder being almost entirely replaced by beating up, mostly with Scots pine.

Norway spruce

Some 128 acres were planted in P.22 and P.23 on the Crag face. This was almost a complete failure, with the entire crop in check. Beating-up with Scots pine improved conditions to a certain extent, and by F.Y.37 some had attained a height of 12 ft. while others remained in varying degrees of check. The greater part of this ^{area} was destroyed by the 1942 fire.

Sitka spruce

Only on the bracken and rush-flush areas has this species been successful. Up to P.28, 234 acres were planted, and all suffered from checking. It is noticeable that a small area of Sitka spruce beneath scrub Scots pine on the Crag top was more successful than elsewhere. Much of this poor Sitka spruce was destroyed by the 1942 fire, and a considerable part of the remainder beaten up with Scots pine. It is hard to account for the choice of Sitka in the P.49 planting on the Howmoor, which has fared little better than earlier attempts with this species. It is intended that this area and the Sitka area planted in P.51, be 50% planted with Scots pine in F.Y.52.

The correct use of Sitka spruce is seen in the P.50 planting on the high moor peat of Compartments 51 to 55, turves cut from Guthbertson-ploughed drains and on a fair depth of peat, 1 ft. or more, with a Calluna - Eriophorum vegetation. Even here a complete Sitka spruce/Scots pine mixture would have been advantageous, however. P.48 Sitka planted in 3-row, 3-row mixture with Scots has been disappointing, and is largely in check. It is intended that this too be replanted, replacing the 3 rows of Sitka with 1 row of Abies nobilis, in F.Y.54 or 55.

The reason for the failure of Sitka is not far to seek. Thrunton has not a heavy rainfall, and except for the peats on the high moorland of Compartments 51 to 56, the soil is sandy and dry beneath rank Calluna. For this reason, Sitka spruce has been excluded entirely from the P.52 and P.53 planting programmes.

Where Sitka spruce has been successful, on the wetter parts of the Blackcock basin on flushed sites, it has formed a useful crop, but in nearly every case it has required extensive beating-up and mixture with Scots pine

to get it away.

Douglas fir

This species occupies a large proportion of the Howmoor, with a certain amount in the Blackcock basin. Up to P.28, approximately 140 acres had been planted, but it was a failure on Calluna, and has been beaten up extensively with Scots pine and Sitka spruce. On the Howmoor its success has been variable; for the most part there has been a tendency for complete patches to show poor growth. Dr. A. Muir, of the Macaulay Soil Research Institute, examined these in 1938, and found that where no pan had formed, growth was good, but showed distinct falling-off wherever pan had formed.

Douglas fir planted along the Coe Burn side, on the deeper and richer soil, have made consistent good progress, and the Scots pine/Douglas fir mixture planted in F.Y.46 on the lower slopes of the Crag End has been successful so far.

Mixtures

Most species were originally planted pure, and it was not until F.Y.46 that any mixtures were initially planted. The P.46 was on Thrunton Crag End, and on the lower slopes a Scots pine/Douglas fir mixture was planted. The Scots pine have grown well, and are satisfactorily nursing the Douglas fir. Scots pine/Sitka spruce 3 - row by 3 - row mixtures planted P.47 - 48 on the Crag face have not been^{so} successful, and the spruce is in check in the Vaccinium/Calluna vegetation. The Scots pine ought to have a nursing effect on this in time, and the policy is to wait till, say, F.Y.54, before passing judgment.

Intimate mixtures of Scots pine, Sitka spruce, Japanese larch and Douglas fir occur in the Blackcock basin, as a result of repeated beating-up. In many cases the present crop is much younger than would appear from its P. year. Throughout these mixtures, Scots pine has had a beneficial effect, and it has nursed up a number of difficult Sitka spruce areas.

The success of Scots pine as a nurse for Sitka spruce has resulted in the decision to interplant the P.51 Sitka spruce areas with Scots pine in F.Y.52. It is also proposed to introduce Scots pine into the P.49 Sitka spruce and to introduce a belt of Pinus contorta along the exposed western edge of the P.50 Sitka spruce in Compartments 51 to 55.

Little underplanting has been done: Sitka spruce planted beneath scrub Scots pine on the summit of the crag in P.22 was successful for a time, but in 1930 it is recorded as being no better than Sitka spruce elsewhere.

Ploughing

Ploughing was first done in F.Y. 50, when Compartments 51, 52, 53, 54 and 55 were planted. This ground was previously considered to be unplantable, and was of the Calluna wet moor type, with a thin peat layer over most of the area, 6 in. - 9 in. deep: in places Eriophorum is dominant, and there the peat is 1 ft. - 3 ft. deep. The heather was fairly short, having been burned in the 1942 fire, and being fairly level ground, was a straightforward operation. A Cuthbertson plough was used, with drains cut at 15 ft. intervals, and the turves cut and spread by hand at 5 ft. intervals. Average turf depth is 9 in. In all, 99.8 acres were planted, of which 71 acres were Sitka spruce of British Columbian origin and 2+2 plants. The remainder was planted with Scots pine, both 1+1 and 2+1; this Scots pine was of East England origin. Planting was by means of semi-circular spade.

Both species made good progress, and there are remarkably few deaths, which may be partly due to the exceptionally wet summer of 1950. While it might have been advantageous to mix the Sitka spruce with Scots pine throughout, this is one of the few true Sitka sites on Thrunton, where the peat is deep.

A small area was ploughed in Compartments 22 and 29, and planted in F.Y. 51. This is stonier ground, steeper, and with heavy growth of heather, which could not be burned off safely. An R.L.R. plough was used, ploughing at 5 ft. spacing. Because of the rough nature of the ground, it was not possible to plough as much as had been hoped, nor was the actual ploughing particularly good. The soil on this area is a thin layer of raw Calluna humus, 3 in. thick, over stony sand. Corsican pine was planted, by semi-circular spade on top of the furrow slice, at 4½ ft. spacing.

Beating-up and subsequent operations

The initial failure of much of the early planting resulted in extensive beating-up operations. For the most part, beating-up was done with the same species as had been originally planted, and as the failures were largely due to faulty species selection, the beaten-up plants failed too.

This was remedied in the early 1930's, when extensive beating-up with Scots pine was done in all the "1920" areas. A typical example is Compartment 33, on Calluna ground in the Blackcock basin. Originally planted with European larch and Corsican pine in F.Y.25, it was beaten up with the same species in F.Y.27 and with European larch again in F.Y.29. The Corsican pine was beaten up with Scots pine in F.Y.30, and the European larch with Sitka spruce and Japanese larch in F.Y.32. These last fared little better, and the entire area was beaten up with Scots pine and Sitka spruce in F.Y.34, and with Scots pine in F.Y.36. Further beating-up was done with Sitka spruce on turves in F.Y.47 - 22 years after the original planting.

By F.Y.33, 1120 thousand plants had been used in beating up. Of these, 408 thousand were Scots pine and on some parts, particularly the crag summit, they entirely replaced the original crop. Between F.Y.33 and 41, a further 288 thousand plants were used in beating-up. Some of the poorest areas have been virtually replanted several times.

In addition to failure due to choice of species, faulty planting and a tendency to replace every single failure has resulted in the large number of plants used. The principle of replacing 4 deaths with 1 beat-up does not seem to have been realised, and there has been great striving after an impossibly high standard of stocking.

The types of plants used in beating up have varied, but usually 2+2, or 2+1+1 plants have been used. Occasionally bigger plants, such as 2+3 or 2+2+1 have been planted, but these are exceptional. No manurial treatments have been done in connection with beating up.

There is no evidence that the plantations have suffered through lack of weeding. On the bracken-flush areas and on the old woodland sites on the Howmoor, weeding in the first year is essential, but on heather which has been adequately screefed at time of planting, little needs to be done in the first year. Where heather has been burned off, and where turves have been used or ploughing done, weeding is greatly reduced. Scale or intensity of weeding does not appear to have been a decisive factor in the success or otherwise of the crop.

Rates of Growth

Because of the uneven nature of so much of the crop, the collection of growth data is not easy; this is especially so in areas which have been

repeatedly beaten-up in early life, with the result that the age of individuals may be much less than the age of the plantation.

After the fire of 1942, the late Mr. W. Forsyth, at the request of the Chairman, obtained certain data on the growth and yield of various species on the area burnt. Age-height graphs from these data are reproduced below.

The height increment data given below was obtained by a modification of a strip-sampling method devised by Mr. R. F. Wood. This allows the equivalent of the 100 tallest trees per acre to be measured, thus obtaining the top height of the crop.

These measurements are expressed graphically, and they are in no sense age-height graphs. They are intended to illustrate the relative current growth rates of different species, and they also indicate the effect of initial check, in relation to non-checked stands.

Rates of Growth

Compt. No.	Species	P. Yr.	Age	Vegetation	a) Altitude b) Aspect c) Slope d) Exposure	Top Ht. of crop (ft.)	Mean Annual Height Increment (ft.)	Current Annual Ht. Increment over last 5 years (ft.)
5	S.P.	27	24	<u>Bracken/Vaccinium</u>	a) 600-700' b) E c) Slight d) Mod.	29.9	1.2	0.8
5	S.P.	28	23	<u>Calluna/Vaccinium</u>	a) 600-700' b) N.W. c) Steep d) Mod.	28.3	1.2	1.2
38	S.P.	29	22	<u>Calluna/Grass</u>	a) 400' b) E c) Slight d) Slight	28.0	1.3	1.3
3	S.P.	33	18	<u>Bracken/Vaccinium</u>	a) 500' b) N c) Mod. d) Slight	27.5	1.5	1.3
34	C.P.	25	26	<u>Calluna</u>	a) 700' b) E c) Mod. d) Slight	19.1	0.7	1.3
46	C.P.	26	25	<u>Calluna</u>	a) 600' b) N c) Mod. d) Slight	22.1	0.9	1.5
34	E.L.	25	26	<u>Bracken/Grass</u>	a) 700' b) E c) Mod. d) Slight	37.3	1.4	0.7 ±
2	E.L.	33	18	<u>Bracken/Grass</u>	a) 400' b) N.E. c) None d) None	31.0	1.7	1.0 ±
21	J.L.	21	30	<u>Bracken/Grass</u>	a) 550' b) N.E. c) Mod. d) Mod.	42.5	1.4	1.1 ±
11	J.L.	22	29	<u>Vaccinium</u>	a) 500' b) N c) Steep d) Mod.	36.9	1.3	0.8 ±
37	J.L.	24	27	<u>Grass</u>	a) 400' b) E c) None d) Slight	37.5	1.4	1.0 ±
38	N.S.	24	27	-	a) 400' b) E c) None d) None	30.8	1.1	1.4

Compt. No.	Species	P. Yr.	Age	Vegetation	a) Altitude b) Aspect c) Slope d) Exposure	Top Ht. of crop (ft.)	Mean Annual Height Increment (ft.)	Current Annual Ht. Increment over last 5 years (ft.)
37	N.S.	28	23	-	a) 400' b) E c) None d) Slight	27.1	1.2	1.0
29	S.S.	24	27	-	a) 400' b) E c) Slight d) Slight	34.4	1.3	1.1
41	S.S.	25	26	-	a) 500' b) E c) Slight d) None	38.2	1.5	1.3
43	S.S.	26	25	-	a) 400' b) E c) Slight d) Slight	39.3	1.6	1.4
11	D.F.	22	29	-	a) 500' b) N. c) Mod. d) Mod.	41.4	1.4	1.5
12	D.F.	23	28	-	a) 400' b) N c) Mod. d) Mod.	36.8	1.3	1.4
38/39	D.F.	24	27	-	a) 400' b) E c) None d) None	35.6	1.2	1.5
36	D.F.	25	26	-	a) 600' b) E c) Slight d) Mod.	43.2	1.7	1.4
42	D.F.	26	25	-	a) 400' b) W c) Slight d) Slight	41.8	1.7	0.8
3	D.F.	27	24	Formerly Grass/ Bracken	a) 500' b) N.E. c) None d) Slight	45.6	1.9	1.2

* On these samples, the current annual height increment was calculated over the past 3 years.

