FORESTRY COMMISSION

HISTORY

OF

ALLERSTON

FOREST

NE (E) CONSERVANCY

FORESTRY COMMISSION

HISTORY

of

ALLERSTON FOREST

1921 - 1951

NORTH EAST (ENGLAND) CONSERVANCY

HISTORY OF ALLERSTON FOREST

C O N T E N T S

HISTORY of ALLERSTON FOREST

CHAIRMAN'S COMMENTS

I have read with great interest this history compiled from Reports of Headquarters Inspections, local officers, and the Research Branch. I do not think that any point of importance has been omitted and the most useful contribution I can make is to try to explain my motives in giving such directions as were in fact given from time to time.

Our early work - on "dale land" and felled woodlands - was straightforward enough. It was not until the late 1920's that I realized that we were repeating on the plateau at Allerston, and on a large scale, errors which had proved expensive elsewhere. Chief among them was the planting of spruces on heather and heather/Scirpus land. Planting was accordingly cut down drastically while the whole position was reviewed.

I think the point that weighed most with me was the clear indication that the only places where spruces were showing any vigour were those where, for some reason or other, the surface had been disturbed and the soil heaped up. It was a logical deduction that the young trees required a far greater depth of rooting medium than the undisturbed moor or shallow ploughing provided. That and effective drainage seemed the main requirements in preparation for planting. In the upshot it appeared that heavy ploughing tackle offered the best solution.

We were greatly helped at this stage by the representative of Tractor Traders Ltd. (Mr. Collis), both as to the power unit and the plough. The plough-makers were scarcely interested. There is probably on the Assistant Commissioner's files a record of a meeting held on 11/12th December, 1929, at the pub at Thornton Dale, out of which it was decided to make a large scale trial with a "20 Caterpillar" (approximately a "D.2.")

and such ploughing equipment as could be got.(H.Q. file 376/27, Allerston Inspections).

The trial took place on half-frozen ground above High Dalby one February day in 1930 in the presence of Sir John Stirling Maxwell and myself. It was successful enough to indicate that we were on the right lines. It was from that point that heavy ploughing, which has transformed so much of our work, began to develop actively. There is a good report in two parts (H.Q. file 47/30) by Guillebaud and Steven respectively.

What this trial ploughing turned up was a revelation to me. There was the whole soil profile, pan and all, displayed for yards at a time and in a way that trial holes here and there could never show. Further, in the wet places the water disappeared almost at once.

The first temptation, as on all such occasions, was to regard the whole problem of the heather/Scirpus moors as solved, but in fact we were puzzled to know what to plant. Would Scots pine show such improved growth as to be worth while; would Corsican pine get Brunchorstia; would Japanese larch and Sitka spruce now grow as we were accustomed to expect; should beech or birch have a place in the crop? Pritchard proposed a mixture of the lot (except Corsican pine which he could never abide!) and very reluctantly I agreed to a certain amount of it. My own inclination was towards a 50-50 mixture of Scots pine and Sitka spruce, but neither I nor anybody else anticipated the vigorous development of the stunted heather which followed ploughing. For the next few years we added little towards the solution and it was not until 1939 that the Wykeham experiments, then about 11 years old, began to provide pointers.

The next important date (from my point of view) was in 1942 when I found on inspection that the current ploughing procedure was to hitch a Killifer and plough in tandem and to

plant in the bottom of the furrow. As the moisture tended to collect in the bottom of the furrow, the loss and initial response was good but to my mind held out no future for the trees. Further, it was a bad mechanical arrangement, particularly as the plough worked very badly. This procedure was accordingly ended.

Later on the same tour I saw the work of the Grub Breaker on Broxa Moor (H.Q. file 268/37, Langdale Inspections) and asked Dilley, who was there, whether we could not now design our own plough. I gave him the following specification:

(1) To plough to 18 in.

(2) To stall a D.4. tractor without damage to itself.

He undertook to do so in association with Paterson; there was later a meeting, which I attended, with representatives of the firm of Russels of Kirbymoorside, and the R.L.R. plough emerged.

I still hold that partial ploughing with the soil heaped high is (apart from cost) superior in the long run to full ploughing on the Allerston, Black Isle etc., sites. I have had from James Fraser confirmation of the "heaping" theory. He has a 70-year-old pine wood on Kilcoy (Black Isle) illustrating the point. The objection that extraction will be difficult over deep-ploughed land is a bogie. Another conviction of mine is that the crop should contain a deep-rooting species (pine) to continue the aerating effect of ploughing.

General Remarks.

There is no doubt that we went forward over-confidently and too quickly with the early moorland planting. If we had defined the problems, acknowledged our ignorance of how to deal with them, and instituted well-designed experiments, we might have had by 1931 instead of 1939 a considerable volume of practical information leading to better techniques. (The Jingleby experiment was a small step in the right direction, but unfortunately the conditions there were not typical).

It is easy to be wise after the event and experience has to be bought in one way or another. But if, as Forester Anderson says, the experiences at Allerston will not help us much on the new and extensive Cleveland Hills areas (I do not know them well enough to confirm his views), the procedure is obvious enough. Experimental areas for this purpose need not be large - an acre or so will suffice - but they must be sufficiently numerous to cover the range of practical problems, and be laid down in good time, that is well in advance of the large scale planting on the sites in question.

'R'
6.10.50.

HISTORY of ALLERSTON FOREST

GENERAL DESCRIPTION of the FOREST

Situation and Name

The name is derived from the village of Allerston on the Pickering-Scarborough road where inspecting Officers stayed in the early years of afforestation in this district. It is also the name of the moor which forms the bulk of the moorland area planted.

Area and Utilisation

The total area amounts to 13,941 acres, covering a more or less compact block of moorland country lying between Pickering and Scarborough. The forest area is mainly confined to the higher ground of the moorland plateaux, broken up by farmland in the dales and valleys.

Former use of the area was mainly sheep grazing, though parts of the lower slopes were cultivated up till the time of acquisition; such areas existed on Staindale, Dalby, Wykeham and Bickley, being mainly confined to the shallow corn growing soils on the oolite outcrops.

Sporting rights over the moorland were of considerable value in former times, and many of the slopes of the dales, particularly near Dalby, were renowned for rabbits. On certain farms, the valuation was calculated on the stock of rabbits, and the economy of considerable areas was based on a careful and elaborate system of trapping by stone enclosures or "types", many of which remain to this day in varying stages of dilapidation.

Woodlands on the area were of no great extent; a few small scattered conifer shelter belts were to be found on the edges of the moorland, and irregular mixed hardwoods, mainly oak and birch covered much of the valley slopes, particularly in Staindale, and as "hanging woods" overlooking the Langdale and Troutsdale valleys.

Since the early acquisitions above Allerston village in 1921, the forest area was extended rapidly to the east by the Wykeham Beat (1924), and to the north by the Staindale (1921) and Bickley Beats (1926). The inclusion of Harwood Dale (1927) is somewhat of an anomaly, as the Beat is separated by some 7 miles from the main Allerston Block, and shows marked dissimilarities of soil and terrain. The only considerable increase in recent years has been the acquisition of Wydale in 1949 and Troutsdale in 1951. Cross country routes and tracks now exist by which, including the adjacent Langdale Forest area, one can go from Kingthorpe (Dalby) in the south-west to Penny Howe (Harwood Dale) in the north-east without leaving Forestry Commission ground, except for a break of 1½ miles near Harwood Dale village - a distance of nearly 25 miles.

For the purpose of management, the forest is divided into four Beats, Dalby (4014 acres), Staindale (2670 acres), Wykeham (3800 acres), Bickley (1637 acres).

TABLE II

(a)	Plantations -		
	Acquired	103	acres
	Formed by F.C.	10,132	"
(b)	In hand, awaiting planting -		
	Blanks after felling	Nil	
	Burnt areas	5	"
	Other land in hand	1,984	"
(c)	Nurseries	9	"
(d)	Agriculture. Number of tenancies		
	15 (permanent agricultural)	515.337	"
	7 (pending planting)	282.791	"
(e)	F.W.H.	296.851	"
(f)	Other land in hand	109.968	"
(g)	Other land (see Table I Cols.12 and 13)	503.433	"
	Grand Total	13,941.380	acres

The management of several farms has been transferred to the Ministry of Agriculture as under.

High Rigg	(Dalby)	11/10/50	190.481 acres
Backleys	(Bickley)	6/4/50	145.452 "
Broad Head	(Wykeham)	1951	96.672 "
Hern Head	(Wykeham)	1951	64.128 "
Basin Howe	(Wykeham)	20/3/51	103.372 "

TABLE I.

Name	From	By	Date	Total Acqu.	Plantations Acquired	Plantable excl. col. 6	Nurseries	Agricultural	F.W.H. etc.	Unplantable excl. col. 6	Other Land				Total
											Land Permanently transferred		Land temporarily transferred		
											Description	Acreage	Description	Acreage	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
DALBY															
Pt. High & Low Dalby	Duchy of Lancaster	Grant	3. 3.21	1592.558											
Allerston and Ebberston pt.	Sir K. Cayley	Purchase	23. 3.21	965.600											
Thornton Estate pt.	G.F.G. Hill	Purchase	17.10.23	883.280	5	3428	-	305.380	67.964	17.312	-	-	High Riggs Farm transferred to M.A.F.	190.481	4014.137
Black House	Sir K. Cayley	Purchase	29.10.36	12.809											
Thornton Dale	G.F.G. Hill	Purchase	9.11.39	326.551											
Warren House	Major Gillam	Purchase	28. 6.40	233.339											
STAINDALE															
Pt. High & Low Dalby	Duchy of Lancaster	Grant	3. 3.21	742.800											
Allerston and Ebberston pt.	Sir K. Cayley	Purchase	23. 3.21	1918.876											
Thornton Estate pt.	G.F.G. Hill	Purchase	17.10.23	15.400	-	2567	-	22.580	69.980	10.419	-	-	-	-	2669.979
Crosscliffe (1)	Col. Palmes	Lease	14.11.24	103.403											
Less pt. Crosscliffe transferred to Bickley 1951				110.500											
BICKLEY															
Ebberston	Sir K. Cayley	Purchase	20.10.24	120.350											
Crosscliffe (2)	Col. Palmes	Purchase	26. 3.26	1407.990											
Transferred from Staindale in 1951				110.500	2	1180	-	175.906	129.481	4.358	-	-	Backleys Farm transferred to M.A.F.	145.452	1637.197
Less sold to Mrs. Rowntree			3.1. 28	1.643											
WYKEHAM															
Wykeham	Lord Downe	Lease	9.10.24	1199.756											
Harwood Dale pt.	Lord Derwent	Lease	18. 2.27	77.588											
Wykeham Ext. (1)	Lord Downe	Lease	12.10.29	493.550											
Brompton Moor (1)	Sir K. Cayley	Lease	11. 3.30	319.724											
Wykeham Ext. (2)	Lord Downe	Lease	12.11.30	13.961									Hearn Head Farm at disposal of M.A.F.	64.128	
Brompton Moor (2)	Capt. Harland	Lease	28.10.31	149.082	96	3189	8	294.262	29.426	16.679	-	-			3800.867
Hallykeld Wood	Duchy of Lancaster	Grant	27. 8.38	105.508											
Hallykeld adj.	Capt. Harland	Lease	6. 2.42	32.823											
Wydale	Mrs. Illingworth	Lease	21. 2.49	983.259									Allerston Basin Howe at disposal of M.A.F.	103.372	
Basin Howe (incl. 3.000 leased in 1949)	Sir K. Cayley	Purchase	20. 3.51	329.874											
Irton Manor	A.M. Norton	Purchase	20. 9.51	95.742											
HARWOOD DALE															
Harwood Dale pt.	Lord Derwent	Lease	18. 2.27	1348.200											
Penny Howe	Lord Derwent	Purchase	6. 2.51	472.000	-	1757	1	Nil	Nil	61.2	-	-	-	-	1819.200
Less pt. sold to N.R.C.C.				1.000											
					103	12121	9	798.128	296.851	109.968	-	-	-	503.433	13941.380