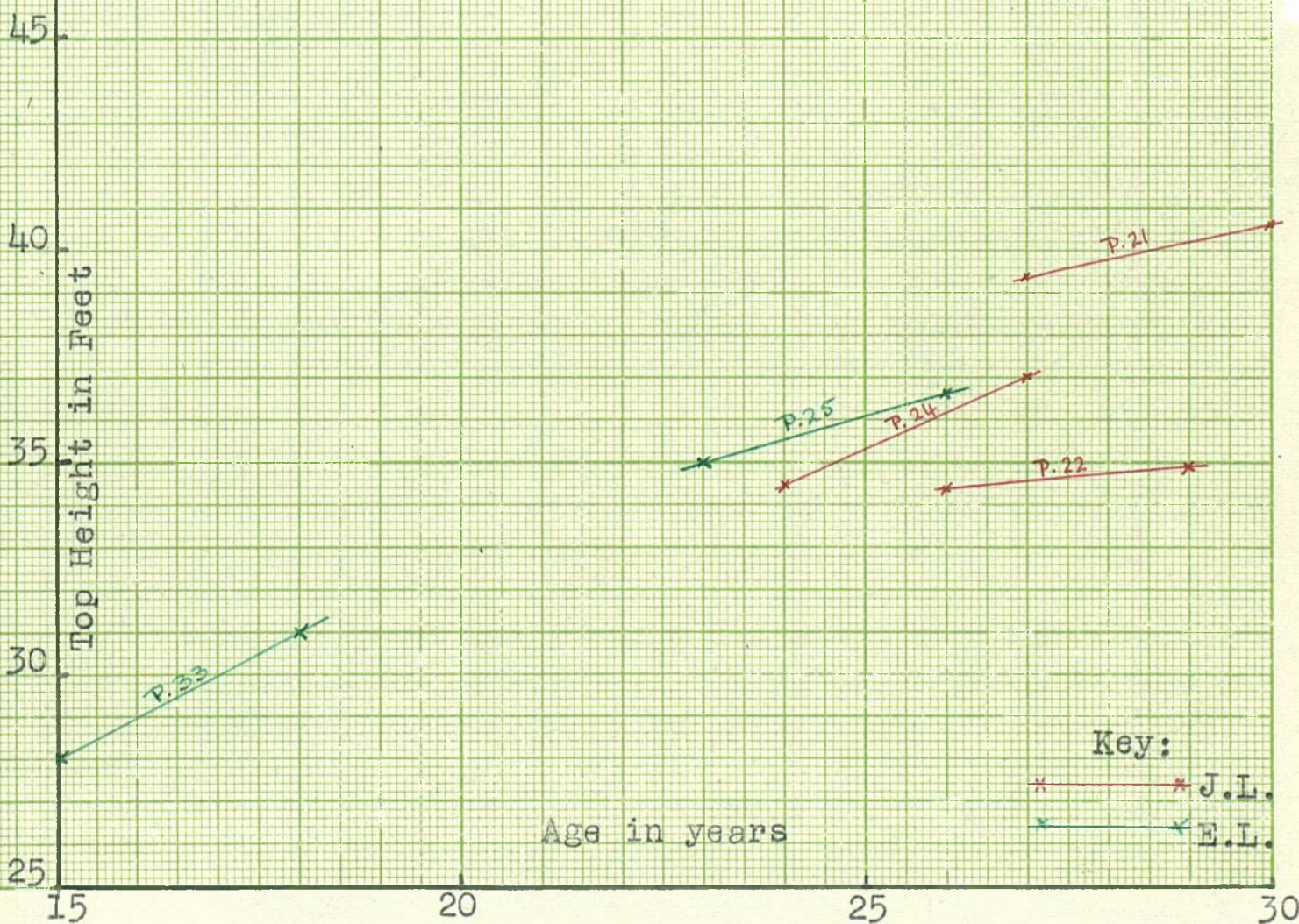
RATE OF GROWTH DATA
Scots and Corsican Pine

Rothbury Forest
(Thrunton)



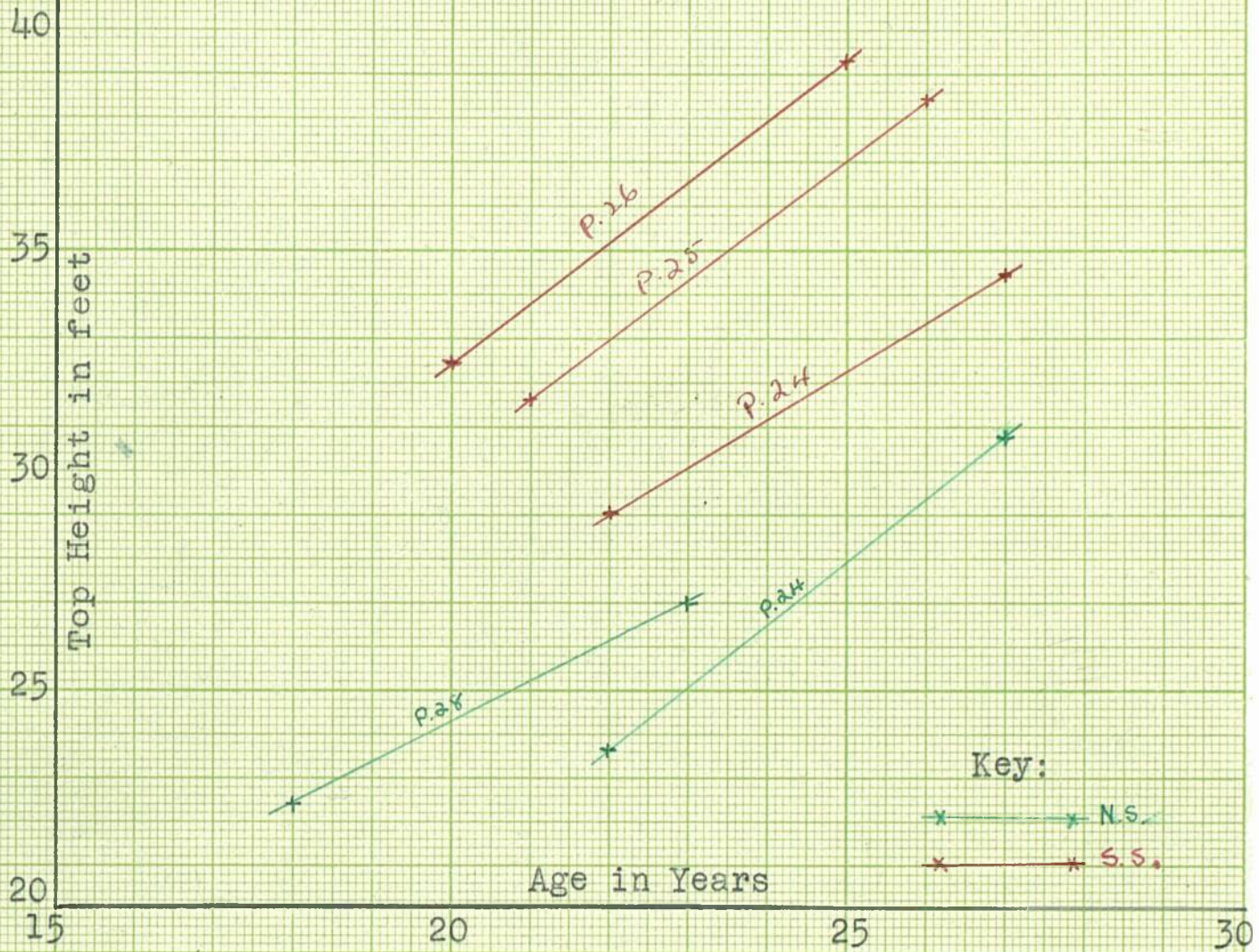
RATE OF GROWTH DATA
European and Japanese Larch

Rothbury Forest
(Thrunton)



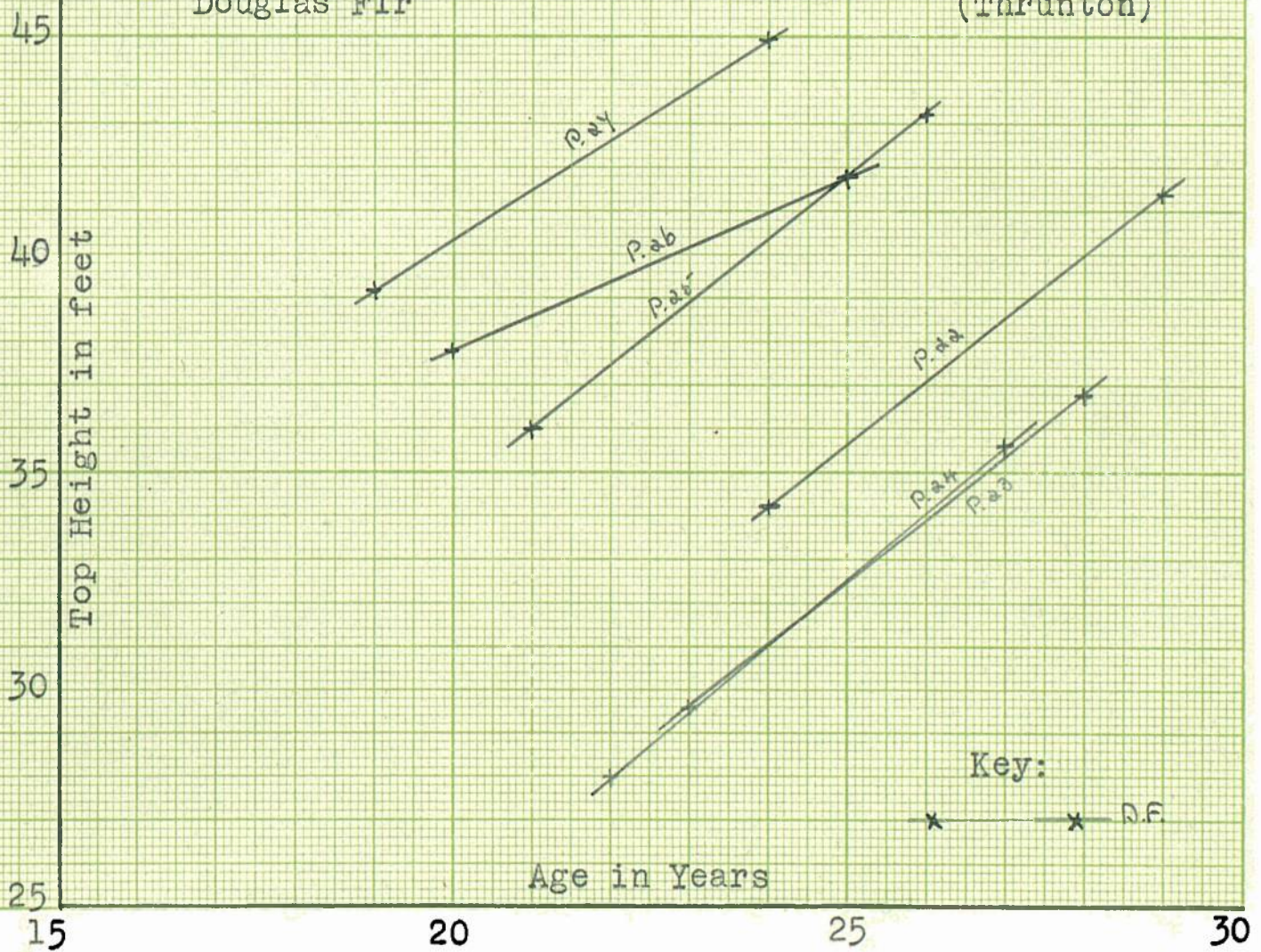
RATE OF GROWTH DATA
Norway and Sitka Spruce

ROTHBURY FOREST
(Thrunton)



RATE OF GROWTH DATA
Douglas Fir

ROTHBURY FOREST
(Thrunton)



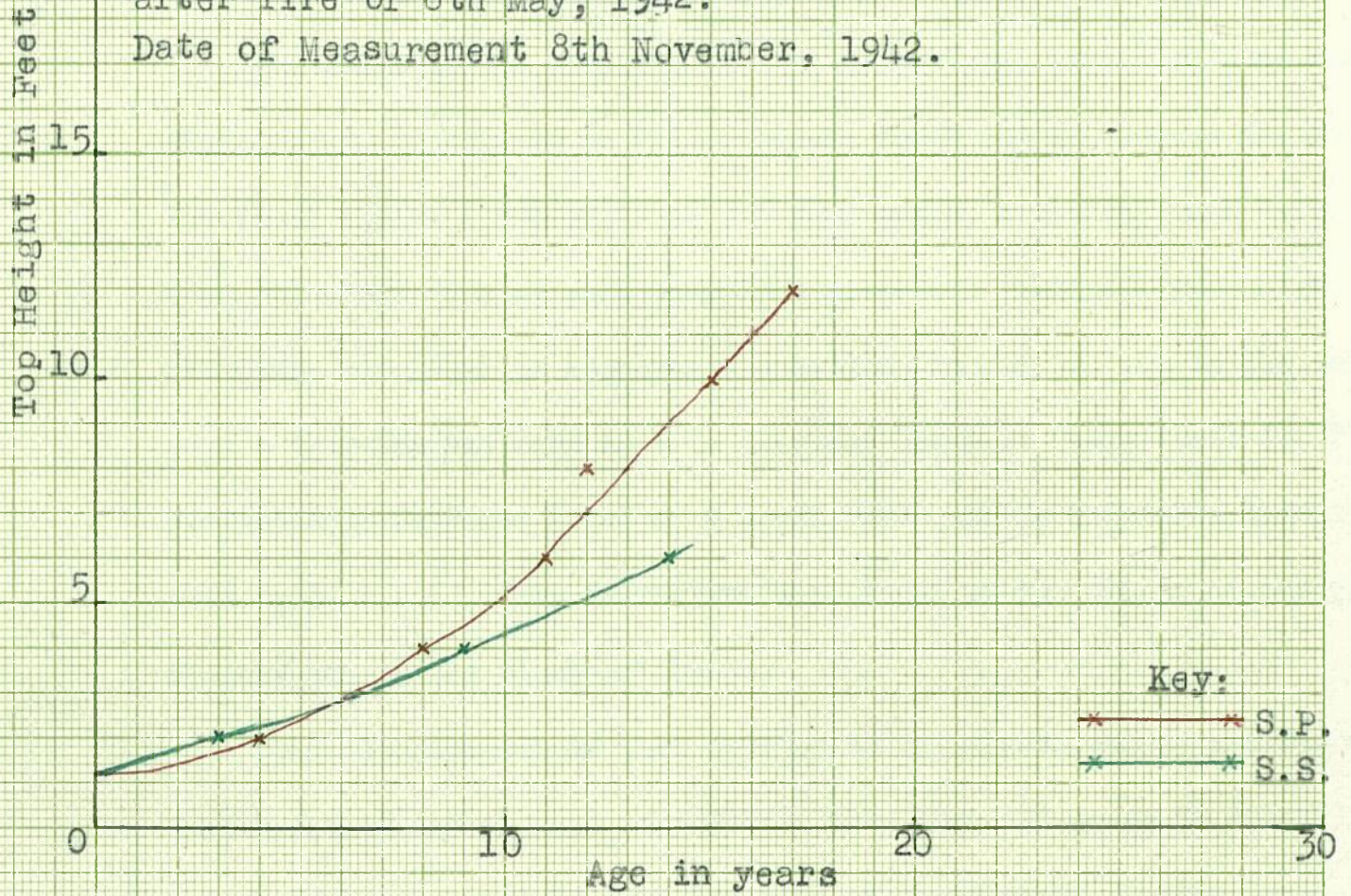
RATE OF GROWTH DATA

Rothbury Forest
(Thrunton)

Age-Height Graphs of
Scots Pine and Sitka Spruce, Compt. 25.