The Sporting tenancies over the area are held by individuals and syndicates, as under

		Tenant	Acreage	Rent
1.	Allerston Moors 66 years lease from 17/7/42	Craven Dairies	2884	£10
2.	Flainsey Rigg 60 years lease from 17/10/23	G.F.G. Hill	898	£5
3.	Pexton Moor 21 years lease from 9/11/39	G.F.G. Hill	326	£1
4.	Warren House 14 years lease from 31/3/40	I.H. Gillam	233	£1
5.	High & Low Dalby & High Wood Seasonal	T.P.B. Balderson	2290	£60
6.	Wydale 42 years lease from 14/1/49	Mrs. G.E. Illingworth	983	Peppercorn
7.	Crosscliffe 5 years lease from 1/4/52	W. Craven	1406	£50
8.	Penny Howe 42 years lease from 1/1/51	Lord Derwent	472	Peppercorn
9.	Fishing at Thornton Dale Beck	Negotiations with C.W. Paine	-	-

The tenancies of some farms including certain marginal land depend on the present food shortage, and the ultimate use of the ground will no doubt be decided at a later date.

Physiography

With the exception of Harwood Dale, the Beats comprising Allerston Forest are remarkably similar in the general conformation of the ground. The general aspect is southerly, with the lower slopes on Dalby and Wykeham at 500 ft. rising to nearly 800 ft. along Crosscliffe Brow on Staindale and Jerry Noddle on Bickley. The dales and valleys run in a southerly direction draining into the main River Derwent, but this pattern is confused by the large valleys of Troutsdale and Deepdale on Bickley which curl in an easterly direction to join the River Derwent before it too swings south to cut through Forge Valley into the Vale of Pickering.

The area is one of moorland plateaux which fall sharply - even abruptly to the north and east, into deep narrow valleys; the exposure from the prevailing south-west wind is considerable, and damaging east winds from the sea 12 miles away occur regularly in early spring.

The moorland area of Harwood Dale is quite dissimilar, consisting of a long stretch of moorland with a south-west aspect rising from 400 ft. to 800 ft. Its lack of any shelter and proximity to the sea four miles away make this one of the most exposed Beats in the District.

Geology and Soils

Geologically, the area is formed from rocks of the Middle Oolite Series of the Jurassic period. These vary from the light porous stony calcareous grits of the moorland plateaux to the heavy wet estuarine clays found in the valleys.

The dip of the rock strata is such that over much of the area, the older formations are found at a higher elevation and apparently "above" the more recent. The general pattern to be formed throughout the area shows

(a) A large area of calcareous grit covering the greater part of the plateaux (lower calcareous grit).

(b) Outcrops of an oolitic limestone with sparse vegetation, and usually agricultural ground, but covering extensive parts of Dalby (lower limestone).

(c) Extensive areas of sand and sandstone found on the slopes of the dales, and on the lower moor tops e.g. Sawdon Moor (passage beds).

(d) Scattered areas of low moor such as Pexton and Irton surrounded by agricultural land (middle calcareous grit).

(e) Stony and rocky ground, usually steep, varying in consistence from shale to massive sandstone and even rubble (Oxford Clay merging into Kellaway rock).

(f) Stiff wet clays, often with silt and wash in the valley bottoms (Estuarine Clay).

This rock formation results in the conspicuous Tabular Hills peculiar to parts of the North Yorkshire Moors, and due to the hard and resistant nature of the Kellaway rock; Jerry Noddle provides a good example.

As a result of the angle of dip of the strata the north and east facing slopes are abrupt, and characterised by heather and bilberry, whereas the south and easterly slopes are generally gentle, with deeper soils growing a richer flora including often dense bracken.

The soils found on the moorland grits are typical podsols, with a hard pan formed at depths varying from 6 in. to 18 in.; the soil is very freely drained, leached and poor. The soils on the oolite outcrops are the poorest and most difficult for tree growth to be found on the area, consisting of little more than limestone rag - a rendzina with no horizons. The hillsides and valley slopes vary considerably from stony shallow soils to deep rich loams, and even heavy wet clays in places. Certain ridges towards the top of the slopes are found generally over the area, and are characterised by very hard dry compacted stony soils, on which tree growth is always very poor.

Pockets of peat occur frequently on the moors, usually at the head of gills and slacks, but some fairly large peat bogs are also to be found on Staindale, and at Harwood Dale.

Vegetation

By far the greater part of the area is covered by heather. This plant becomes very strong and woody if left unburnt for many years, and then becomes a serious competitor for water and space on these dry porous moorland soils. Wetter patches on the moor are characterised by Eriophorum spp. and occasionally by Scirpus, though this is not common; Erica cinerea is to be seen in places, particularly on dry banks, whilst Erica tetralix is widespread on some of the wetter heaths, notably at Harwood Dale. Bog myrtle is also to be found to some extent over the wet heavy clay moors of Harwood Dale, where the Molinia is also

to be seen pure over as much as 100 acres - an unusual sight in this district.

The slopes are characterised by dense bracken, but this is generally present on the south and east aspect slopes where the soil is deeper; whilst on the north and west aspect slopes, heather and Vaccinium myrtillus are usually dominant. Some Empetrum nigrum and Vaccinium vitis-Idaea are also found.

The heavy wet loam and clay slopes of Wykeham and Bickley have a more varied flora, particularly where the ground carries, or has at some time carried, a tree crop. Dense grass, with rushes on the waterlogged sites are common, with scattered birch, alder, ash, willow and thorn bushes.

The deep but drier areas of the sandy passage bed outcrops vary from grassland to heather, but much of it has at one time been cultivated; the adjacent areas of oolitic limestone are the most conspicuous by virtue of their characteristic vegetation the grass layers are very sparse, with scabious, cowslip and hawthorn, and dogs mercury in the shadier places.

Many of the slopes and small valleys at one time were covered by forest, but in most cases, only small patches of woodland remain, with fringes of alder, ash and birch along the streams. Remaining woodlands consist mainly of oak, ash, birch and alder, with scattered holly, lime, elm and beech.

Meteorology

Records for the area are very scanty, and none apply specifically to the forest area under review.

Nearby stations at Irton, Scarborough, and Sleights would seem to indicate a rainfall of about 30 ins., but no general figure can apply to the whole area. Weather is notably variable over this stretch of country, and the lower parts of Dalby, Bickley, and Wykeham probably do not get more than 26 ins. or 27 ins. of rain per annum, whilst the higher ground of Staindale, Bickley and Harwood Dale may enjoy as much as 36 ins. or 38 ins.

The moors are exposed and very cold in winter. The prevailing wind is south-west, but cold east winds are experienced in early spring, as described above. The deep valleys afford very considerable protection from wind and cold, and this can be seen reflected in the vegetation and growth of trees. The oblique angle of the sun on the north slopes has not encouraged any great activity in the micro-organisms of the soil, and this has resulted in a much shallower and more acid soil maintaining a distinct flora. On some of the steep south facing banks, however, an appreciable degree of insolation occurs in summer, and beech and Douglas fir wilt badly after spells of hot dry weather.

Frost is only locally important, and tends to lie in some of the shallow valleys and gills leading off the moors. Wet and boggy areas in the dales also suffer from frost damage.

Snow damage has occurred from time to time, particularly on or below exposed ridges (Backleys) and on steep banks (Wydale); no severe storm damage has occurred except for an area of Scots pine (Pexton) recently thinned in 1947 as seed trees.

Risks

In view of the presence of such large areas of heather, the main risk is fire. This danger is lessening over large areas of Bickley, Wykeham and Dalby, but the greater part of Staindale and Harwood Dale is still in a very dangerous condition where the plantations are just in the thicket stage, or where the heather has not been suppressed. The introduction of the R.L.R. plough has without doubt provided a measure of safety which lasts for three or four years after planting.

Measures to cope with this risk are based on

(a) Road communications.

(b) Lookouts, patrols and telephones.

(c) Water supplies.

(d) Fire Engines and transport.

The first item is dealt with below, but probably no other

factor has contributed more to the safety of the forest than the development of an adequate road system. Lookouts depend on two fire towers and two lookout huts, connected by G.P.O. or field telephone to Fire Control Centres; their activities can be supplemented when required by motor cycle or cycle patrols. Fire fighting equipment and transport is centred at the Fire Control Centres, one at Wykeham, and one at Dalby; Harwood Dale relies on equipment from Langdale. Fire engines with portable pumps and tanks can be detailed at short notice, and arrangements for assistance in manpower, tools, and transport are ready. The provision of water on the dry moors is a problem which can only partly be solved by static water held in large and small dams and tanks distributed over the area. Natural supplies are earmarked and prepared.

Several fires have occurred on the forest, but only three of any size. Two of these were due to enemy action - at Bickley where 54 acres were burnt out in 1940 and at Harwood Dale where 240 acres were burnt in 1940.