From measurements taken by W. Forsyth
after fire of 6th May, 1942.

Date of Measurement 8th November, 1942.

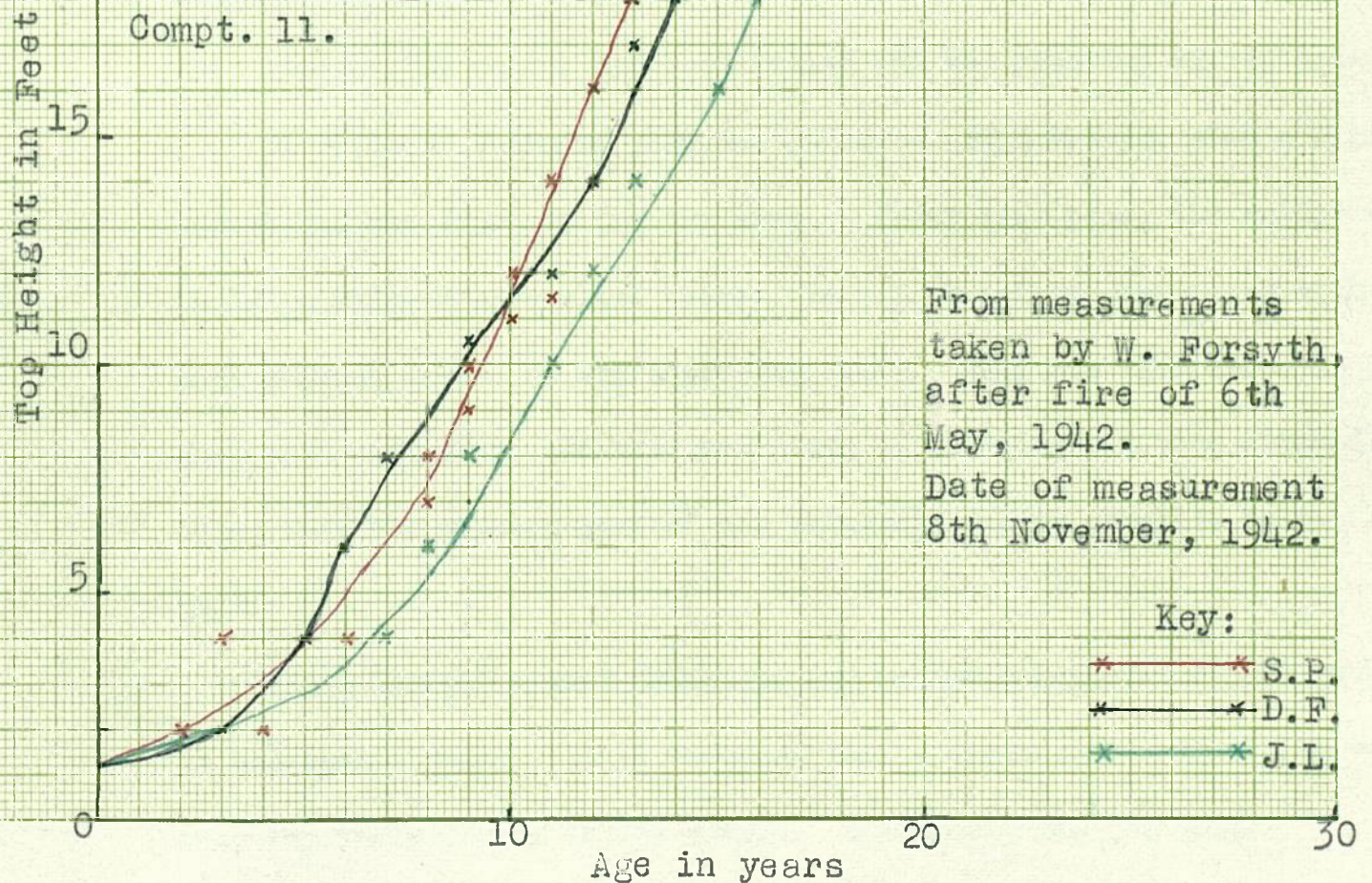


RATE OF GROWTH DATA
Age-Height Graphs of
Scots Pine, Japanese
Larch and Douglas Fir,
Compt. 11.

Rothbury Forest
(Thrunton)

From measurements
taken by W. Forsyth,
after fire of 6th
May, 1942.

Date of measurement
8th November, 1942.



Treatment of Established Plantations

The crop has been systematically brashed as soon as the lower branches have died to a height of 6 ft. Since F.Y.49, all brashing has been done on 70% of the crop only. Normally saws are used for brashing, and it is done at present on piece work, at £5 per acre. No high pruning has been done.

Cleaning has usually been done at the time of the first thinning, as weed species are few; birch being the commonest.

The Working Plan prepared in 1937 by N. Wray, laid down that thinnings should begin in F.Y.42, in P.21 Japanese larch and in Douglas fir in the Blackcock basin, and proceed on a 3-year cycle, thinning to be carried out over the entire forest each year in a piecemeal fashion. Some light thinnings were done in acquired plantations in F.Y.35, and in the following year a thinning was done in P.24 Japanese larch in Compartment 37. Thinning continued in Japanese larch on a small scale and no extensive thinning was done until F.Y.47, when operations were begun on the oldest stands on the Howmoor and in the Blackcock basin.

This thinning was by then overdue in the oldest crops, and was continued during F.Y.48 and 49, and was little more than "B" grade in intensity. A system of racks was laid down in parts of the Howmoor, by the process of removing every ninth row entirely. This has proved inadequate in almost every instance. Without provision of an adequate road system at this time, extraction difficulties were great, and at the end of F.Y.48 it is estimated that some 20,000 cu.ft. had been felled and was awaiting extraction.

No definite thinning plan was followed until F.Y.50, when a Plan of Operations was drawn up for the area. Under this plan, the entire area would be thinned on a block system, in F.Y.51 and 52, beginning with the most overdue areas, in the Blackcock basin. Work has progressed in accordance with this plan, and this year rate of thinning has been stepped up, in order that the greater part of the thinnings may be complete by the end of 1951.

The interval between thinnings has varied considerably, but generally it has been 4 years. It is proposed that a 3-year cycle should be worked over the three blocks of the Howmoor, Blackcock, and Coe Burn.

Largely because of the lateness of thinning, out-turn from recent thinnings has been fairly large. Most of the produce is in the form of

pitwood, especially in the smaller size of prop which is popular in the Northumbrian coalfield. No satisfactory figures are available for the volumes of thinning prior to F.Y.50. The areas thinned per year are as follows:-

F.Y.	Area thinned (acres)	Volume of yield (cu. ft.)	Remarks
35	2	-	acquired stand
36	4	-	acquired stand
37	60	-	acquired stands
39	20	-	
40	4	-	
41	9	-	acquired stands
42	4	-	thinned by Timber
43	-	-	Production Depart-
44	27	-	ment.
45	10	-	
46	38	-	
47	17	-	
48	96	14,000	} estimated
49	15	2,500	
50	57	25,700	

The yield figures for F.Y.48 and 49 have been estimated from details of prepared produce. Thinning by contract has been done in F.Y.41, when 6 acres were done this way, and a further 5 acres in F.Y.50.

A considerable proportion of the old acquired stands on the Howmoor were felled during the war. Then fellings were largely done by the merchants, the timber having been sold standing. The rate of felling has been as follows:-

F.Y.	Area felled (acres)	Remarks
40	7	Scots pine by Timber Production Department
42	9	Scots pine by A. Miller & Co.
43	22	" " "
45	11	Old beech ... by A. Miller & Co.
46	5	Old beech, Scots pine "
48	17	Old beech ... "
49	10	Cankered European larch P.25 felled by Department
50	5	" " " " "

In addition, 89 acres of Scots pine and European larch devastated by the 1942 fire were felled by A. Miller & Co. between F.Y.42 and 44.

Research

There are no Research Branch experiments on Rothbury Forest but several local experiments have been carried out from time to time. The earliest of these was a mulching experiment, directed by the Assistant Commissioner in 1938. This was laid down in Compartment 41, where the crop of P.25 Sitka spruce notch-planted with 2+3 plants had been beaten up to F.Y.37, and drained in F.Y.38. 2 oz. of basic slag per plant were applied in April 1938. Treatments were as follows:

- a). 2 rows of Sitka spruce in check: turves placed on each side of plant.
- b). 2 rows treated with cut heather placed round plants in check.
- c). 2 rows treated with raw humus (peat) and soil from drains.
- d). Control.

Results were based on a visual assessment of whether individuals showed "improvement", "little or no change" or "dead". No replications were laid down. Limited success was achieved, the most marked improvement being with treatment (a), but results were not conclusive.

A brashing experiment was carried out in F.Y.50, to determine the relative costs of 100% and 75% brashing, on various species. The results are summarised below:-

Species	brashing cost per acre		percentage "75% cost" is of "100% cost"
	100%	75%	
Scots pine	72/-	60/-	83%
Corsican pine	90/-	72/-	80%
European larch	100/-	80/-	80%
Norway spruce	180/-	150/-	83%
Sitka spruce	180/-	130/-	72%
Douglas fir	110/-	90/-	82%

Conclusions

This has been a difficult forest to establish, and several points emerge from consideration of the reasons for this.

A more cautious approach in the early years would have allowed better application of the lessons learned from the first plantations. On this area the early site assessment was faulty, due to the vegetation transition from grazed fell-land to Calluna on enclosure, and abnormal wetness after clearance of the old crop, and to have proceeded on a less ambitious scale would have minimised failures. Such an approach is not always necessary

on a new area, provided some experience of the type of site is available. At Kielder and Swarland, both new types of ground, this principle of a cautious beginning was applied with success.

The Fell Sandstone areas of Northumberland are a distinct group from the afforestation point of view, quite separate from the limestones of the North Tyne. The Sandstone areas around Rothbury form dry, rocky crags and slopes, and in a low rainfall area, are essentially pine sites, the latter species being mixed with spruce only on peat areas. The pure spruce areas of Kielder and Harwood are impracticable here, on account of both soil and climate.

On this type of ground, species selection on the following lines is likely to give the most satisfactory results.

Scots pine on heather ground over dry light soils and rocks.

Scots pine/Sitka spruce or Pinus contorta/Sitka spruce on heather vegetation where peat is of greater depth than 15 in.

Pinus contorta on exposed deep peat at high elevation.

Japanese larch or Douglas fir on flush areas and good loams with a stable grass vegetation.

A comprehensive Thinning Plan is essential on a forest like Thrunton, where the crop is markedly uneven. Otherwise arrears of thinnings accumulate, and if the thinnings are not sufficiently heavy, the arrears are perpetuated.

The indifferent quality of labour and local supervision in the period up to 1935 has resulted in a certain amount of inefficient planting and a great deal of over-beating up. A resident forester, housed on or close to the area, will be advantageous.

The fire of 1942 showed, as did the North Tyne fires up to 1948, that less reliance should be placed on passive protective measures such as fire lines, and greater attention paid to good access routes, speedy call-out systems and trained fire teams, well equipped.

SWARLAND

Physiography

The ground rises gently from 250 ft. elevation at the southern end to 600 ft. at the north, where the ground is almost flat. The slope down to the Swarland Burn which forms the south boundary is short but steep.

Aspect is southwest to south; exposure moderate in the south, and slight elsewhere. Drainage is south-westward, into the Swarland burn which flows to the south-east.

Geology and Soil

Swarland lies on rocks of the upper Bernician limestone group, of the lower Carboniferous series, which predominate in this area. This is overlaid with boulder clay, which has given rise to stiff clay loams or clays, with occasional medium loam where mixed with sand. The name "Swarland" is said to mean "the stiff clay land".

Vegetation

When the area was taken over by the Forestry Commission, it carried a variable growth of scrub, birch, ash, and oak. The clearance of this has given rise to two types of vegetation.

1) Grass: Over the greater part of the area, mostly Agrostis and fescues, with some Deschampsia caespitosa and Holcus mollis and occasional Molinia. There is abundant bramble, willow-herb, and hardwood coppice growth, also bracken, hard fern, and bluebell.

By the Swarland burn a riverine form of this type exists, with the coarse grasses dominant, along with rushes and other species listed above.

2) Calluna/grass: at the northern end of the forest area, Calluna is dominant, but is interspersed with grasses and other species as in the first type. This is by no means a Calluna-moor vegetation.

Risks

The area is surrounded by agricultural land, and fire risk is normally low. A certain danger exists from passers-by and picnickers at the north end of the area, where a public road forms the forest boundary, but trespass is rare. There have been no fires on this area.

Damage by stock is negligible, and though rabbits are numerous in this district, damage has been slight. Roe deer are rare, being for the most part intruders from the nearby woodlands of Felton Park, though during the war they caused some damage.

Insect and fungal attack has so far caused little damage.

Honeysuckle is troublesome on this forest, and requires annual cutting. Rough coppice growth from old hardwood stools is vigorous, and also requires cutting to keep it in check, over much of the area. Broom is another troublesome weed, especially in the north of the forest.