The incidence of rabbits over the area varies greatly; the main population has always been at Dalby, but after the initial clearing of the area, two full time warreners have been required to patrol the boundary fences and keep down rabbits which move in and breed in favourite localities, notably Givendale, Sand Dale, Hawdale and the Nut Wood. At Bickley, Wykeham and Staindale, rabbits are local and sporadic, but constant vigilance is necessary to keep out invaders. At Harwood Dale vermin are not important.

Hares have always caused trouble, and their ability to jump fences at will makes their eradication impossible. Damage has been sporadic, but the recent extensive planting of beech has necessitated more active measures to keep the forest areas clear.

Strenuous measures are required to keep down the numbers of foxes which would otherwise become established in the woods; badgers too become troublesome in destroying fences, and have to

be controlled. Jays, magpies and carrion crows were becoming major pests some years ago, but strenuous measures have done much to keep their number down. The grey squirrel is fairly abundant, but its numbers are considered to be fairly static. The damage is confined to the destruction of pine cones, but the large areas of beech planting may suffer at a later stage unless this pest is kept under very strict control, or eliminated.

Game is not abundant, and though pheasants and partridge are not uncommon and well distrubuted, grouse have practically disappeared from the moors. A few deer appear to live in the forest but although they are known to breed their numbers do not increase; red deer and fallow deer have been observed, and their numbers are not thought to exceed a dozen.

Fungal attacks have so far been few, and restricted in extent. A small area of Corsican pine has been infected by Brunchorstia for several years, but this infection does not spread appreciably, and individual trees keep recovering. A very much more widespread infection of a needle cast disease (Hypodermella sulcigena) has discoloured foliage of Corsican pine at Wykeham for 10 years or so, and two years ago appeared at Harwood Dale; so far it appears to have had little effect on growth.

Insect attacks have been sporadic, but so far without serious consequences. A widespread sawfly infestation in 1934 on Dalby was followed by the influx of huge numbers of starlings which devoured the caterpillars; since then attacks have been occasional, limited in extent, and scattered.

Damage by Pine Shoot Beetle has not been noticeable yet, but the most rigid control of felling and peeling must be observed in summer. The Pine Weevil has not caused any great damage, but trapping has always been necessary on and near newly planted areas adjacent to older pine woods. Results of this trapping have been very variable and often surprising.

Damage by the Pine Shoot Moth is restricted to small areas

on Bickley, where Corsican pine on the south slope of Jerry Noddle have been attacked. On larch, heavy attacks of the Larch Leaf Miner occur at infrequent intervals, but also annually in certain small patches; the effect does not appear to be serious. The Larch Shoot Borer (Argyresthia spp) is common generally, particularly in European larch, and does not help the generally unhealthy condition of many trees of this species in this District.

Heavy attacks of Neomyzaphis on Sitka spruce occur from time to time, but the effects on the older trees which are well established are short lived and soon overcome. Smaller trees in check are much more seriously affected.

Severe blast effects are often observed in early summer as a result of freezing east winds in spring. These have been apparent on larch, Scots pine and Pinus contorta; the selection of species varies according to the date when these winds occur.

Frost is not an important factor, and as described above, its effects are usually to be found in small gills and hollows, particularly where wet or badly drained, and when the choice of species has been faulty.

The light sandy nature of much of the moorland soils makes it prone to scour and erode when the vegetational cover is removed, and when the slope adds velocity to accumulating water flow. This effect is being lessened as road sides become stabilised by grass, and as tree cover is established on the moors.

The effects of atmospheric pollution, though discernable are not sufficient to have any real effect on tree growth.

Roads

Prior to 1948 there were few roads of any kind, and the rough cart tracks which traversed the moors were quite unsuitable for vehicles. The district as a whole was conspicuous for lack of roads, and bad access.

Initial development of the road system aimed at

(a) Creating essential all weather roads for access and main extraction routes.

(b) A network of bulldozed rides for access in dry weather in the event of fire.

These objectives were more or less realised by 1951, and subsequent work has concentrated on a programme of limited but steady development of the main system.

On Dalby, the completion of the main valley road from Ellerburn to High Staindale has provided quick access to a large area. The main approach road across Pexton Moor, and the Moor Road via Jingleby to Bickley has cut out nearly 15 miles in the distance from Thornton Dale to Langdale End, and in addition has provided a framework for feeders and secondary rides.

At Wykeham, the light metalling of the Moor Road from Sawdon to Northmoor has provided the same service, and together with the network of graded earth roads and bulldozed rides, has made possible extraction and access in all but the worst weather to most of the moor. The heavy clays and loams to be found in the Bakers Warren and slopes to Bickley still present a difficulty, as these soils rarely dry out even in summer, and current extension work on metalled roads has been found essential.

Harwood Dale is still in a somewhat less advanced condition, and the wet nature of much of the ground presents the same easy access as elsewhere. Improvement and metalling of bad stretches is in hand, together with the improvement of old tracks and moor roads.

Labour

The labour problem has varied from time to time with the development of work in the forest. Much of the work in earlier years was seasonal in view of the heavy planting programmes, but now the most of the forest staff are engaged on felling and conversion of thinning.

Since early days, most of the labour has come from villages

nearby in the Vale of Pickering; farms and scattered homesteads are few in this district, and all available labour is required for agriculture. The building of Forest Workers' Holdings at Dalby in 1927, and later at Wykeham and Bickley in 1932 did much to settle a regular forest staff, and the Ministry of Labour Camps at Dalby and Birch Hall (Langdale End) in 1935 provided men who were engaged almost entirely on road making and draining on the adjacent areas of Dalby, Staindale, Wykeham and Harwood Dale.

Labour came by bicycle to such places as Low Dalby and Northmoor (Wykeham); from then it was necessary to walk. Not until the development of the roads in 1948 was transport used, and now the current practice is to transport most men from the villages to the place of work.

Labour for the relatively isolated area of Bickley has never been easy, and the early planting programmes were carried out by men from Wykeham, some of whom walked from as far away as Snainton and Ebberston. Small numbers also came from Scarborough.

During the war years the labour position was relieved to a great extent by the provision of prisoners of war, at first Italian and later German, billetted in Thornton Dale and transported by lorry. With their repatriation soon after the war, and the expansion of the forest programmes, labour shortages were apparent for some time, but the Forest Workers' Training Scheme helped to some extent, particularly round Langdale.

To some extent, labour staffs have been interchangeable throughout the District, but this is becoming less necessary now that work programmes are becoming more constant, and with the planting up of most of the open moorland. The present staff of 130 men should be adequate for the next few years; the expansion of this staff will depend greatly on the sale of standing thinnings.

SILVICULTURE

General Description of the Land Acquired

The land acquired by the Forestry Commission in this district falls into two main divisions

(i) Dale Land

(ii) Moorland

(a) Low Moors 600 ft. - 750 ft.

(b) High moors. None above 813 ft. on land acquired, but up to 1400 ft. in the North Yorkshire moors as a whole.

(i) Dale land This could be planted with fair assurance of success from observation of existing stands. Douglas fir and Japanese larch were the main species planted. Excellent stands of European larch were seen at Helmsley on similar land, and this encouraged the assumption that this species would grow. It was therefore planted in the dale land pure and in mixture, in the early years, but has not proved a success and it is now realised that the use of this species is a mistake in this district.

(ii) Moorland There was little evidence to show what species would grow, wide surveys of the Cleveland hills showed only a poor stunted type of Scots pine on the moorland areas, and there was not enough Corsican pine to judge the possibilities of this species. Scots pine was the main species in fact selected for planting in the early years on the moorland, though in 1922-24 144 acres of Sitka spruce and 58 acres of Norway spruce were planted as pure crops on the open moorland at 750 ft. elevation (These spruce crops are still in check in 1949).

Choice of Species

Scots pine.

The capacity of this species was based on existing crops on the untreated soil, which did not show much promise. Now, with results apparent from planting on ploughed soils, a

very different assessment can be made. Cultivation has had a marked effect on Scots pine, the effect of medium ploughing (P.38-42) compared with early hand cultivation being more marked than the difference between R.L.R. and medium ploughing though it is still early to assess the latter.

Corsican pine.

This pine grows so rapidly on good sites cultivated with R.L.R. plough that there is some risk of wind-blow in trees 5-10 years old. Trees have had to be staked in exposed sites to prevent this. Great caution was exercised in the use of this species on the moorland owing to the experience in Wales, where Brunchorstia did considerable damage in plantations above 1000 ft. Now it has safely been grown in Allerston up to 800 ft.

Pinus contorta.

The use of this species is still in the experimental stage, particularly as regards the race to use, and the utilisation of the timber. It will grow on soils where other species cannot be established, but it is likely to have a limited application only.

Japanese larch.

There were equal doubts about this species on the moorland, and early plantings on ground prepared by hand were not successful. Again the experiments at Wykeham have shewn the very different capacity of this species on moorland which has been mechanically cultivated.

Medium ploughing so improved the early rate of growth of Japanese larch on the moorland that even at 800 ft. it can be thinned at 14 years of age to yield 170 cu. ft. in the first thinning. Results on R.L.R. ploughing are likely to be an improvement on this.

The falling off of growth increment in the Japanese larch planted in the dales and on old woodland has not yet become apparent. The oldest stand is now 27 years of age.

Aira flexuosa has come in at the 2nd and 3rd thinnings as a mat on the forest floor, but whether, on further opening of the canopy, this will yield to a more varied ground flora, remains to be seen.

Japanese larch is a shallow rooting species and evidence elsewhere leads to the possibility that growth will fall off when the trees are about 30 years old. The problem then is how to treat the crop. Three courses are open.

i. To clear fell. This is contrary to policy and will lead to exposure of the soil.

ii. To underplant after a heavy 3rd or 4th thinning.

iii. Carry out normal thinning.

A further extension of experiments is required now to establish how, when, where and with what species and stocking to underplant Japanese larch. Douglas fir shows most promise to date. Sitka spruce is useless for underplanting.

Spruces.

There was doubt as to the possibility of establishing these; early experiments showed greater success with Sitka than with Norway on heather land, but the original turf planting methods, successful in the peat areas in other parts of the country were a failure on the dry moorland in this district. The species were planted pure, and it was only when results from experiments began to materialise, towards 1940, that the possibility of establishing Sitka spruce in mixture with Scots pine on cultivated ground became apparent.

Sitka spruce.

The failure of this species planted pure on the heather without cultivation is very evident. An example is the 144 acres of Sitka spruce planted in 1922-24 at 750 ft. on the moorland at the head of the dales. This crop is still, in 1949, after 27 years growth, being weeded. 50% of the plants are not out of the heather, which is nowhere suppressed; and only a few scattered clumps have reached a rather unhealthy pole stage. As a pure crop on the moorland,

it only succeeds in the small areas of deeper peat and the moist flushes which occur here and there on the moors. These are indicated in the vegetation by Molinia and other grasses and the absence of heather. It will grow on the bracken and grass slopes in the dales, though not with remarkable vigour. A typical example is the P.22 Sitka spruce plantations in Blackhouse. Of this 16 acre plot, 5 acres were on marshy ground and now show outstanding growth. The remainder is on dry calcareous grit, heather covered and the trees here have not yet suppressed the heather or closed canopy. This appears to hold good for the pure crop whatever the cultivation. The inference is that Sitka spruce as a pure crop should be confined to those well-defined patches on the moors where deep moist peat is present.

The aphis attack is thought to be transitory. Sitka is a species that grows best in regions of high rainfall, and butt rot must be watched for in this district of dry, shallow soils.

Norway spruce.

The general failure of this species on heather ground was referred to by the Chairman. It is growing well in the dale bottoms.

Douglas fir.

After early failure, this species is doing well in the dales, and there are many examples, in addition to that pointed out by the Chairman, in Flaxdale, where Scots pine used as a beat-up has successfully nursed this species into vigorous growth. It is still growing well as a species under-planted in failing European larch.

Tsuga.

Growth is good but the timber is liable to butt rot.

Spruce/Pine mixtures.

A Norway spruce/Scots pine mixture was planted on a considerable acreage of moorland as a 1 row 1 row mixture in P.27. Now, in 1949, only scattered Norway spruce remain and

the result is an open crop of practically pure pine.

Sitka spruce/Scots pine mixture was planted sporadically on a small scale in the 1930's but the first large scale planting of this was in P.39. Up to P.44 it was planted as an alternate row mixture, occasionally 2 rows of spruce to one of pine, and on a small scale, with 3 rows of pine to one of spruce. In P.45 on R.L.R. ploughing the species were planted as a 2 row 2 row mixture and in P.49 as a 3 row 3 row mixture.

Over the greatest part of the area on which the alternate row mixture is planted, the pines have or are about to close canopy over the spruce, the majority of which, even after 10 years growth, are still not out of the heather. The spruce are in fact, in the situation of underplanted trees, and as such, from the evidence in the experimental plots, appear to have little chance of survival.

It is only in the comparatively small areas on the passage beds between the upper and lower calcareous grits, characterised by a deeper peat, an absence of pan, and indicated by a mixture of Molinia with the heather, that the spruce is showing equal vigour with the pine.

The two row alternate mixture is as yet too young to assess, but the indications are that the same factor predominates, and that in spite of the R.L.R. ploughing, it is only on the more moist passage beds that the mixture will succeed.

On the estuarine clays which occur among the calcareous grits on Harwood Dale and Langdale forests, Sitka spruce, whatever the mixture or cultivation, is yellow and sickly and overgrown by the pine. Only on the moist peats and passage beds in these forests does it look healthy.

Other mixtures.

A considerable area in 1931 was planted with Scots pine/Japanese larch/beech mixture on the moorland. The beech have all died out, but the remaining crop is reasonable for the degree of cultivation it has received (shallow ploughing).

Choice of Species on the Oolitic Limestone

The outcrop of this formation is well defined, capping the rigg tops between 500 ft. and 625 ft. elevation, and covering in all some 900 acres. The largest part of this ground, some 630 acres, was planted in the early years from 1921-26; about 300 acres were planted with pure Scots pine, 100 acres with Scots pine beaten up with Corsican pine and now a mixture of the two, 220 acres with pure Corsican pine and the remainder with Norway spruce. There was no planting on the oolite from 1927 to 1937; the 250 acres of oolite planted from 1938 to date have been practically all planted with Corsican pine (mostly of the ursuline variety), 50 acres in mixture with Norway spruce.

This oolitic outcrop is characterised by the absence of soil, the surface being covered with small stones giving way at a few inches below the surface to rounded broken rock, for about 10 ft. in depth. The vegetation is extremely sparse and altogether absent in patches. It consists of thin grasses, with scattered thorn bushes.

In the working plan for Allerston for the period 1937-46, the difficulty of growing pines on the oolite was recognised and it was laid down that Corsican pine should be planted and beech introduced after approximately 6 years, with beech as the final crop. It was not, however, until later in 1936 that the die-back of the pine was first seriously brought to notice. This was in the P.21 area above Sanddale, the crop of Scots pine then being 16 years old. Similar conditions were found to be present throughout the pines on the oolite, though Corsican pine is less seriously affected. This die-back takes the form of a yellowing of the needles on individual trees and groups; followed the next season by loss of the lower crown coupled with loss of vigour and death in the third or fourth season after the die-back has started, though the process is accelerated in a dry summer. Now in 1949, the P.21 Scots pine on the rigg between Sanddale and Hawdale resembles a devastated

area, with 75% of the crop gone or moribund in groups. A few yards away, where the oolite outcrop ends, the Scots pine on the calcareous grit and on the cornbrash is growing with full vigour and no die-back is apparent. This appears to confirm the opinion that the die-back is a system of deficiency of some essential nutrients caused by the excess of lime, and not primarily due to fungus or insects which are secondary.

It is interesting to note that on the nearby Duchy of Lancaster Pickering Estate, crops of mixed hardwoods and larch with scattered pines were raised on the bare oolite by importing soil into pits dug out of the oolite, one bucketful of soil per plant. These crops now 30 years old are healthy, though the pine has all gone.

Underplanting of beech in the pines on the oolite started on a very small scale in 1935, but it was not until 1942 that, as a result of instructions from the Chairman, this was carried out as a systematic operation. 65% of the older age classes of pine remain to be underplanted, and must be done soon or the cover will not be adequate nor the produce to be removed marketable. The whole of the younger age group (250 acres) remains to be underplanted in spite of the prescriptions of the 1937-46 working plan.

A special working plan to cover the oolitic outcrop is under preparation.

Planting.

(a) Methods of Planting

The problem was tackled in 1924 by Dr. H.M. Steven, who laid out an experimental plot of 10 acres north of Jingleby in Compartment 132. This plot was planted with the following species in bands of 4 rows each across the area, which was heather covered:-

European larch, Japanese larch, Douglas fir,
Corsican pine, Scots pine, Pinus ponderosa,
Norway spruce, Sitka spruce.

Planting was by mattock after shallow single furrow ploughing, and it was soon found that the best results, from all species, were obtained where the soil had been most disturbed, e.g. where banks were planted. Sitka spruce showed more promise than Norway spruce under these conditions. Scots pine, mattock planted did not do too well.

(b) Rate of Planting

From 1921-1927 the average area planted per year was 440 acres; thereafter it was reduced to 150 acres because there was uncertainty about the best soil cultivation methods and the best species to plant. From 1933 onwards, the planting rate increased and it is now approximately 500 acres per annum. By 1954 all available ground in this district will have been planted, unless the area is extended by new acquisitions.

Ploughing

These early experiments lead to the conclusion that success in planting the moorland depended upon:-

(i) Stirring up the soil for the roots to ramify.

(ii) Breaking the hard pan.

In 1928 ploughing was started to achieve these objects (there had been some shallow ploughing with an agricultural plough to establish the first crops in P.21 and P.22. These were mainly on the oolite, with sparse vegetation, and ploughing on the heather did not start until 1928). The first ploughs used were the normal agricultural type, which disturbed perhaps 3 in. of the soil but did not break the pan. In 1930 a tractor, one of Oldings caterpillar tractors equivalent to a D.2 was used to draw the plough.

The depth of cultivation was not considered sufficient and in 1931, as a result of a visit to High Dalby, by the Chairman, Sir John Stirling Maxwell, Bt., and Mr. O.J. Sangar, Ransomes were asked to produce a plough for the purpose. This they did by adding strengthening to their agricultural plough, but this

was continually breaking down and shallow ploughing had to be reverted to.

The Oliver double-furrow plough, first used in 1932, did good work, but failed to rupture the pan.

Ransomes then produced a solotrac plough, which was slight improvement on their earlier one. The above ploughs were in use over the period 1932-1938.

The next development, in 1938, was subsoiling with the Killifer subsoiler to break the pan, after ploughing to a medium depth with the Oliver plough, both pulled by one tractor. This had the desired result of breaking the pan and disturbing the soil, but the method was cumbersome and results on the plants not entirely satisfactory, though a great improvement on all previous methods.

On 19th July 1942 the Chairman saw a demonstration at Broxa (Langdale) of the Massey-Harris No. 3. Grub Breaker plough, which turned out a two foot wide furrow at a maximum depth of 16 in. He considered that this, though fulfilling the functions he required, was not a strong enough implement for the purpose and ordered the Mechanical Equipments Officer to design with Russels of Kirbymoorside a plough which would fulfil the functions of the Killifer subsoiler and a plough in one implement. It should be strong enough to stall a D 4 tractor, and must plough to 18 in.

The result was the R.L.R. forestry plough, which was first used in 1943 at Wykeham and has been used ever since with only slight modification, producing the desired effect of heaping and stirring the soil and breaking the pan. At the same time it is strong enough to stand up to the roughest conditions.

The R.L.R. plough has given outstanding results. In new planting, beating up has been reduced to a fraction of what it used to be. The plough has also been used to beat up ground originally planted by hand and by this means the beat-up plants have rapidly established themselves and caught up the original plants, the breaking of the pan and the disturbance of the soil

has also benefited the original plants.

The species most benefiting from this cultivation are Scots pines and Japanese larch. The results with the Sitka spruce vary, and other factors such as the nursing effect of mixtures have as important an effect as cultivation. The increased growth of the pines and Japanese larch on R.L.R. ploughing is the most striking feature of district planting since 1943.

Suppression of heather for all species on the moorland, appears to be as important as cultivation and breaking the pan. The P.34 and P.35 areas on Staindale (mainly pine) were both ploughed 3 years before planting. The heather had re-established itself before planting and the resultant crop has still not got away, or closed canopy after 15 years growth. Areas even on shallow ploughing planted the same season as ploughing have closed canopy and suppressed the heather at an earlier stage.