Little damage from frost has occurred, though some is to be expected in the low-lying ground by the Swarland burn.

Roads

The area is well served with public roads to the north and east. Within the forest there are several old tracks which are up to access route standard, and these are supplemented by mowing of rides where necessary to allow further access in case of fire.

Labour

It has always been relatively easy to obtain labour at Swarland, being close to Swarland village and the new housing estate there. It has been possible to build up a force of 4 skilled men, well able to cope with all work. During the past year it has been necessary to transport these men occasionally to Hepburn, where there is a decided labour shortage, as there has been insufficient work to keep them fully employed. The one Commission house on Swarland is occupied by the forester.

SILVICULTURE

(i) Preparation of the ground.

The old woodland on the site was cleared off around 1925, leaving only a small area of 2 acres of Scots pine and European larch planted in 1895 or thereabouts, with an additional 1 acre of Norway spruce planted in 1920, in Spring Wood (Compartment 4), and 2 acres of a similar species mixture in Compartment 1. The larch are recorded as being of good growth, but attacked to a small degree by Fomes annosus. The Scots pine were poor, and badly infested with Myelophilus piniperda. This was felled in 1940 by the Timber Production Department.

Prior to planting, the area has been cleared of scrub, birch, broom, gorse, and rhododendron, all of which were present over much of the area. A complete clearance was done over all the area except for Enginehouse Wood (Compartment 3), where a very light cover of standard birch and sycamore,

selected for form, have been allowed to remain among the young crop. The area has been rabbit-fenced before planting in all cases, and stock-fenced where adjoining pasture fields.

(ii) Choice of Species

It was originally proposed that the Calluna ground in the north of the area be planted with Sitka spruce and that where advantage could be taken of an overhead birch cover, oak should be planted in blocks. Elsewhere, larches and Douglas fir should be the main species, along with beech.

Sitka spruce was the principal species planted in P.39, on the Calluna ground of Compartments 1 and 2, 8 acres were planted, and 1 acre each of Scots pine and Japanese larch. Oak and beech, in mixture by groups were planted on 33 acres in P.40, also in Compartments 1 and 2. 13 acres Japanese larch and 2 acres of various ornamentals were also planted that year. A further 19 acres of oak-beech mixture were planted below an over-crop birch and sycamore in P.41 in Compartment 3. 8 acres Japanese larch and 2 acres Norway spruce were also planted.

In P.42, Sitka spruce was planted on 15 acres, Douglas fir on 14, and 1 acre planted with Norway spruce. 2 acres of ash also planted, and a further 2 acres in P.43. The principal species that year was European larch (17 acres), with Sitka spruce (4 acres) and Douglas fir (2 acres). P.42 and P.43 areas were on the northern slopes of Spring Wood (Compartments 4, 5, and 6), on a grass vegetation.

In P.44 and P.45 the lower slopes by the Swarland burn were planted, using Norway spruce (23 acres) and Japanese larch (20 acres). Douglas fir was planted on a further 13 acres. Douglas fir was planted over the larger part of the P.46 area, (15 acres), the remainder being planted with Norway spruce (5 acres). Douglas fir was again the principal species in P.47 planting, when 6 acres were planted, along with 3 acres of Picea omorika and 3 acres of Lawson's cypress, and a further 6 acres Douglas fir were planted in P.48; 2 acres Japanese larch and 1 acre Norway spruce was also planted.

The P.49 and P.50 areas, Compartment 10, were planted with Sitka spruce for the most part, over 25 acres. Small areas of beech and sycamore were also planted.

Since F.Y.41 no hardwoods have been planted; instead Douglas fir has been used to a greater extent. Japanese larch has been an automatic choice of much of the area, and hybrid larch would also have been very suitable. Norway spruce has been confined to stream sides, and the potential frost area along the Swarland burn. The use of Sitka spruce on this forest, being in low rainfall area, raises some doubts, however.

(iii) Planting and subsequent treatment

In general, hardwood species have been pit-planted and conifers have been planted by notching, though in some cases, particularly in F.Y.41 and 42, they too were pit-planted. Norway spruce has usually been notched on turves, and Sitka has occasionally been planted this way.

Spacings used in F.Y.39 were 4 ft. for Scots pine, $4\frac{1}{2}$ ft. for Japanese larch, and 5 ft. for Sitka spruce. Thereafter, 5 ft. has been generally used for larches and spruces, while Douglas fir has been planted at 6 ft, though 5 ft. spacing was used for this species in F.Y.42 and F.Y.48.

Type of plants used at Swarland have varied considerably. Scots pine have been 2+1, while European larch have been 1+1 and 2+1+1. 2+1 has been the usual size of Japanese larch, but 1+1 and 3+1 have also been used. 2+2 has been the commonest size of Norway spruce planted, with occasionally 2+3 and 1+2 being used. Sitka spruce have also been planted largely as 2+2, while Douglas fir has been planted both as 2+1 and 2+2 transplants. 1+0 and 2+0 oak seedlings have been planted, and beech have been 1+2+1 or 1+2+2.

The rate of planting has been as follows:-

P. 39	10.1 acres
40	47.5 "
41	30.0 "
42	29.0 "
43	26.0 "
44	26.2 "
45	37.7 "
46	20.0 "
47	12.5 "
48	9.0 "
49	11.2 "
50	<u>15.3</u> "

Total: 275.3 acres

The P.50 planting completed the programme, and since then operations have been chiefly maintenance.

Beating-up has been done with the species originally planted, except in the case of the ash planted P.42 - 43, which failed entirely and was replaced by Japanese larch. The oak/beechn mixture planted at 4 ft. x 4 ft. in Compartments 1, 2, 3, and 4 in P.40 - 41 was interplanted with Norway spruce at 4 ft. x 8 ft. in F.Y.45, to provide a nursing effect. Losses in the oak/beechn mixture ran as high as 50%, but in other species, the annual number of plants used in beating-up has been 20% of the original number. Beating-up has been necessary 8 to 10 years after planting, on the poorer areas of Compartments 1 and 2, but elsewhere the crop has been established 5 to 7 years after planting. On the whole, hardwoods, Japanese larch and Sitka spruce have required more beating-up than Norway spruce or Douglas fir.

The size of plants used in beating-up has usually been the same as that used in planting. Larger sizes have occasionally been used; 1+1+1 and 2+1+1 Japanese larch have been used, and 3+2 and 3+3 Norway spruce. Sitka spruce have been used as large as 3+2+1, (F.Y.49), but 2+2 and 3+2 have been the usual sizes. Douglas fir have usually been 2+2 or 2+1+1 plants. 2+0 and 1+1 plants have usually been used in beating-up oak, and 1+2+1, 1+2+3, and 1+3 have been the commonest size of beech.

Weeding has been essential to the success of the crop, and has been necessary annually for the early years, until the crop is established at least. Broom, gorse, bracken, and coarse grass are commonly met with, and honeysuckle is troublesome. Rough coppice growth of birch, oak, and other hardwoods is frequent, and is cut back, though where of good quality it is allowed to remain to maintain complete stocking. Natural regeneration of ash, sycamore and oak, where worthy, is encouraged, however.

The cutting back of the oak to stimulate clean growth was tried on a small scale in F.Y.48, in Compartment 3, but the results were not as promising as might have been expected, and it has not been repeated.

None of the crop has reached the brashing stage yet. The most successful species have been Douglas fir and Japanese larch. The P.40, P.41, P.45 Japanese larch and P.44 Douglas fir have been particularly good; the P.40 Japanese larch in Compartments 1 and 2 will be ready for first thinning in F.Y.53. Norway spruce has been generally successful, particularly on stream sides, though a shelterbelt of this species planted P.41 in

in Compartment 3 has remained in check on the heather vegetation. It is proposed that this plantation should be written off, and the area replanted with Scots pine. Sitka spruce has also been slow to start on heather ground, but elsewhere is growing well. Other conifers such as Lawson's cypress, Thuja plicata, Picea omorika and Picea asperata are all growing well, but are still in the very early stages.

The oak and beech P.40 and P.41 have grown slowly, but show signs of promise. The introduction of Norway spruce among this crop in 1943 has had a beneficial effect, and the beech especially are doing well. The stage has now been reached when some of the Norway spruce will need to be cut out in order to allow the hardwoods room for development. Tsuga has also been introduced among the hardwoods on a small scale, in Compartment 3, in F.Y.42 and 44.

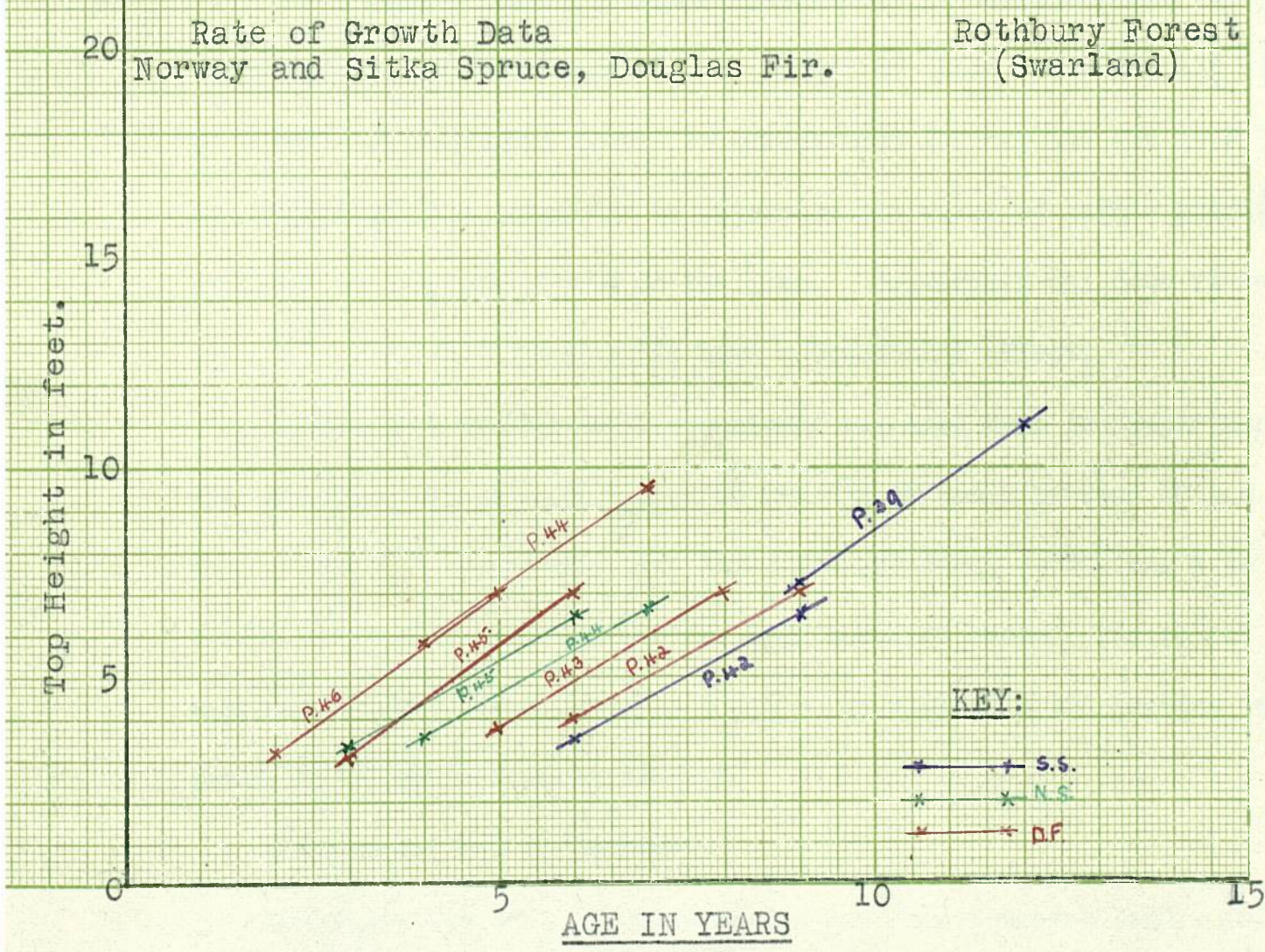
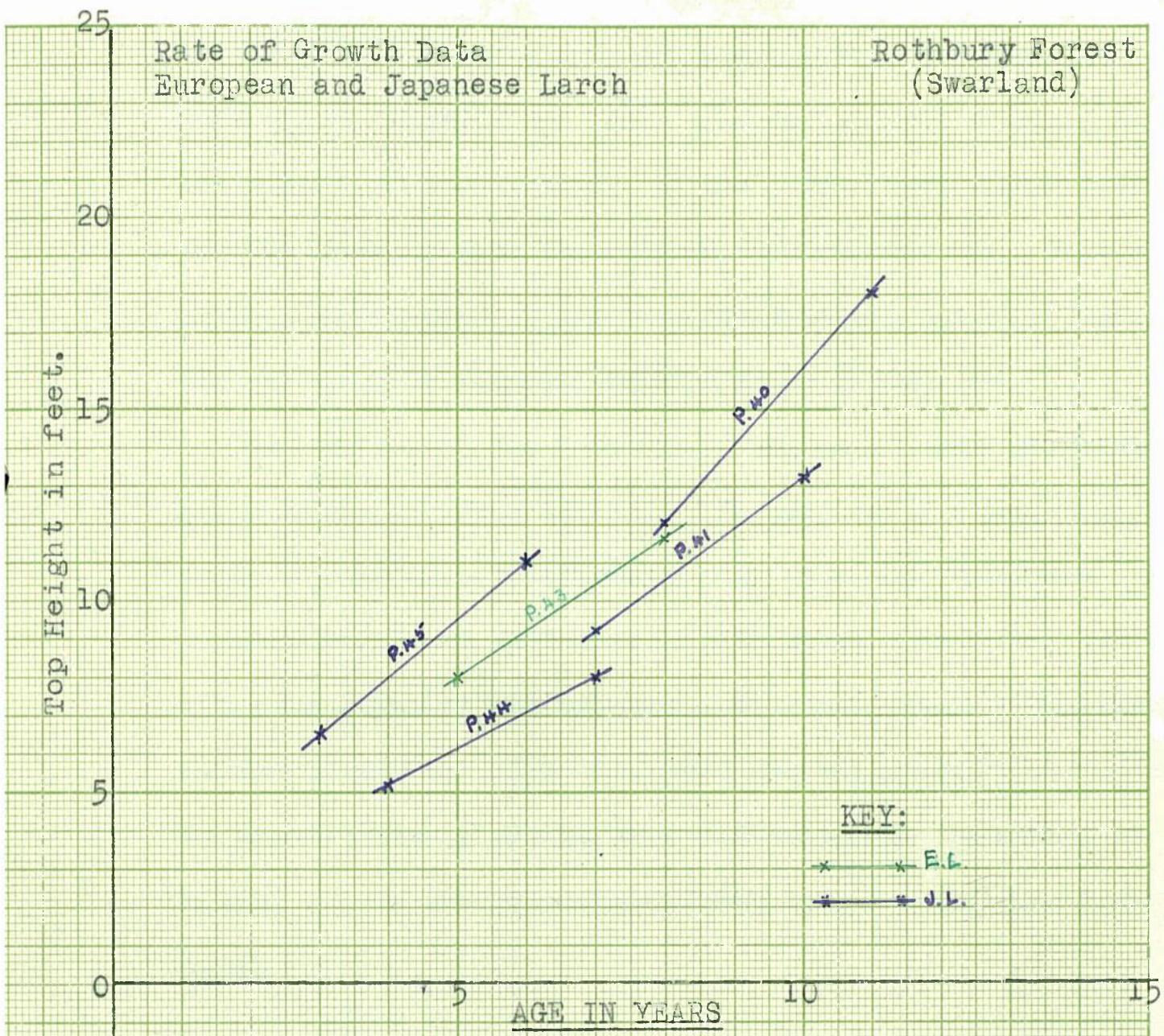
(iv) Rates of Growth