In this district it is necessary to plough in summer for planting in the following autumn to enable the trees to beat the heather.

Weeding.

There was a tendency to neglect weeding on the dale land and to plant too much spruce, as indicated above, on the heather or ground which reverted to heather after cessation of grazing.

Research - Note by Research Branch.

Introduction.

The first experiment was laid down by Dr. H.M. Steven at Dalby in 1924. In 1928, by which time it had become obvious that the planting of these moorlands was by no means simple and that it was going to call for a great many experiments, a reserve of 150 acres was made available at Wykeham.

By 1941 the Wykeham area having been filled up by experiments an extension area was selected at Broxa in which subsequent work was carried out. From an earlier date (1932) it became obvious that certain parts of the moorland which could not be

ploughed, on account of rock or boulders, would require experiments of a different sort, so a few compartments at Harwood Dale forest were handed over for the purpose.

In all, the Wykeham area contains eighty experiments within the 150 acre reserve and the Broxa extension which runs to 160 acres, contains a further seventy-five trials. At Harwood Dale there are forty experiments in an area of 70 acres.

The account given below deals in turn with each of the main projects into which the experimental work falls.

Ploughing and Ground Preparation.

The first experiment was laid down in 1924 using an agricultural plough. This was not, however, the first use of ploughs for afforestation in the district as the division had ploughed old fields in oolite areas in 1921-22 and almost a century ago the local estate used a six-horse plough before planting. This first (1924) experiment, however, was not a success, though exactly why it failed so badly is not clear, the furrows were probably not deep enough to improve the surface drainage nor wide or frequent enough to smother the heather for more than a year or so; neither did they provide enough aerated soil for early rooting. The main outcome was to emphasise the need for more intensive ploughing.

Accordingly, in 1928, a most interesting experiment (6.P.28) was laid down, incorporating direct notching, patch planting, single and triple furrow, and complete ploughing, as well as the use of explosive charges at intervals to break the pan; this last treatment was quite ineffective. The plough employed turned out furrows of from three to six inches in depth, referred to now as shallow ploughing. After twenty-one years Scots and Corsican pines have reached twenty feet in height and are fully stocked with the triple furrow and complete ploughing, but are only fifteen feet fall and the crop is irregular where directly planted. Sitka spruce and Japanese larch failed except on these more intensive ploughings, where they are now ten and

twenty-one feet fall respectively. In every species there is a consistent, though generally small increase of height with intensity of preparation, the height on triple furrow always being a foot or so greater than that on single furrow but a foot or so less than that with complete ploughing.

In 1931 this experiment was followed by another using the Oliver double-furrow plough (Experiment 11 P.31). This penetrated eight to nine inches now termed "moderately deep", in comparison with the present deep ploughing produced by the R.L.R. plough. The Oliver plough was used to produce double furrow and complete ploughing. In certain areas subsoiling with a special tool was carried out as a separate operation before using the Oliver plough.

Growth has been faster in Experiment 11 than in Experiment 6 with its shallower ploughing. Thus Japanese larch has reached twenty-three and contorta pine twenty-one feet high at eighteen years old. As regards method, complete ploughing has in all cases increased the height by two to five feet compared to double furrow, while in three species out of five the double furrow with sub-soiling is in turn rather better than complete ploughing. The underground channels made by the sub-soiler still persist and the long-term effect of this treatment will be watched with great interest. This double furrow plough was used for the Wykeham experiments from 1932-39.

In 1935-38 a number of root investigations were carried out on Scots pine growing on soil cultivated by various means. The main conclusion was that the roots did not travel freely through the leached zone nor the pan, but did branch freely in the ploughed soil and deposition layer. This result served to confirm the need for intensive cultivation.

When work commenced at Broxa in 1941 the divisional plough used was a single furrow type with a subsoiler drawn behind the plough. Growth in the earlier Broxa experiments has been extremely poor. In 1943 another ploughing experiment was laid

down, this time comparing different ploughs as well as intensities. The newly developed R.L.R. plough was used for both single and complete ploughing and was also combined with subsoiling, while the divisional plough was used for shallow single and double furrows with subsoiling. Results have to date been excellent throughout this experiment, after six years Japanese larch has reached six feet, Scots pine five, Corsican pine three feet, while Sitka spruce varies from three to five feet. So far, differences between ploughing methods are not great, but are generally in favour of more complete ploughing. This excellent start has delayed the appearance of differences due to preparation method much longer than was to be expected, probably due to two things (i) the excellent nursery stock, much of it from heathland nurseries, which was used at planting and (ii) to the application of phosphate throughout the experiment. For the moment, however, there is no adequate evidence as to the relative value of these ploughing methods. Further trials at Broxa compare single furrow, double furrow and complete ploughing using the R.L.R. plough.

The most unfortunate gap in these experiments is the lack of direct comparison between the moderate deep double furrow plough with sub-soiling used in Experiment 11 at Wykeham and the deep R.L.R. ploughing as used at Broxa. Growth on both types has been good, and a direct comparison of growth rate, cost and their ultimate effect on the site would have been most valuable.

The fact remains that the relative importance of actual ploughing depth, breaking the pan and smothering the heather cannot yet be ascertained and until this is tested experimentally, the ideal type of ground preparation and hence type of plough must remain uncertain; experiments considered below suggest that, for spruce, mere smothering of the heather and the discouragement of heather gemination may be far the most important.

Species, mixtures and nursing.

The most important line of research at Allerston apart

from ploughing has been concerned with the interaction of one species upon another alongside or in mixture. There have been practically no trials of species planted in pure plots since 1928-33 during which period it was found that only pines grew where directly planted, and that Japanese larch was the fastest growing species on ploughed ground. Spruces never grew at all where directly planted and checked after a few years on ploughing. Many other species were tried and failed almost completely.

From 1932 onwards trials of broom as a nurse to Sitka spruce were laid down and have given most striking results. The broom provides early shelter, helps to suppress the heather and possibly supplies nitrogen to the spruce, but once again the fundamental cause of the effect is not known.

Then in 1939 as mentioned by the Chairman, the nursing effect of pines and larch on spruce became apparent in the ploughing experiments of 1928 and 1931, where the species, originally planted pure in small plots, were now starting to interact where they met. The most striking effect was that produced on Sitka spruce by adjacent Japanese larch. Root investigations showed that where the growth of the spruce had improved, it was rooting among the adjacent larch, under which the ground vegetation had been killed. These and other observations led in the period 1938 to 1943 to a whole series of experiments on the different lines of work which they suggested, the most important of which are:-

(a) Planting of mixtures and methods of mixing; Sitka spruce has been used as the main crop to be nursed and Japanese larch, Scots and Corsican pines as the nurses, different proportions and different arrangements have been tried. These are long term experiments from which little has yet emerged. In mixtures of an earlier date European larch is among the promising species.

(b) Use of broom alone and in combination with Scots pine to

provide short and long-term nursing. Excellent early growth has been obtained with a number of species including Douglas fir, Tsuga, beech and Lawson's cypress as well as Sitka spruce.

(c) Introduction of more tender species into existing and quite vigorous pine crops. Several attempts were made with Sitka spruce but are not as successful as had been hoped. Much better results have been obtained with the introduction of other species including Douglas fir, Tsuga and Abies sp. Recently this method has been extended to a wider range of species, and the introduction made on ploughed strips.

(d) Trials of heather killed by mulching, screefing and auto hoeing. These treatments inspired by the observation that spruce rooted freely where the heather was killed under Japanese larch, have resulted in spruces, and in one instance Lawson's cypress, coming out of check and making good growth. They serve to emphasise the great importance of heather eradication, first by ploughing at the time of planting and later by nurse species which can shade out the regenerating heather.

These experiments give the greatest hope that a far greater variety of species will soon be available for what at the present time are predominantly pine forests, though it must be realised that the ultimate success of even the Scots pine/Sitka spruce mixture, the only one used on any scale, is by no means yet certain.

Manuring.

A number of experiments from 1928 onwards have included manuring trials. The only positive result in the early years was obtained with phosphate which was usually applied as basic slag. Phosphate is an aid to good early growth of all species but benefits pines to a rather smaller extent than other species. One to two ounces of slag or ground mineral phosphate has in

recent years always been applied to species other than pine in the experiments.

Recently Dr. Crowther of Rothamsted has reopened the question of field manuring and since 1947 an extensive series of experiments has been laid down at Broxa.

Method of Planting on ploughing.

Several early experiments on the older types of ploughing were inconclusive. With the introduction of R.L.R. ploughing with its deep furrow and huge ridge, the actual position and method became important. While tests of various positions were laid down from 1945 onward the 'step' position was adopted in experiments until results were forthcoming. The step was cut into the ridge side thus avoiding the dry ridge top and the furrows which are liable to flooding, while at the same time giving shelter in the early years and allowing the roots easy access to the decaying vegetation.

Planting Stock.

Trials of different ages of planting stock of the common species have been made from time to time. In the early years transplants were generally found to be more successful, though seedlings of pines and Japanese larch were successful when slag was applied.

With the development of the heathland nursery technique came many trials comparing stock from nurseries at Wareham, Harwood Dale and elsewhere with normal planting stock from long established nurseries. The success of the heathland plants has been striking and must very largely account for the excellent experimental plantations at Broxa.

A number of other trials compare plants from different nursery manurial regimes and plants subjected to different handling or treatment prior to planting, for instance puddling or root or shoot pruning. In a large number of cases results were negative in that if the plants were fit for planting at

all such differences in treatment did not affect survival or growth. This information was of importance even though there is little to see in the actual experiments to-day.

Note on experiments at Harwood Dale.

This reserve is on ground which was unploughable at the time when the planting was carried out. With present equipment a great deal of this land could in fact have been ploughed and present policy is only to plant land that can be ploughed. Thus the Harwood Dale experiments are now of rather less interest than those elsewhere in the district, particularly as they are concerned largely with methods of planting. Losses have been high in many of the experiments and in other spruces and larches have checked or failed. The most important early trials are of the Anderson group system with intensive hand cultivation of patches.

Little new work has been done at Harwood Dale in the last ten years apart from trials of heathland nursery planting stock and trials of Sitka spruce in mixture, both on lines similar to the trials at Wykeham and with comparable results.

Other experimental work.

In addition to the work already described there are at Allerston three provenance trials containing a number of plots of the same species raised from seed of different origin, two of these, at Wykeham and Harwood Dale are of Pinus contorta and the third at Harwood Dale is of Japanese and hybrid larches.

Work on the raising of plants from seed in small temporary heathland nurseries at Allerston commenced in 1934. In 1941 a very successful heathland nursery was established at Harwood Dale, thus paving the way for the 72 acres of Conservancy nursery of this type now in use in the district.

In recent years much of the field work of the Oxford Soil party has been carried out at Allerston and a small number of experiments have been laid out to their design in order to aid research in the more fundamental aspects of the site and their

relation to tree growth on these moorlands.

A great proportion of the work carried out in recent years has been concerned with the nursery extensions and field manuring experiments for Dr. Crowther.

Also there has been a series of experiments on the position of planting on plough furrows and a most successful series of direct sowings with Scots pine and Sitka spruce using complete fertilizers. Other species also show promise.

Summary.

The group of forests forming the Allerston area contain one of the largest concentrations of experimental work in the country. The trials cover all phases in the establishment of plantations on the heaths which are a dominant feature of this area. The main results obtained have been in the preparation of the ground for planting by ploughing, improved methods having led to greatly increased survival and growth and increased the range of species available. It is possible that still further improvements may be made in the method of ploughing. Interaction of species in mixture has been a major study and the use of nurses may still further extend the number of species. A large number of experiments deal with forest manuring, method of planting and type and treatment of planting stock. The results most widely applied at the present time are those concerned with the raising and use of heathland stock and the application of phosphate at planting. Recently sowing has been found to be a promising method of establishment on ploughed ground.

Fundamental studies on the soil and its relation to tree growth are at present being carried out at Allerston and there have been already a number of investigations into root development

It may be concluded that the experimental work has led to very great changes in technique in the area and also improved greatly the value of these heaths for afforestation.

"J.W.L.Z."

April, 1950.

Future Problems.

This district has a low rainfall, 22-28 in. and a light porous soil. The problem will be to maintain the soil fertility and to keep the rate of growth going.

1. Choice of Species.

From this survey covering the whole of Allerston district it follows that the selection of species on the moorland, cultivated with R.L.R. plough should be:-

(a) Pure heather (Calcareous grits with pan) Scots or Corsican pine, with blocks of Japanese larch as a variant and for fire protection.

(b) Heather with bracken (Indicative of aeration and broken or with no pan) Japanese larch or pine/spruce mixture.

(c) Heather with Molinia and grasses (A moist peat, indicative of passage bed material) pine/spruce mixture, 2 or 3 alternate rows.

(d) Molinia, Juncus and other grasses, no heather (Deep moist peat) pine/Sitka spruce.

On pure heather ground where no cultivation is possible owing to steepness, as on the scarps where the plateaux fold over into the dales, Scots pine is the only species likely to show reasonable growth.

Oolite outcrop. Beech should be established on the oolitic outcrop with Corsican pine as nurse, planting the beech and pine together on new planting and bringing in the beech as early as possible in pine crops already established.

Beech should also be planted along ride sides on the moorland.

Red oak, Norway maple and sycamore should be established on ridesides and in plantations on the moorland in small quantities for amenity and soil improvement in association with pine nurses.

Birch has at present little value as timber. It is a

soil improver only. Plenty of birch will establish itself in the second rotation after a pine crop and can be brought up with the crop as a soil improver.

2. Natural Regeneration.

This is a problem which will have increasing prominence as our crops grow towards maturity and the aim should be to establish it. Experiments are needed as to when to start opening the canopy to secure it, and how best to do this. The continental practice of a long regeneration period of 40 years or more will result in uneven aged woods to be managed on the selection system, but in England rate of growth is such that crops, though uneven aged tend to become of even height.

The securing of natural regeneration and methods by which it should be done in various species on different sites must occupy the attention of all foresters.

3. New Acquisitions.

On new acquisitions in the north Yorkshire Moors such as Keldy, the lessons learnt at Allerston must be applied to avoid mistakes made there and to benefit by the experience in that district in which so much pioneer work was done.

Observations by Conservator and State Forest Officer.

1. Soil cultivation

It is essential to cultivate the soil in such a manner that the pan is broken and the Calluna is kept in check for a few years.

To date the R.L.R. plough is the most economic method of doing this but cheaper machines may be found to do the same work and to leave a surface more suitable for extraction.

2. Selection and Distribution of Species.

Scots pine. It may well be that the Scots pine on the moorland soil type will give a much better yield per acre than was anticipated in the early days, but snow break is a danger.

Corsican pine grows well and to date there is no sign of Brunchorstia below 800 ft. elevation. Neither Norway nor Sitka spruce does well in this area of comparatively low rainfall and light sandy soil, except in the comparatively small areas of deep peat, and it would be wiser to confine them to these areas.

Japanese larch. As a result of improved methods of soil cultivation this species is growing very well and should be planted more extensively in the future. On the basis of the recently revised yield tables, it may well be that it will have a much longer rotation than was originally anticipated.

Douglas fir. This species grows well at the bottoms of slopes (free from frost) where the soil is reasonably deep and it should be planted more extensively on such areas.

Beech. On oolitic areas, beech should be planted. If given a chance in its early stages beech will grow reasonably well over a large part of the area. It should be planted in groups throughout conifer crops and given head-room by cutting back conifers where necessary.

Consideration should be given in trying out other species such as Tsuga, sycamore, red oak and Norway maple, to be brought up in groups or strips in the older conifer areas, particularly Japanese larch, as such areas will be invaluable as a guide to the future management of new acquisitions in the Cleveland area.

W. Forsyth
S.F.O.

C.A. Connell.
Conservator.

16th May, 1950.

APPENDIX I.

Notes from Inspection Reports 1931 - 1949.

Date	Inspecting Officers.
Sept. 1930	Mr. W.L. Taylor, Assistant Commissioner
Sept. 1932	British Association
March 1933	Mr. W.L. Taylor, Assistant Commissioner
April 1933	Mr. O.J. Sangar
May 1933	Chairman
Nov. 1933	Mr. W.L. Taylor, Assistant Commissioner
Jan. 1935	Assistant Commissioner
July 1935	Sir Alexander Rodger
Sept. 1936	Mr. W.L. Taylor, Assistant Commissioner
July 1937	Chairman
Oct. 1937	Mr. W.L. Taylor, Assistant Commissioner
May 1939	The Commissioners
April 1941	Mr. A.P. Long, Acting/Assistant Commissioner
June 1942	ditto
July 1942	Chairman with Advisory Committee on Forest Research.
Nov. 1942	Mr. A.P. Long, Acting/Assistant Commissioner
July 1943	ditto
Aug. 1943	Mr. W.L. Taylor
July 1944	Chairman
Dec. 1946	Mr. C.A. Connell, Conservator State Forests
Aug. 1947	Mr. A.H. Gosling, Deputy Director General
Aug. 1947	Chairman
March 1948	Mr. C.A. Connell, Conservator State Forests
March 1949	Mr. O.J. Sangar, Director; and National Committee (England)

From 1921 to 1927 the average annual planting programme in the main Allerston block was 440 acres per year. This was reduced in 1927 to 150 acres, as the dangers of such rapid planting of ground of unknown possibilities became apparent.

In 1932 no clear planting was done, and the whole staff employed on maintenance of existing plantations.

In 1933 Mr. O.J. Sangar was deputed by the Chairman to carry out a critical survey of all the plantations at Allerston (including Wykeham and Bickley) and as a result of his report, a "repair" plan was drawn up to ensure maintenance of and attention to a considerable acreage of plantations the success of establishment of which was doubtful.

As early as 1933, when inspecting the pines on the oolite above Sanddale, the Chairman advised the introduction of beech into gaps in the crop (this was before the dieback started) using the surrounding pines as nurses with the idea of eventually converting the plantations into a hardwood crop. This advice was not followed on any large scale until some ten years later when the die-back had come in and was causing serious concern.

In his inspection in September 1936 Mr. W.L. Taylor concluded that on present evidence the whole of the moorland and much of the dale-land is pine ground, judging by the failure up to date of Sitka spruce on those sites. He also advocated a certain mixture of hardwoods such as birch where these could be established.

During the inspection by the Commissioners in May, 1939 of the P22 Japanese larch at Blackhouse the Chairman raised the point of underplanting this species, the future of which, to timber size, he regarded as uncertain. This originated the experimental underplanting of Japanese and European larch in Housedale, and has direct bearing on his remarks on this subject in 1949. During this visit too, the nursing effects of Japanese larch and pines on Sitka spruce in the Wykeham experiments were first noted, which lead later to an extensive area of moorland being planted with the Sitka spruce/Scots pine mixture.

In July 1942 when the Advisory Committee on Forest Research visited Allerston, the failure of pine on the oolite was

discussed. Chemical analysis of the needles of moribund trees has shown a deficiency of manganese; Professor Priestley of Leeds University suggested that death was due to the immobility of certain ions in a highly alkaline medium such as occurs on the oolite. The only solution appeared to be to reduce the alkalinity of the soil by the introduction of humus forming trees such as beech and other hardwoods.

In his inspection in July 1944, the Chairman drew attention to the probable under-assessment of the moorland as a medium for the production of pines: the great effect of deep ploughing could not have been foreseen in the early years.

Throughout the inspections from 1930 to 1947 there is recurrent reference to the pure spruce areas on the moorland, planted in 1921-25. Various treatments such as trenching by hand and throwing the soil round the plants and vigorous heather weeding were suggested and carried out; but though the plants survived, no noticeable invigoration resulted. In 1936 part of this area, in Compartments 79 and 80, was ploughed out and replanted with Scots pine which has in 1949 closed canopy and is growing well. The remainder is still as backward as ever. The R.L.R. plough is to be taken through the area in 1949, ploughing among existing trees, and the crop beaten up with Scots pine and Japanese larch on the ploughing which should also stimulate the spruces which remain.

In his inspection in May 1949 with the National Committee for England, the main points raised by the Chairman were the underplanting of Japanese larch on a large experimental basis, and the preparation of a comprehensive working plan for the conversion of the pine plantations on the oolite into hardwoods by the introduction of beech. This should take place at such a stage that the pine thinnings removed when the necessity for giving the underplanted beech more light arises, are in a marketable condition i.e. <u>before</u> they have suffered die-back.

HISTORY OF ALLERSTON FOREST.

APPENDIX II.

Record of Supervisory Staff.