The height increment data given below was obtained by the strip-sample method used at Thrunton (see Page 22); the heights are top heights, being equivalent to the mean height of the 100 tallest trees per acre.

Because most of the crop is still very young, the current annual height increment has been calculated over the past three years. Even so, it is identical with the mean height increment in some cases. These data have been graphically represented, and it is apparent that larches and Douglas fir have so far shown the fastest growth, though Norway spruce is growing at the same rate as the poorer Douglas fir. Sitka spruce is also showing a good growth rate, after a slow start.

Rates of Growth

Compt. No.	Species	P.Yr.	Age	Vegetation	a) Altitude b) Aspect c) Slope d) Exposure	Top Ht. of crop (ft.)	Mean Annual Height Increment (ft.)	Current Annual Ht. Increment over 3 years (ft.)
6	E.L.	43	8	Bracken/ Grass	a) 400' b) W. c) Steep d) Mod.	11.6	1.4	1.2
1	J.L.	40	11	Grass	a) 550' b) S.E. c) Mod. d) Mod.	18.0	1.6	2.0
3	J.L.	41	10	Grass	a) 550' b) W. c) Mod. d) Mod.	13.3	1.3	1.8
9	J.L.	44	7	Bracken/ Grass	a) 300' b) W. c) Steep d) Mod.	9.2	1.3	1.3
8	J.L.	45	6	Bracken/ Grass	a) 300' b) S.W. c) Mod. d) Mod.	11.0	1.8	1.4
9	N.S.	44	7	Bracken/ Grass	a) 300' b) W. c) Slight d) Slight	6.6	0.9	1.0
8	N.S.	45	6	Grass/ Rush	a) 300' b) W. c) None d) Slight	6.5	1.1	1.1
1	S.S.	39	12	<u>Calluna</u>	a) 600' b) N.E. c) Mod. d) Mod.	11.0	0.9	1.3
4	S.S.	42	9	Grass	a) 450' b) W. c) Mod. d) Slight	6.5	0.7	1.0
4	D.F.	42	9	Grass	a) 450' b) W. c) Mod. d) Slight	7.0	0.8	1.0
4	D.F.	43	8	Grass/ Bracken	a) 450' b) W. c) Slight d) Slight	7.0	0.9	1.1
9	D.F.	44	7	Grass/ Bracken	a) 300' b) W. c) Slight d) Mod.	9.5	1.4	1.4
8	D.F.	45	6	Grass/ Bracken	a) 300' b) S.W. c) Steep d) Slight	7.0	1.2	1.3
6	D.F.	46	5	Grass/ Bracken	a) 400' b) W. c) Steep d) Mod.	7.0	1.4	1.3



(v) Nurseries

A small nursery was maintained at Thrunton between 1926 and 1931. This was formed on land leased from Lord Ravensworth on a 5-year lease. The lease was not renewed after 1931. Area was 4.5 acres on ground immediately to the north of Compartment 11. Plants produced were all for home consumption and little is known about stocks, productivity, etc. Most of the early planting stock appears to have come from Scotland, and later Hamsterley, Chopwell and Dalby nurseries supplied plants to this area.

Swarland nursery was formed in F.Y.41, on 5.1 acres of agricultural ground within the forest boundary. The soil was of a heavy type, and liable to consolidate unless worked under favourable conditions. Principally a lining-out nursery, good crops of Sitka spruce were raised, but Norway spruce was generally unsatisfactory. Chlorosis, probably lime-induced occurred in patches. The annual weed crop was generally heavy. Following the general policy of closing down small nurseries, the nursery was closed in 1950, and the area planted with Norway spruce as Christmas trees in F.Y.51.

Research

There are no Research Branch experiments at Swarland, but two local experiments have been carried out. First of these was a grazing experiment, on 5 acres of unplanted ground in Compartment 10, carried out in F.Y.43. The object of this trial was to determine the value of cattle grazing in reducing the coppice growth on the area. Assessment was done visually, and it appears that grazing did have a beneficial effect.

In F.Y.49 a shelter belt experiment was laid down in Compartment 10. The existing shelter belt consisted chiefly of beech between 80 and 120 years old, with a few ash, oak, lime, and sycamore; width was $\frac{1}{2}$ to $\frac{3}{4}$ chain. On the south-west edge ran a 8 ft. tall hawthorn hedge. The object of the experiment was to find a suitable method of replacing the shelter belt while still retaining sufficient shelter.

Treatments were as follows:-

1. Underplanting with Austrian pine under full overhead light, and beech/sycamore under shade.
2. Planting cypress hedges on either side of belt; underplant thinned beech with Tsuga/Thuja mixture; Hawthorn hedge cut back.

3. Underplanting of thinned beech with pure beech.
4. As 2, using Douglas fir and Abies grandis for underplanting.
5. Planting Scots pine and Austrian pine under thinned beech in full light, with beech/sycamore under shade.
6. Plant $\frac{3}{4}$ chain wide strip to lee of belt with sycamore and beech.
7. As 6, but with outside three rows of Scots pine.
8. As 6, planting the leeward strip with pure Norway spruce.
9. Clear fell the existing crop, layer the hedge, and replant the belt with Norway spruce making it $1\frac{1}{2}$ chains wide instead of $\frac{3}{4}$ chain.

No replications of these treatments were made, and no assessments have been carried out so far.

Conclusions

While it is early to draw conclusions from this area, it is felt that here the method of approach has been sound. The spreading of the planting programme over 12 years has allowed the lessons of the first years to be applied to the rest of the area, with regard to choice of species especially. Thus the area planted with hardwoods has been limited, and Douglas fir and Japanese larch more able to get away quickly and suppress the heavy weed growth, have been more extensively used as the programme progressed. The labour force has been able to cope with the planting and beating-up, and with the heavy weeding involved on this type of ground. In addition, the "idle period" between the completion of the planting programme and the start of the thinnings has been reduced to a minimum.

This policy of small annual planting programmes has proved a wise one at Swarland, and the lessons learned here can be applied to similar old hardwood areas in this district, such as Hepburn and Birsley Wood. The principal need is speedy establishment and suppression of the strong vegetation, thus cutting out costly weedings. For this purpose Japanese larch and Douglas fir have proved the most suitable species.

Generally, it is desirable that hardwoods should be grown wherever site quality is such that they will form a good crop. They suffer from the disadvantage of slow early growth and competition with weeds when planted pure, as was found here. Under the conditions found at Swarland, hardwoods are best raised in mixture with conifers, the crop later being treated so as to favour the hardwoods. For this purpose Norway spruce is an obvious choice,

on account of its value as Christmas trees.

Though Swarland is now entirely planted up, this problem of hardwood establishment will be further investigated on the best ground at Hepburn and at Birsley Wood. There the soil is lighter and poorer than Swarland, but on the best ground conditions are approximately the same.

HEPBURN

Physiography

Hepburn Wood lies at the west edge of Hepburn Moor, and runs along the lower slopes and steep face of an escarpment rising with a moderate slope from 275 ft. to the 600 ft. contour, then steeply to the 800 ft. contour, on the eastern boundary. Principal aspect is west, and degree of exposure to the south-west is severe on ground above 700 ft. but this area is relatively small. Many springs arise at the crag foot, and these converge into a main stream in the south-west corner.

Geology and Soils

Except for the south-west corner, Hepburn Wood lies on rocks of the Fell sandstones series, brought in the area by an extension of the great Hetton syncline. The crags which are exposed to the east of the wood are of massive, rather soft and gritty sandstone, with false-bedding to the north-west, quite contrary to the eastward dip. An uncertain fault runs north-east - south-west across the wood, almost on the boundary between Compartments 5 and 6 and Compartments 7 and 8, and as a result, the south-west corner, including Compartments 9, 10, 11 and 15, is situated on rocks of the cementstone series. Except for the crags, the area is overlaid with boulder clay, giving rise to loams and clay loams, of considerable depth. The soil becomes shallower on the steep ground to the east.

Vegetation

This is uniform over the greater part of the area, and typical of the dry oakwood type of the east coast region. Grasses predominate, chiefly Agrostis and fescues, and bracken is abundant over the whole area. The woodland character of the vegetation is emphasised by abundant bluebell, primrose, Mercurialis and other spring-flowering plants. Brambles are plentiful. This vegetation occurs below the rough birch and alder coppice areas, and on the re-afforested areas.

Below the scrubby oak coppice on the poorer high ground, dense Vaccinium with patches of Calluna occur. There are a number of rush flush areas around the numerous springs on the middle slopes.

Above the crags, on Hepburn moor, vegetation is pure Calluna.

Risks

The area is surrounded on three sides by agricultural ground, and fire danger is low. The heather moors to the east constitute a danger in spring when burning is in progress, however. There is also a certain danger from passers-by and picnickers, especially at the north end of the area. No fires have occurred so far, however.

Rabbits are numerous in this district, but have not been a serious pest on the forest. Good fencing is maintained, and trapping keeps the numbers in hand. Hares are rare, and trespass by sheep is only occasional. There are a small number of roe deer, both in Hepburn wood and in the adjacent woods of Chillingham, to the north. These have not been troublesome so far.

No damage has yet been caused by insect attack.

The area is free from frost hollows, and little or no damage has been observed so far; no damage has been caused by wind or drought.

Roads

A metalled public road forms the northern boundary of the forest area, and access is also possible from the south, by metalled road to Bewick Folly Farm, and then to the southern boundary of the forest by way of a field track, the tracks of which were gravelled by the Forestry Commission in F.Y.51.

Within the forest, an old coach road runs the full length of the area, and this was improved in F.Y.51 by the Engineering branch up to the standard of a fairweather road. This road runs parallel to the eastern boundary. At the south corner of Compartment 2 another fairweather road branches off the old coach road, and keeps parallel with the west boundary, to the south-west corner of the area, then eastwards along the southern boundary to connect with the field track from Bewick Folly Farm. This road was also made in F.Y.51.

The old roads on the area were in bad repair, as a result of long

neglect and the felling operations which were carried on between 1923 and 1930. The provision of good roads within the forest in the past year has greatly facilitated extraction of produce.

Labour

This has been difficult to obtain in this area, in which farming predominates. Extensive use was made in F.Y.47 and 48 of European Voluntary Workers, as many as 50 being employed at one time, under a ganger from Thrunton. The permanent labour force has normally been four to six men. At present, six are employed, in addition to European Voluntary Workers. The number and availability of European Voluntary Workers varies, but is usually between 3 and 6. The use of large numbers of European Voluntary Workers proved to be costly, owing to difficulties in supervision; those employed now are more satisfactory.

Supervision at Hepburn has always been difficult, and has meant the forester travelling a great deal. The recent decision to make Hepburn a separate forester's charge will make the situation much easier.

There are no Forestry Commission houses at Hepburn.

SILVICULTURE

(i) Preparation of ground

Hepburn Wood was a mixed crop up till the years immediately after the 1914/18 war. This ground has been woodland for centuries, and the previous crop would be established about the same time as the woods in Chillingham Park, in the first half of the nineteenth century. Principal species were oak, ash, and larch, with some birch and alder, and a number of ornamentals.

Between 1920 and 1930 the greater part of the hardwoods were removed, and all the larch, which is reported to have been of excellent quality.

When the Forestry Commission purchased the property in 1946, the derelict woodland was principally birch aftergrowth, with alder, poor oak and occasional ash. No value was placed on the timber at the time of purchase.