Planting started in 1921 on the riggs above Sanddale. The Officers in executive control of the district from its opening to date have been as follows:-

Conservators

1946 - 1947 R.E. Fossey

1947 - 1950 G.J.L. Batters

Divisional Officers

1921 - 1927 A.P. Long

1927 - 1939 A.D. Hopkinson

1939 - 1948 R.E. Fossey

1948 to date W. Forsyth

District Officers

1925 - 1926 G.B. Ryle

1926 - 1933 A.H.H. Ross

1933 - 1939 R.E. Fossey

1939 - 1947 A. Paterson

1947 - 1948 J.B. Stocks

1948 - 1949 P.F. Garthwaite

T.E. Anderson has been Head Forester since 1933 with a break during the war years when he was seconded to the Timber Production Department.

APPENDIX III.

Notes by Head Forester T.E. Anderson.

1. Ploughing.

The first ploughing at Allerston was actually done in P.21; this was very shallow and done with a Fordson tractor.

It was not until the end of 1930 that the Ransome semi-deep ploughing was introduced. A small area of P.30 was cultivated by this machine and all ground fit to plough was thereafter treated.

2. Choice of Species.

From P.28 to P.30 20-25% of beech was planted on the moorland in mixture with pines. These have practically all died out but I know quite definitely that the cause of death was not due to over-topping and over-shading by the conifers. When I came to Allerston the pines were 2 ft - 3 ft. high on these areas and no beech were left then. The cause of the beech failure was exposure and unsuitability of soil.

Japanese larch.

Japanese larch should be planted more extensively in the future, but whether it is best as a pure crop or in mixture with pines is an open question.

Douglas fir.

My own opinion is that we should go slow in planting Douglas fir in this part of the country and such planting should be only on proved good soils.

Beech.

On quite a lot of the oolite areas beech should be planted to make a complete crop, and only on marginal oolite or where Corsican pine are already growing, or when the plantations are less than 12 years old should group planting be resorted to. In no cases should head room be given the beech by cutting back the conifers. If the beech requires more

light and room then thinning should be the method to bring this about. I think that in time underplanting of Japanese larch will have to be considered, not as an experiment but on a large scale.

3. Brunchorstia.

I am of the opinion that there are definite signs of Brunchorstia below 800 ft. elevation - Compartments 16 and 21, for instance - at Dalby.

4. Notes on inspections made by Officers from Headquarters.

The dying back of conifers was first noted in 1936 at Dalby.

Many thousands of beech were planted at Dalby on oolite from 1935 onwards, not because of the pines dying off, but mainly to fill up gaps.

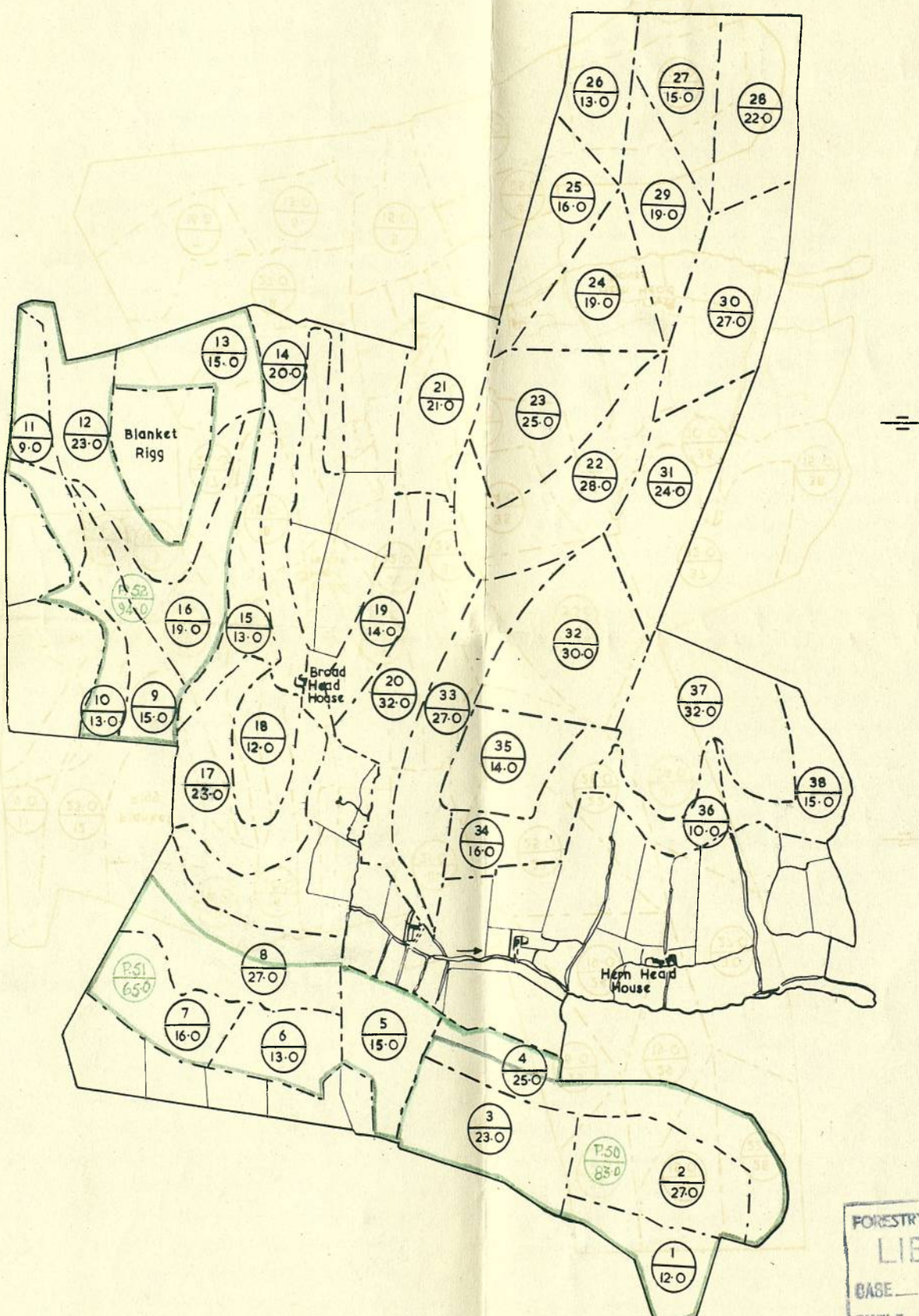
As regards the nursing effects of Japanese larch and Scots pine on Sitka spruce at the Wykeham experiments, it is I believe quite obvious that other treatment was in part responsible for the growth of the Sitka spruce. Such treatment is quite outside the realm of economic forestry in the field.

What happens at Allerston will not be a very safe guide for the management of new acquisitions in the Cleveland areas, for the reason that the soil formations are totally different in that part of Yorkshire from those obtaining here at Allerston.

"T.E. Anderson".

ALLERSTON (WYKEHAM)

Wydale Section



Scale:- Six Inches to One Mile

Yorks. 76 S.E. & 92 N.E.

10 5 0 10 20 30 40 50 60 70 80 Chains

0 1/4 1/2 3/4 1 Mile

— ALLERSTON. W.S.III. —

YORKS 76E.

N

Noddle Farm

Bickley Gate House

Deepdale House

Dorncombe

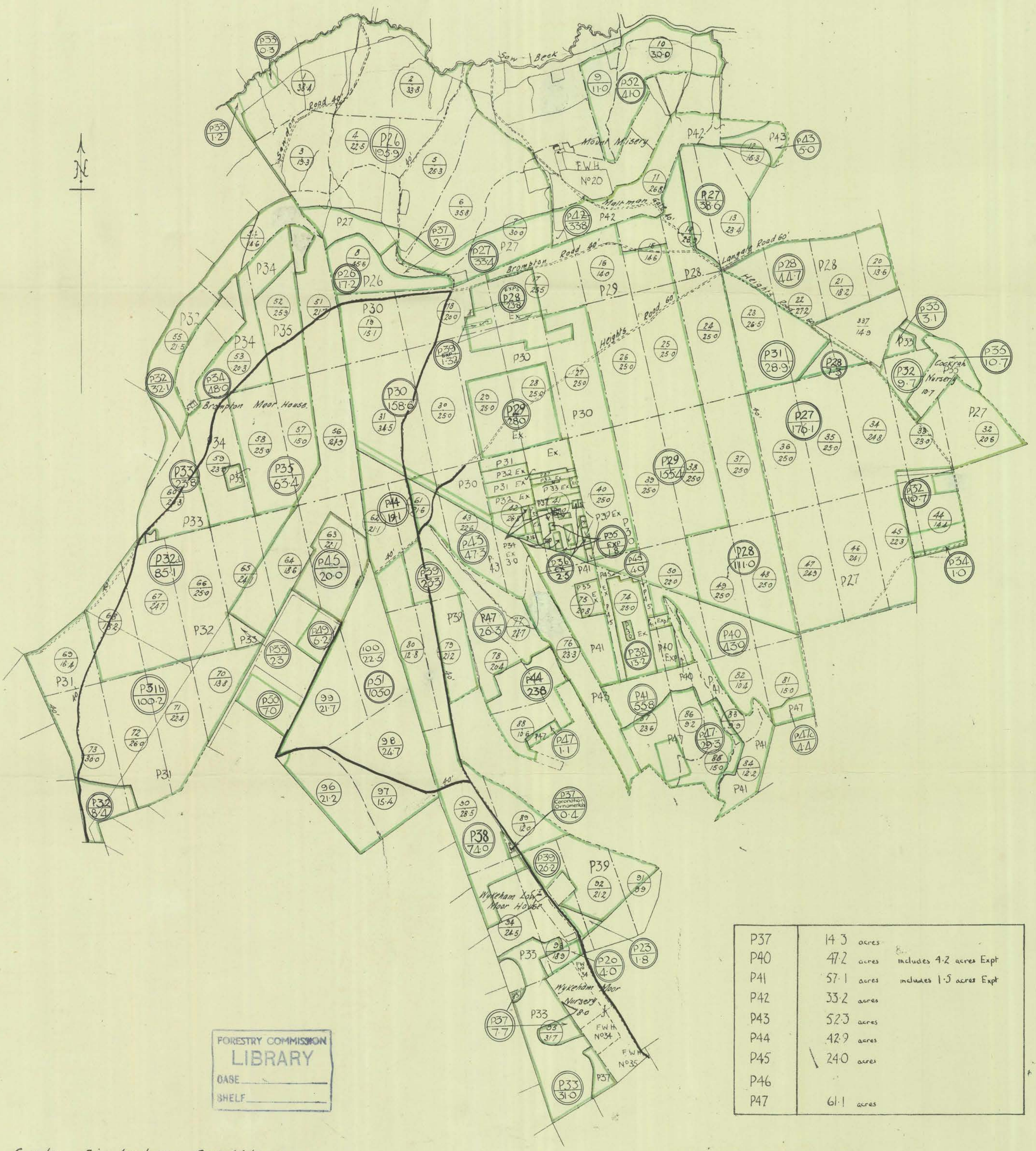
Backleys House

1·648 acres sold to Mrs. Rowntree 3/1/28.