Clearing of the ground was begun in F.Y.47, at the southern end of the area. The birch and alder were cleared, and the lop and top burnt. A number of birch, selected for form and cleanness of bole, were allowed to stand as a light overcrop where this was possible; but over most of the area

the birch has been removed entirely.

(ii) Choice of Species

The principal species planted so far have been Douglas fir and Norway spruce, the latter on the lower ground along stream sides. In F.Y.49, 14 acres were planted with Douglas fir and 5 acres with Norway spruce. In addition 4 acres of Japanese larch and 2 acres of sycamore were planted, and half an acre of Sitka spruce, this last on the highest ground in the east of the P.49 area. In F.Y.50, 18 acres of Norway spruce again on the lowest and wettest ground, and 10 acres Douglas fir were planted, along with 5 acres European larch and 5 acres of sycamore. All these species were planted pure. Douglas fir was planted on the small P.51 area.

It is intended to continue to plant the above species, planting Douglas pure on the moist, but reasonably well drained slopes and Norway spruce on the wettest ground. Japanese larch will be used on the driest areas of good soil, and on the very best ground oak, planted at 2 ft. in groups will be put in among the Japanese larch. On the dry, poorer soil of the steep slopes below the crag, Scots pine will be planted.

Wherever possible an overcrop of good quality birch will be left to grow up with the young crop, to give a nursing effect. Where it can be underplanted with Douglas fir, 400 stems per acre will be left; 200 stems per acre will be left where Japanese larch is to be planted. Douglas fir, Japanese larch and occasionally Norway spruce have all been planted under birch on the P.49 - P.50 area. The birch stands at up to 200 stems per acre.

(iii) Planting and subsequent operations

Planting was begun in F.Y.49 when 26 acres were re-afforested at the south end of the area, and in F.Y.50, 38 acres were planted to the north of this.

To allow work on preparation of ground and produce utilisation to be brought up to date, only 2 acres, a block within the P.50 area, were planted in F.Y.51.

Planting was done entirely by notching, and standard spacings were used, 5 ft. x 5 ft. for larches and spruces, and 6 ft. x 6 ft. for Douglas fir. The type of plant used has varied. Japanese larch plants have been 2+1,

while European larch have been 1+1+1. 2+2 Norway spruce were used in F.Y.49 and 2+3 in F.Y.50. The Sitka spruce planted in F.Y.49 were 2+2, while both 2+1 and 1+1 Douglas fir were used that year. In F.Y.50 1+1+1 Douglas fir were planted, and 2+1 plants in F.Y.51. The Norway spruce used has been of home origin, from S.E. (E) collection, and the Japanese larch seed was imported from Japan in 1947.

No manurial treatments have been carried out.

The P.49 area suffered substantial loss in the dry summer of that year, due largely to late planting, and beating-up has been in the region of 45% with all species, the Japanese larch especially suffering heavy losses.

The P.50 area has been more successful, but losses are still fairly high in European larch and Douglas fir in the region of 40% though only 20% in Norway spruce. It is too early to judge the success or otherwise of these plantations.

Beating-up has been done over the whole area each year, beating-up normally being done with whichever species had been originally planted. 4.0 beech were introduced into the P.49 area in F.Y.50 however. The size of plants used in beating-up has been roughly the same as used in original planting. In F.Y.50, plants used to beat-up the P.49 area were 1+0 (beech and sycamore), 2+1 (Japanese larch), 2+1+1 (Norway spruce and Sitka spruce) and 2+3 (Norway spruce). Douglas fir used were 1+1+1, 2+1+1, and 2+2. In F.Y.51, 2+0 and 2+1 Japanese larch were used, 3+1 Norway spruce and 1+1+1 Douglas fir, on both P.49 and P.50 areas.

Beating-up success has depended largely on the dryness of the summer and on the degree of weed growth. Bracken and grass are the main weeds, and fairly intensive weeding has been required in the past. Birch and privet are likely to be troublesome, as time progresses.

Considerable quantities of birch and alder turnery poles, oak (and other species) round mining timber, firewood, saw timber and hardwood stakes have been produced in the course of hardwood scrub clearance. In F.Y.50 17,700 cu.ft. were produced, and up to the end of June, F.Y.51, 14,200 cu.ft. had been produced. The slow progress in preparation of ground and utilisation is the result of labour shortages, and caused the reduction in the F.Y.51 planting programme. The scrub on Compartments 2, 6, 7, and 13 (89 acres) has been sold to J.T. Minto and Co., Timber Merchants, and the

ground will be left clear for planting as part of this contract.

(iv) Conclusions

It is early to draw conclusions from this area, where plantations are in their earliest stages. Several points have emerged from the general management of the area, however.

The limiting factor in rehabilitation has been the rate of scrub clearance. It was originally intended that the area be cleared and replanted in 2 years, but this proved impossible, and the programme was modified in 1949 to its present form. The sale of scrub to a timber merchant, with clearance of the ground for planting as part of the contract, has solved this problem to a large extent.

The use of large gangs of unskilled or semi-skilled men is very difficult when local supervision is inadequate. European Voluntary Workers were used on a large scale here in 1948, but now more manageable squads are employed. Local supervision from Thrunton or Swarland has never been a completely satisfactory arrangement, and when the proposed acquisition of Chillingham is complete, this area will become a forester's charge.

Labour has always been difficult to obtain, and if necessary Commission houses will have to be built to assure a steady force of skilled men.

BIRSLEY WOOD

This area, 88 acres in extent was acquired in 1951, and consists of devastated sycamore and oak, with scrub oak. The bulk of the crop was removed just before or at the start of the 1939 - 45 war. It is situated just above the village of Edlingham, near the crest of the hill at an altitude of 300 ft. - 400 ft. The slope is moderate, aspect east, and fairly well sheltered.

Situated on boulder clay overlying cementstones of the Tuedian group, the soil is a sandy loam, of good depth. Drainage is naturally good to the east.

It is proposed that the area be dealt with when planting is completed on Thrunton, i.e. in F.Y.54. The existing hardwoods will be favoured wherever possible and advantage taken of all promising advanced growth. Where this is not possible, Douglas fir and Japanese larch, the latter in mixture with ash,

beech, sycamore, Tsuga, and Thuja, will be planted. Because of high weeding costs, no slow-growing hardwoods will be planted.

History of Rothbury Forest

APPENDIX I

Notes from Inspection Reports

a) Thrunton

Visit by Mr. R.L. Robinson, Mr. A.P. Long, and Mr. A.D. Hopkinson,
21/6/22.

P.22 Plantations looked well, and Sitka spruce regarded as probably the best tree for the wet ground and the tops. Doubt was expressed about the usefulness of Scots pine. A fair proportion of the lower ground should be planted with Douglas fir. As the whole of this area would be planted up in two or three years, the acquisition of nearby planting ground is urgent.

Visit of Sir Roy L. Robinson and Mr. A.D. Hopkinson, 1/4/27.

Most noteworthy fact at Rothbury is the way the spruce have remained in check on heather. Beating up should be left to a minimum and done with Scots pine or Corsican pine. Not enough attention was paid in the first years to selection of species in accordance with changes in soil and vegetation. Mr. Long took too optimistic a view of conditions under which European larch and Douglas fir would thrive. The 100 acres "doubtful" higher ground should not be planted.

Assistant Commissioner's visit, 6/9/30.

At first sight the North Crag seemed very bad; the crop was very patchy and a number of Scots pine had died. It was instructed that these should be replaced with Japanese larch. The slow growth of Douglas fir was observed, and it was also noted that the Japanese larch on the top of the crag was largely in check and only isolated patches of Sitka spruce were growing well; that planted among the old Scots pine was doing little better. It was decided to beat up the Blackcock area with Japanese larch; if not available, then Sitka spruce on turves would be used, and failing that, Scots pine. Many small Sitka spruce still in check would grow if kept clear of overgrowing heather.

Visit by O. J. Sangar - May 1933.

Earlier plantations are as a whole very disappointing: of 600 acres planted P's 21 to 24, less than 300 acres may possibly be regarded as established. P's 25 to 28, 400 acres, are definitely better, but a considerable proportion of the Douglas fir, Sitka spruce and European larch areas are still not established.

Comments by Divisional Officer on above. (26/8/33).

Soil conditions were extremely deceptive at Thrunton, and largely over-assessed. Very little of the area is suitable for Douglas fir, Japanese larch and European larch, and Sitka spruce has also done badly. The P. 24 and P. 25 areas were grass-covered when planted, but in three or four years the area was completely covered with Calluna. European larch, Japanese larch and Douglas fir only survived on bracken areas, and Norway spruce and Sitka spruce went into check and gradually died. 85% of trees planted in these years ultimately failed. All plantations are disappointing. This is quite the most difficult of the Northumberland areas.

Chairman's visit - 22/11/33

The area has turned out very deceptively. The soil (except on the tops) is sandy for the most part, but deep and with little or no pan. There has been a great invasion by heather since enclosure and a development of heather where bracken has been systematically cut in weeding. We now know that some form of soil aeration (e.g. ploughing) would have got the trees away. Wherever bracken is dominant most species are growing well. The reason for the check of Japanese larch on mixed heather-bracken is not at all apparent: possibly this is due to indifferent planting. Patience is needed and restraint from doing on a large scale anything, the outcome of which, is not reasonably certain.

Instructions were issued that an experiment in "thatching" with Scots pine branches be tried on Sitka spruce in check in heather. Stress laid on the avoidance of unnecessary beating up. Pinus contorta was considered to be valuable for beating up irregular Corsican pine areas. Cutting back of birch to be done with discrimination, and use to be made of this species to help close canopy of the crop.

Visit of Divisional Officer, 5/7/34.

Beating-up satisfactory as a whole, but in some instances Sitka spruce had been planted in strong heather instead of Scots pine. This is quite useless. If ground is too wet for Scots pine, Pinus contorta should be planted on turves, and if this fails the ground should be considered unplantable.

Chairman's visit 10/9/37.

Too much birch has been cut out of the crop in brashing operations. A Scots pine/Sitka spruce mixture was regarded as a good one, but surprise was expressed at poor growth of Corsican pine. The underplanting of old scrub Scots pine with Sitka spruce looked promising. Little could be done at this time towards improvement of the crop: the area has been unusually slow in developing. The position is now that the area is generally fully stocked, though spruce on the north slope of Thrunton crag is unduly backward, and Corsican pine is remarkably uneven.

Assistant Commissioner's visit, 10/5/38.

The Assistant Commissioner directed that spruce was to be favoured wherever possible. P.25 Sitka spruce in check were examined, and instructions given that a mulching experiment be laid down, with a view to finding methods of stimulating growth. A site is required for the forester's house.

Assistant Commissioner's visit, 29/10/40.

The large beech on the Howmoor area should be offered to Timber Production Department and not ringed. The good form and appearance of Douglas fir on this area was noted. The thinning of acquired Scots pine (45-50 years old) was difficult as the stand had been neglected. The Scots pine planted along the foot of the crags would probably draw up the Norway spruce which are backward at present.

Chairman's visit, 3/6/42.

It was agreed that the rides on the area were too narrow to stop the fire (of 6/5/42). It was surprising too that a block of Japanese larch had not done so. The Chairman instructed that data on growth of Scots pine and Sitka spruce on the area, both pure and mixed, should be collected to give a guide to selection of species for the replanting of the burnt area. The

Chairman considered that pure pine ought to do well on the area, and on higher ground it could probably be mixed with Sitka spruce. Corsican pine was regarded as being unsuitable, as the area is too far north.

The origin of the fire was discussed and various types of fire-break considered. It was also considered that much of the "unplatable" ground could be ploughed and planted.

Visit of Conservator (State Forests) England, 16/3/48.

First thinnings on Howmoor estimated at 150 - 200 cu.ft. per acre, = 7,500 to 10,000 cu.ft. over 50 acres. Because of state of internal roads, extraction is difficult. The gaps left by removal of the old beech should be planted with Sitka spruce and a little Tsuga. Sitka spruce should predominate in replanting of the burnt area (1942). On Blackcock area, occasional Scots pine have been killed by Fomes annosus, and on this side of the forest Scots pine does not show much promise. In recent years Sitka spruce formerly in check has pulled away and is now flourishing. P.25 Sitka spruce in Compartment 40 exceptionally good, carrying upwards of 2,500 cu.ft. per acre. Badly cankered P.25 European larch in Compartments 33 - 35 should be 50% felled and underplanted with a Sitka spruce/Tsuga mixture, the Sitka spruce predominating.

Visit of State Forests Officer, 22/6/49.

The "unplatable area" on the high ground should be ploughed and planted in F.Y.50 with Sitka spruce on peat, and Scots pine on rocky knolls. Pinus contorta is also a suitable species. The crag face will continue to be planted with Sitka spruce/Scots pine mixture, but in 3-row strips. More Japanese larch should be used at Thrunton. All brashing should not exceed 70% of the crop.

Visit of State Forests Officer and Utilisation Officer, 18/5/50.

As a matter of principle maintenance and thinning operations should have first priority, and arrears of thinning should be cleared off as soon as possible. There is a danger that unless thinning is tackled on a big scale it may get out of hand.

Visit of Utilisation Officer to Thrunton 4/12/50.

Racking of plantations should be done at 3 chain intervals now, before the stands are thinned.

Pinus contorta should be considered for some areas in F.Y.51 planting. The regeneration of poor P.21 Japanese larch in Compartment 11 would be considered. In addition to cutting out alternate rows of cankered European larch in Compartments 33 - 35, the remainder should be thinned of poor material.

Visit of Lord Radnor and Director (E) 5/6/50.

The savings made by seasoning pitwood before extraction were stressed, and the waste in stacking props on the ground and too far from the road, and by the inclusion of oversize props was pointed out. No more clearfelling of cankered European larch in Compartment 35 should be done, but should be thinned heavily instead. Scots pine, Corsican pine and Japanese larch were suggested for replanting the fire. Beech regeneration under the birch in Compartment 9 should be assisted. It was considered that clearance of scrub at £12 per acre in Birsley Wood was unjustified, and that the existing scrub should be grown on a selection basis with a view to later underplanting.

Visit of State Forests Officer, 15/2/51.

Thinnings greatly in arrears and too light, thus perpetuating arrears: the forest is overstocked. Planting of Sitka spruce in recent years on a porous sandy soil in knee deep heather is a tragedy.

Doubts expressed on Japanese larch/Corsican pine mixture in P.51 planting: these species should be planted separately on sites suited to each individually. The Sitka spruce/Scots pine mixture on the Crag face will probably need the 3 rows of Sitka spruce to be replaced by 1 row of Abies nobilis when Scots pine is 5 ft. tall. Douglas fir and European larch on Howmoor require thinning: this is scheduled for this year.

Visit of State Forests Officer, 4/5/51.

The areas scheduled for thinning in F.Y.52 should be done in F.Y.51. Future thinnings will be on a three - year block system, over the three blocks of the Howmoor, Blackcock, and Coe Burn. Thinnings throughout Central District are on the light side. P.49 Sitka spruce on heather knolls in

Compartments 9 and 10 will be replanted with Scots pine in F.Y.53. The "unplantable" ground (Compartment 56) will be planted in F.Y.53 with Scots pine with a Pinus montana/Pinus contorta wind-break to westward. P.51 Sitka spruce on heather can only be regarded as 50% planted, and every second 2 rows will be re-turved and replanted with Scots pine in F.Y.52. The P.51 Scots pine and Corsican pine should be given an application of phosphates this summer. Drainage maintenance is in arrears.

(b) Swarland

Assistant Commissioner's visit, 29/10/40.

The density of birch left as shelter on the P.41 area was approved. All ash saplings on this area to be cut back and allow stool shoots to develop with the P.41 hardwood crop. The Japanese larch on P.39 area planted at 4 ft. spacing were too close, and that 5 ft. should be used henceforth.

Visit of Conservator (N.E.) 4/10/48.

Japanese larch or beech should have been used in preference to Sitka spruce in P.49 planting. Sitka spruce considered suitable for southern part of area, however. The heavy rhododendron growth could be bulldozed off. The roadsides should be planted with groups of Thuja and possibly red oaks. P.43 ash in Compartment 10 should be cut back and a nurse species planted: Pinus contorta was suggested. Some oak should also be cut back, on an experimental basis. The shelter belt in Compartment 10 should be used for experiments, in collaboration with the Private Woodlands Section.

Visit of State Forests Officer, 13/2/51.

The area considered very suitable for the growth of oak. P.40 Japanese larch will be ready for thinning in 1953.

(c) Hepburn

Visit of State Forests Officer, 18/6/48.

Where existing hardwoods are young and of good quality and stocking, they should be left to grow on. Where frost hollows are expected, a protective cover of scrub should be left. Other areas

should be clear felled, and Japanese larch used to link up the hardwood areas left, as a fire-break. Adequate supervision is badly needed.

Visit of State Forests Officer, 8/9/48.

Species for F.Y.49 planting were considered, and area under Douglas fir should be curtailed and more Japanese larch introduced for shelter and fire-break purposes.

Visit of State Forests Officer, 13/2/51.

P.51 planting programme to be postponed one year to allow preparation of ground to proceed. Douglas fir to be main species planted, with Japanese larch on drier slopes and Norway spruce on damp areas. Scots pine to be planted along the foot of the crags. Birch areas should be thinned to 400 stems per acre and underplanted with Douglas fir.

(d) Birsley Wood

Visit of State Forests Officer, 21/6/49.

Some fair sycamore and ash remain, and regeneration below is flourishing. Sitka spruce or slow-growing hardwoods are to be avoided, and species to be planted are Douglas fir and Japanese larch, the latter in mixture with beech, ash, sycamore, Tsuga, Thuja, or Lawson's cypress.

Visit of Lord Radnor and Director (E) 5/6/50.

The existing scrub should be allowed to grow on in a selection basis with a view to eventual underplanting. The expenditure of £12 per acre as provided in the Acquisition Report is unjustified.

History of Rothbury Forest

APPENDIX II

Supervision

<u>Conservators</u>	1946 - 47	R. E. Fossey (Acting)
	1947 - 50	G. J. L. Batters
	1950 to date	C. A. Connell
<u>Divisional Officers</u>	1922 - 40	A. D. Hopkinson
	1940 - 46	R. E. Fossey (Acting)
<u>State Forest Officers</u>	1947 - 48	R. E. Fossey
	1948 - 50	W. Forsyth
	1950 to date	P. F. Garthwaite
<u>District Officers</u>	1926 - 28	J. H. Mackay
	1928 - 31	G. J. L. Batters
	1931 - 35	A. S. Dicker
	1935 - 37	G. J. L. Batters
	1937 - 42	W. Forsyth
	1942 - 43	J. H. Edwards
	1943 - 48	M. F. Adams
	1948 - 51	S. Forrester
	1951 to date	A. A. Rowan
<u>Foresters</u>	1922 - 30	W. J. Bewick
	1930 - 36	C. Scott
	1936 - 39	N. Wray
	1939 - 50	W. E. Stanley
	1950 to date	J. G. Gledson

History of Rothbury Forest

APPENDIX III

Photographs

The photographs on the first two pages were taken in May, 1933, by Mr. O.J. Sangar. The remainder were taken in June, 1951, by A.A. Rowan.

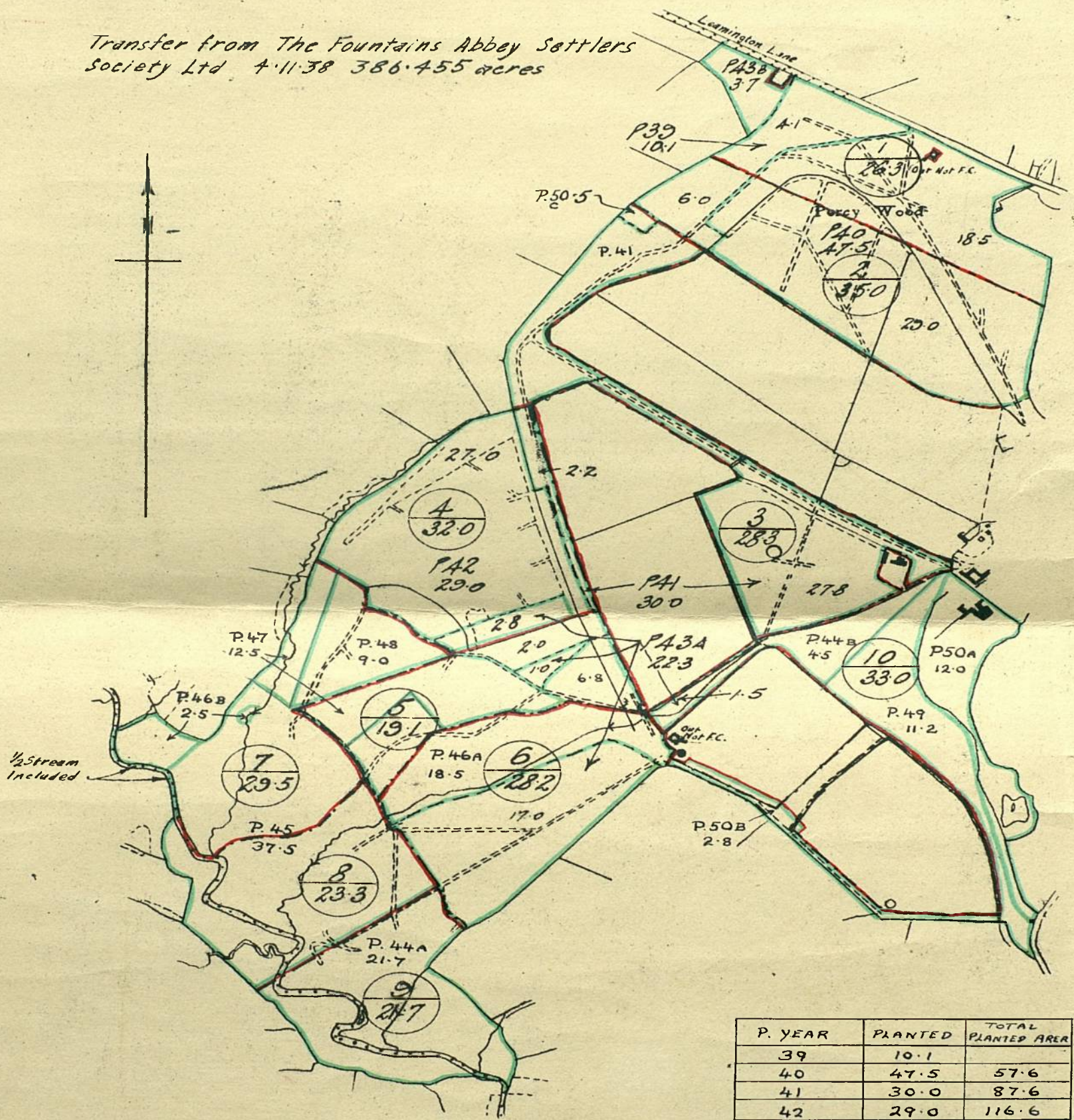
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ROTHBURY Swarland Hall

Northumberland ARSE. 43.5W.

Transfer from The Fountains Abbey Settlers
 Society Ltd. 4.11.38 386.455 acres



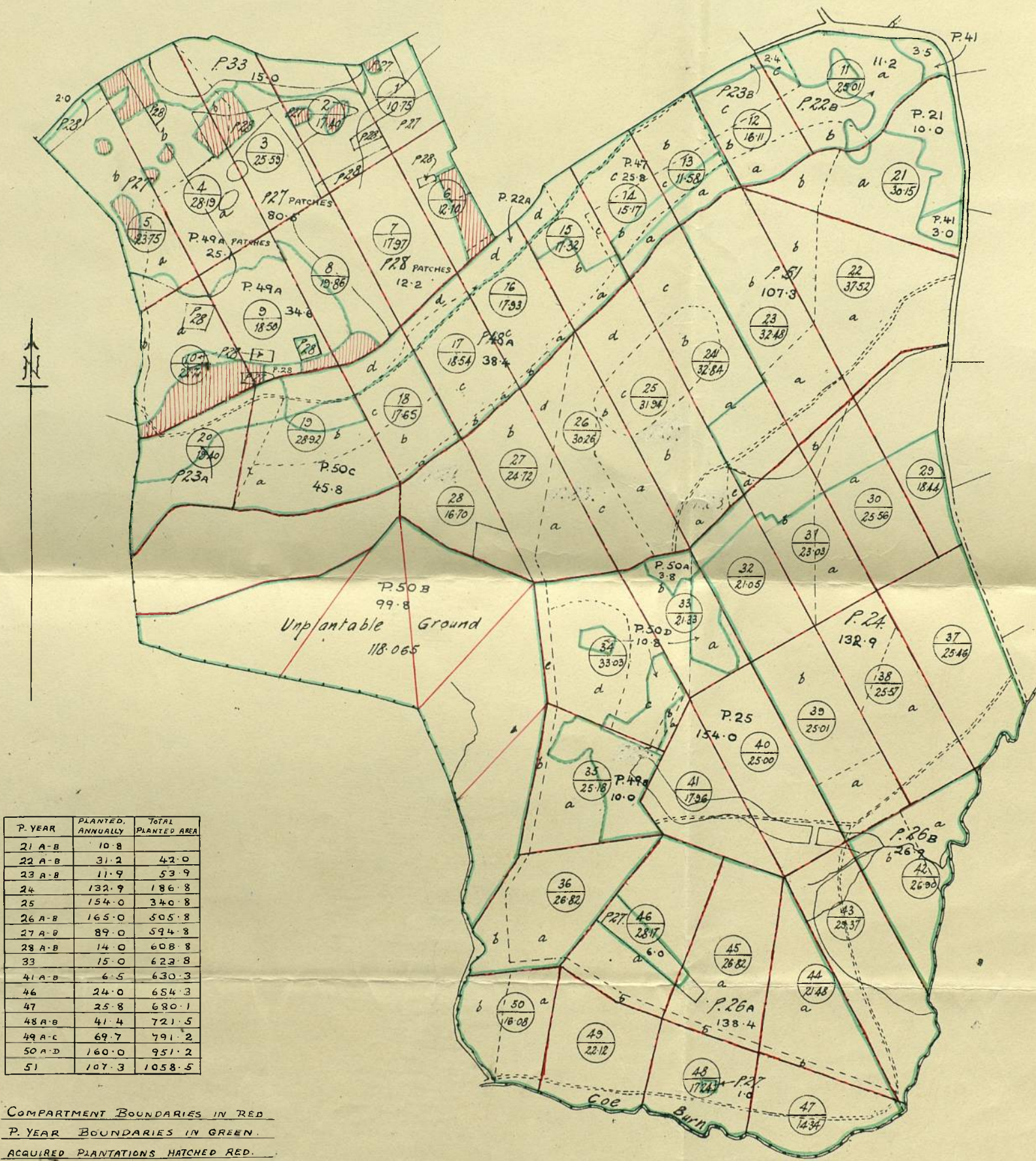
P. YEAR	PLANTED	TOTAL PLANTED AREA
39	10.1	
40	47.5	57.6
41	30.0	87.6
42	29.0	116.6
43 A-B	26.0	142.6
44	26.2	168.8
45	37.7	206.5
46 A-B	20.0	226.5
47	12.5	239.8
48	9.0	248.8
49	11.25	260.05
50 A-C	15.25	275.3

Scale Six Inches to One Mile.