Scale:- 6" = 1 Mile.

ALLERSTON W.S. II.

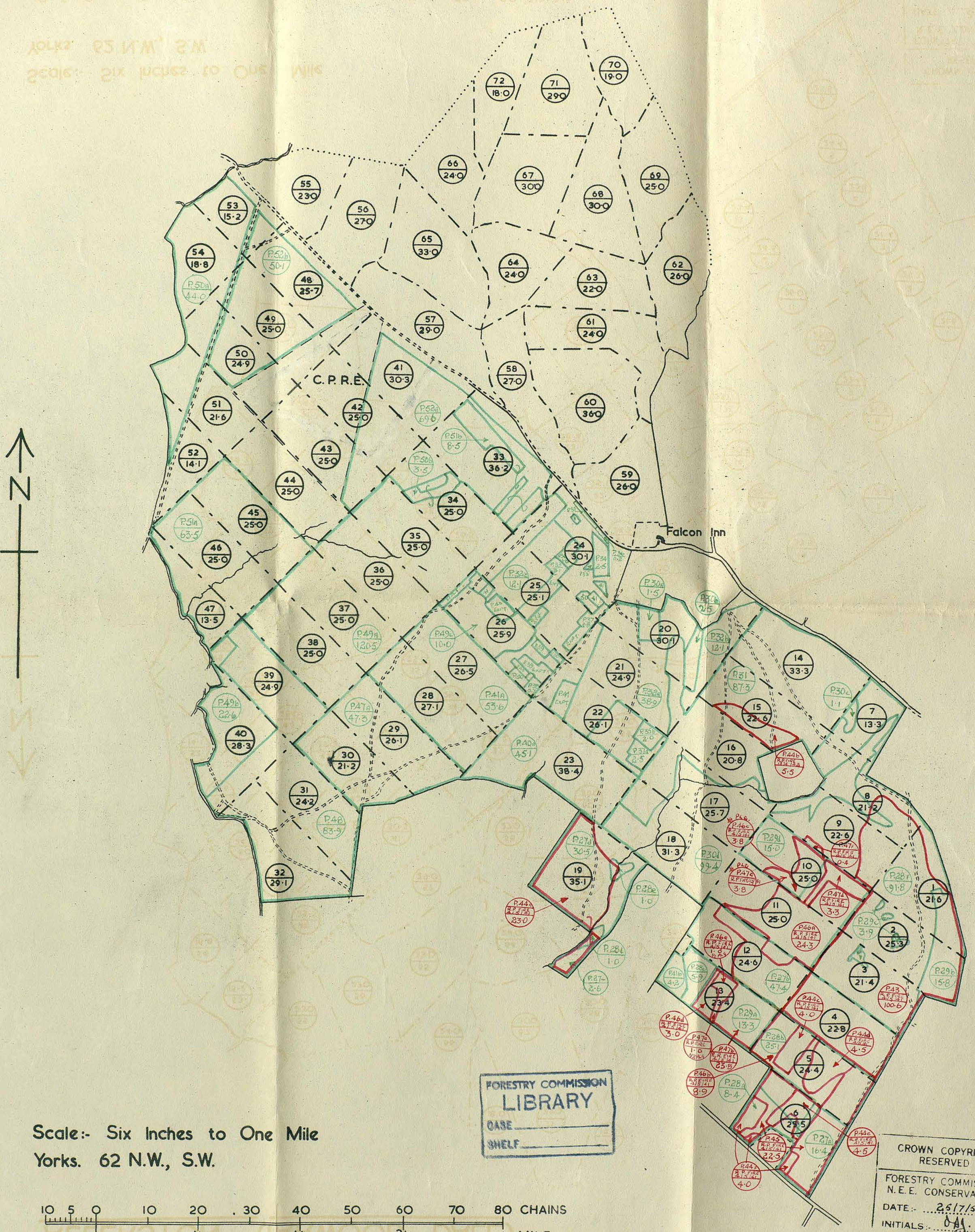
Yorks. 76 SE. 77 SW.



P37	14·3 acres	
P40	47·2 acres	includes 4·2 acres Expt
P41	57·1 acres	includes 1·5 acres Expt
P42	33·2 acres	
P43	52·3 acres	
P44	42·9 acres	
P45	24·0 acres	
P46		
P47	61·1 acres	

Scale:- Six Inches : One Mile.

ALLERSTON (HARWOOD DALE)



Scale:- Six Inches to One Mile

Yorks. 62 N.W., S.W.

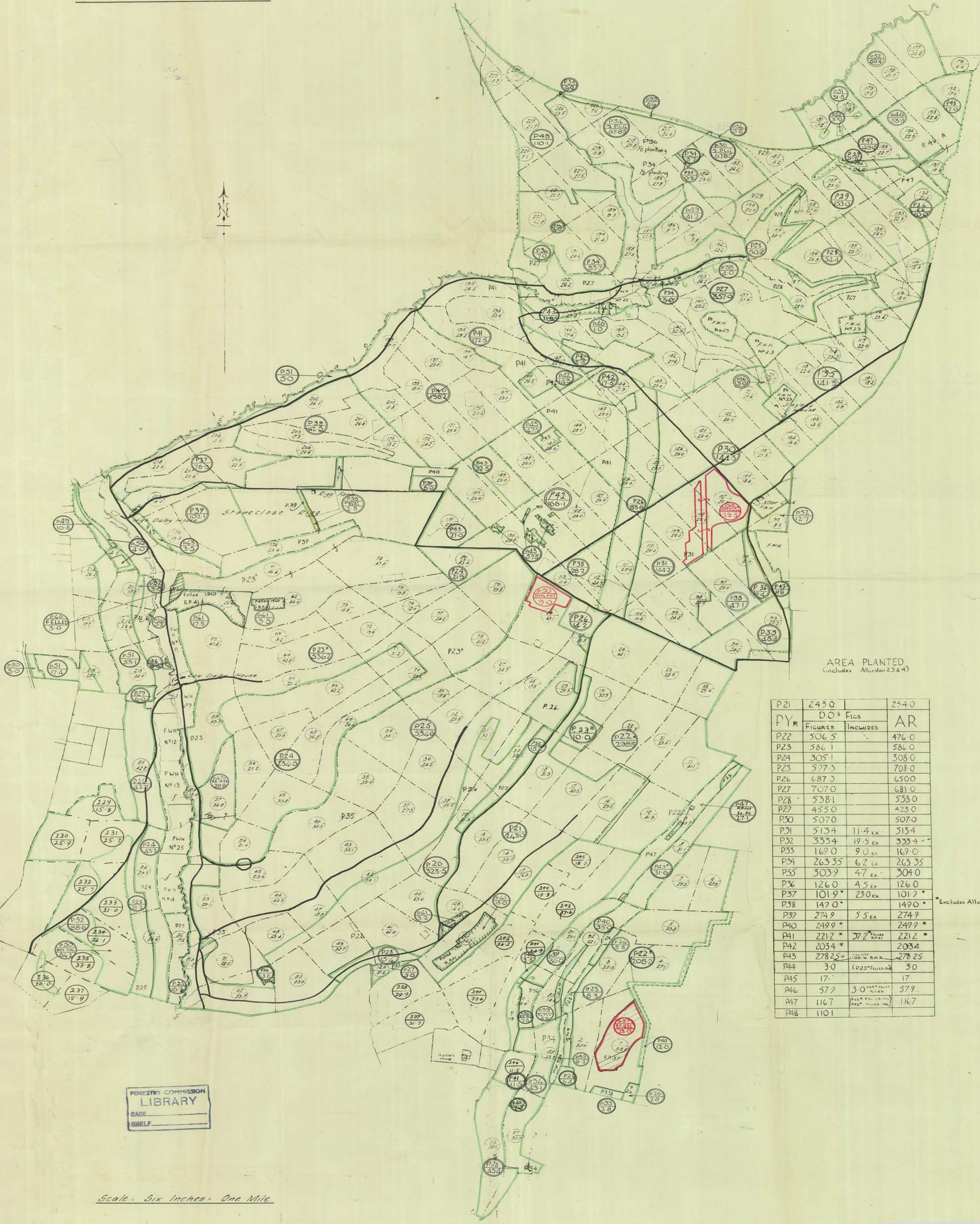
10 5 0 10 20 30 40 50 60 70 80 CHAINS

0 1/4 1/2 3/4 1 MILE

FORESTRY COMMISSION
N. E. E. CONSERVANCY
DATE:- 25/7/51
INITIALS:- D.M.

— ALLERSTON W.S.I. —

Yorks. 76 all, 92 W.



AREA PLANTED
(includes Allerston 2,3 & 4)

P21	243.0		254.0
PYR	D.O's Figs		AR
	Figures	Includes	
P22	506.5		476.0
P23	586.1		586.0
P24	305.1		308.0
P25	597.3		708.0
P26	687.3		650.0
P27	707.0		681.0
P28	538.1		538.0
P29	455.0		423.0
P30	507.0		507.0
P31	513.4	11.4 EX	513.4
P32	333.4	19.5 EX	333.4
P33	169.0	9.0 EX	169.0
P34	263.35	6.2 EX	263.35
P35	303.9	4.7 EX	304.0
P36	126.0	4.5 EX	126.0
P37	101.9 *	23.0 EX	101.9 *
P38	147.0 *		149.0 *
P39	274.9	5.5 EX	274.9
P40	249.9 *		249.9 *
P41	221.2 *	37.2 * Felled RP41	221.2 *
P42	203.4 *		203.4
P43	278.25 *	Includes 100.6 B.A.R.	278.25
P44	3.0	(P25A Felled 1940)	3.0
P45	17.·		17
P46	57.9	3.0 P23A Felled RP46	57.9
P47	116.7	{P22A Felled 1940} {P23A Felled 1940}	116.7
P48	110.1		

* Excludes Allerston 2,3 & 4

Scale – Six Inches = One Mile