COMPARTMENT BOUNDARIES IN RED

P. YEAR BOUNDARIES IN GREEN.

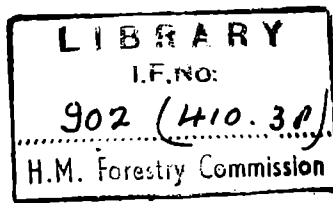
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P. YEAR	PLANTED ANNUALLY	TOTAL PLANTED AREA
21 A-B	10.8	42.0
22 A-B	31.2	53.9
23 A-B	11.9	186.8
24	132.9	340.8
25	154.0	505.8
26 A-B	165.0	594.8
27 A-B	89.0	608.8
28 A-B	14.0	623.8
33	15.0	630.3
41 A-B	6.5	654.3
46	24.0	680.1
47	25.8	721.5
48 A-B	41.4	791.2
49 A-C	69.7	951.2
50 A-D	160.0	1058.5
51	107.3	

COMPARTMENT BOUNDARIES IN RED
P. YEAR BOUNDARIES IN GREEN.
ACQUIRED PLANTATIONS HATCHED RED.

Scale:- 6" = 1 Mile.



HISTORY OF ROTHBURY FOREST

APPENDIX III

Photographs

The photographs on the first two pages were taken in May, 1933, by Mr. O. J. Sangar. The remainder were taken in June, 1951, by Mr. A. A. Rowan.

General view of Howmoor from
Callaly Crag looking N.E.



General view of Howmoor, from
Thrunton Crag, looking West.



P.27, Scots pine, Compartment 4
top height 30'.



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Acquired S.P. Compt 6, aged approx. 70 years. P.27 D.F. in background.



Compt.45. P.26. C.P. Top ht. 30'. The handkerchief is at 6'.



P.26 C.P. in Compt.46, Coe Hill. In foreground can be seen S.P. beaten up among S.S. which are still in check on heather. C.P. on the knoll in the background has developed normally.

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P.33. E.L. Compt 3:
Top height 31'.

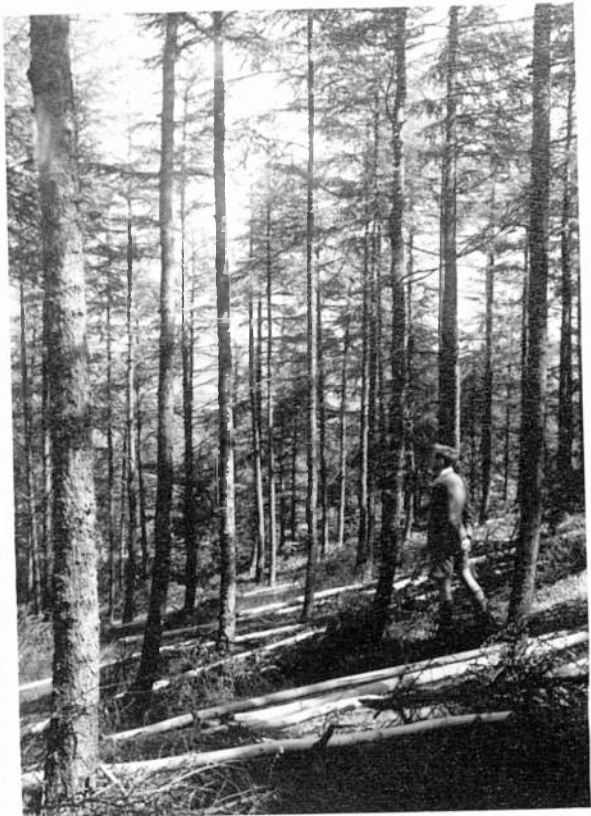


P.24. E.L. Compt.32. This has
been 50% felled because of poor
form and incidence of canker.
Top height 37'.



Compt.56. Natural regeneration of E.L.
under old S.P. and E.L. Vegetation
moss, occasional Calluna. The wall is
4'6" high.

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P.22 J.L. Compt.11: recently thinned. Top ht. 37'



P.21 J.L. Compt 21: recently thinned. Top ht. 42'.



Compts.53 & 54 P.50 S.S. on ploughing at 15' with turves spread at 5'. Vegetation Calluna with patches of eriophorum. In the background is P.25 S.P. in Compartments 35 and 36.

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P.46 S.P. and S.S. Compt.12,
below Crag-top road.



P.25 S.P. Compt.41. S.P.
beaten up in checked S.S. on
Calluna. In middle, S.S. has
has got away: top ht. is 45'.
In background patchy nature of
C.P. on Coe Hill can be seen.



P.24 J.L. and S.P. Compt.37,
S.S. in front are just coming
out of check on Calluna. Top
ht. of J.L. 37'.



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P. 22. S. S. Compt 15, below
Cragfoot road. Top ht. 25'.



P. 27 D. F. Compt. 1. recently
thinned.

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P.27 Douglas fir, Compt.4. in clumps with P.49 Sitka spruce planted between. Handkerchief behind specimen of S.S. Top ht. of D.F. 46'.

SWARLAND



Compt.2. P.39 S.P. with J.L. of same age in background. Handkerchief is at 6'.

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Compt. 6. P.43 E.L., to left: on
right P.45 J.L. in Compt.8. Top ht.
of E.L. is $11\frac{1}{2}'$, of J.L. $11'$.



Compt. 7. P.45 J.L. with N.S. in
foreground: J.L. top ht. $10'$.

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Compt. P.42 N.S. handkerchief on tripod is at 4'.



Compt.9. P.44, D.F., with P.46 E.L. of Compt.6. in background. Handkerchief is at 4'. Top ht. of D.F. is 9'.

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Compt. 3. S. corner. Tsuga/S.S. mixture, P.41. Standard oak and birch in background.



Compt. 3. N.S./oak/beechn mixture, P.41.

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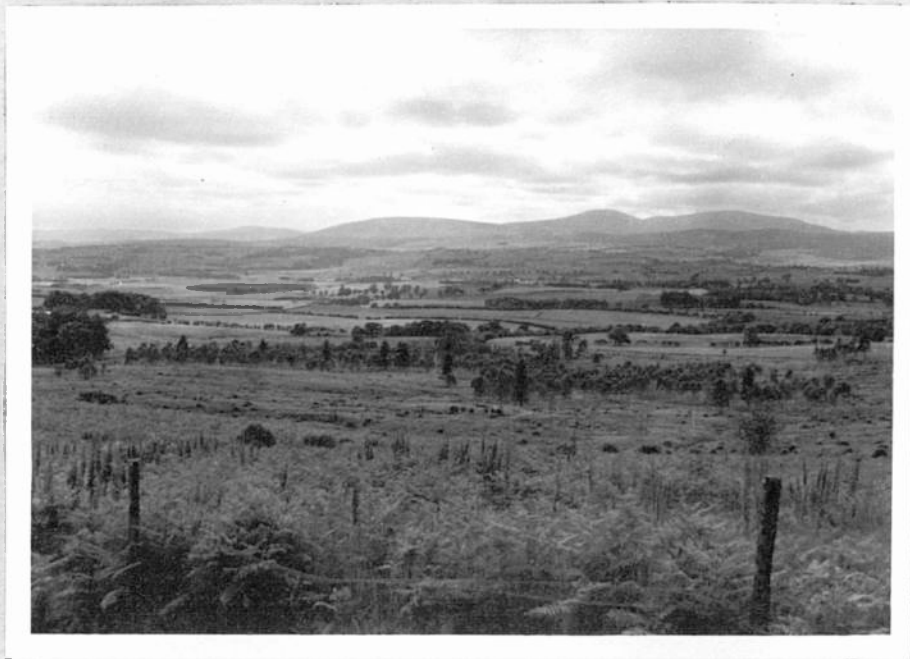


Compt. 7. Scrub birch and alder, untouched. This forms part of the scrub sold to J. Minto and Co.



Compt. 5. birch and ash scrub untouched.

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Compts. 11, 12, 14, and 15.
General view of P.49 and P.50 areas
from N.E. corner of Compt.12. This
shows extent of birch underplanting.



Compt.11: birch underplanted with
P.50 D.F. from N.E. corner of
Compt. 11.

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ROTHBURY FOREST

Photographs on the first two pages were taken in May, 1933, by Mr O.J. Sangar. The remainder were taken in June, 1951, by Mr A. A. Rowan.

1

Top: 33/68. 69. Rothburt. May 1933.
Panorama of P.24 (Compartments 30 and 31) from S.E. corner Compartment 31. Foreground (Calluna) originally planted J.L. and B.U. at various times with N.S. some S.S., and S.P.
Bottom left: 33/70 Rothbury. May 1933. P's 21 22, and 23. Looking up C.11/12 boundary either side; old woodland, Calluna and bracken. Foreground J.Larch, probably originally D.F. of 1923 replanted J.P. in 1925. Upper slope thinly stocked small J.L. of P.22, B.U. at various times including D.F. and S.P. Satisfactory P.21 S.P. on skyline. For details of upper slope see photo 33/75
Bottom right: 33/71. Rothbury. May 1933, P.24. Good clump of S.S. in Compt. 28, old S.P. scrub; adjoins 'unplantable' area. Calluna and vaccinium on 6 inches peat or sand.

2

Top left: 33/72 Rothbury. May 1933 P.21. Foreground Compt. 24; J.L. replanted S.S. background J.L. and then S.P. of Compt. 23.
Top right: 33/73 Rothbury, May 1933, P.21. S.P. Compt.25 on left and C.24 on right
Centre: 33/74 Rothbury, May 1933. Foreground P.22, distance (foot of slope) P.23. J.L. of Compt 12. B.U. S.S. and (recently) S.P.
Bottom left: 33/75 Rothbury. May 1933. P.22, Compt. 11. J.L. on old hardwood ground in distance (of photo 33/76). Foreground B.U. at various times, lately with S.P. For view up this slope see right hand side photo 33/70
Bottom right: 33/76 Rothbury. May 1933, P.21. Lower end of Compt. 11/21 boundary, looking N.E.; bottom gate just out of sight. Specimen of best type of J.L. plantation (old hardwood ground)

3

Top: General view of Howmoor from Callaly Crag looking N.E
Centre: General view of Howmoor from Thrunton Crag, looking West.
Bottom: P.27, Scots pine, Compartment 4 top height 30'.

4

Top left: Acquired S.P. Compt. 6, aged approx. 70 years. P.27 D.F. in background.
Top right: Compt. 45. P.26. C.P. Top ht.30'. The handkerchief is at 6'.
Bottom: P.26 C.P. in Compt.46, Coe Hill. In foreground can be seen S.P. beaten up among S.S. which are still in check on heather. C.P. on the knoll in the background has developed normally

5

Top left: P.33. E.L. Compt 3: Top height 31'
Top right: P.24. E.L. Compt.32. This has been 50% felled because of poor form and incidence of canker. Top height 37'
Bottom: Compt.56. Natural regeneration of E.L. under old S.P. and E.L. Vegetation moss, occasional Calluna. The wall is 4'6" high.

6

Top left: P.22 J.L. Compt. 11: recently thinned. Top ht 37'
Top right: P.21 J.L. Compt 21: recently thinned. Top ht 42'
Bottom: Compts. 53 and 54 P.50 S.S. on ploughing at 15' with turves spread at 5' vegetation Calluna with patches of eriphorum. In the background is P.25 S.P. in compartments 35 and 36.

7

Top: P.46 S.P. and S.S. Compt. 12, below Crag-top road.
Centre: P.25 S.P. Compt.41. S.P beaten up in checked S.S. on Calluna. In middle, S.S. has got away: top ht. is 45'. In background patchy nature of C.P. on Coe Hill can be seen.
Bottom: P.24 J.L. and S.P. Compt. 37, S.S. in front are just coming out of check on Calluna. Top ht. of J.L. 37'

8

Top: P.22. S.S. Compt 15, below Cragfoot road. Top ht. 25'.
Bottom: P.27 D.F. Compt. 1. Recently thinned.

9

Top: P.27 Douglas fir, Compt.4. in clumps with P.49 Sitka spruce planted between. Handkerchief behind specimen of S.S. Top ht. of D.F. 46'
Bottom: (Swarland) Compt.2. P.39 S.P. with J.L. of same age in background. Handkerchief is at 6'

10

Top: Compt. 6 P.43 E.L., to left: on right P.45 J.L. in Compt. 8. Top ht. of E.L. is 11 1/2', of J.L. 11'

Bottom: Compt. 7. P.45 J.L. with N.S. in foreground: J.L. top ht. 10'

11

Top: Compt. P.42 N.S. handkerchief on tripod is at 4'

Bottom: Compt. 9. P.44, D.F., with P.46 E.L. of Compt. 6. in background. Handkerchief is at 4'. Top ht. of D.F. is 9'

12

Top: Compt. 3. S. corner. Tsunga/S.S. mixture, P.41. Standard oak and birch in background.

Bottom: Compt. 3. N.S./Oak/Beech mixture, P.41.

13

Top: Compt. 7. Scrub birch and alder, untouched. This forms part of the scrub sold to J. Minto and Co.

Bottom: Compt. 5. birch and ash scrub untouched.

14

Top: Compts. 11, 12, 14 and 15. General view of P.49 and P.50 areas from N.E. corner of Compt.12. This shows extent of birch under-planting.

Bottom: Compt.11: birch under-planted with P.50 D.F. from N.E. corner of Compt. 11