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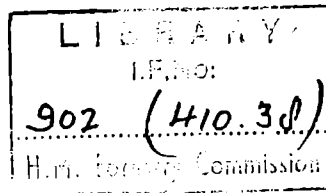
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HISTORY
OF
REDESDALE

FOREST
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FORESTRY COMMISSION

HISTORY

of

REDESDALE FOREST

1932 - 1951

NORTH EAST (ENGLAND) CONSERVANCY

HISTORY OF REDESDALE FOREST

	<u>Contents</u>	<u>Page</u>
<u>GENERAL DESCRIPTION OF THE FOREST</u>	1
Situation and Name	1
Area and Utilisation	1
Physiography	4
Geology and Soils	5
Vegetation	6
Meteorology	8
Risks and Protection	9
Roads	12
Labour	14
 <u>SILVICULTURE</u>	 15
Preparation of Ground	15
Choice of Species	16
Planting	19
Beating up	20
Weeding	21
Rates of Growth	22
 <u>APPENDICES</u>		
I Notes from Inspection Reports	25
II Record of Supervisory Staff	28
III Other notes of interest	29
IV Map of the Forest		

HISTORY OF REDESDALE FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation and Name

Redesdale Forest in the County of Northumberland lies immediately south of the Anglo-Scottish border and about fifteen miles north-east of the junction of the Northumberland - Cumberland boundary with Scotland. It straddles the main road from Newcastle to Jedburgh (via Otterburn). The River Rede, a tributary of the North Tyne, runs through the forest area roughly parallel to the road. A few miles to the north-east lies the main block of the Cheviot Hills.

The name is historic, for the present area and the surrounding ground, much of which has been disafforested in the past, has long been known as Redesdale.

Area and Utilisation

Redesdale consists of a main block with one outlier two or three miles to the west of Stewart Shields and Hillock. The planted area at the end of F.Y.51 was some 8300 acres and the eventual planted area from acquisitions already in hand will be in the region of 11,500 acres. It is hoped to reach this target by F.Y.56. There is some possibility of additional acquisitions.

More exact details of the utilisation of land and the farms concerned may be obtained from Table I. The greater part of the area was obtained in two or three major purchases. Thus the large Catcleugh block in the north formed part of the original Kielder purchase. Between four and five thousand acres comprising Stewart Shields, Byrness, Raw and Cottonshopeburn Foot farms were obtained as a block from the late Sir James Marr Bt. and later purchases from the same source brought in Blakehope farm, Rookan farm and Blackblakehope.

This was primarily a sheep rearing country before afforestation and outside the forest areas this is still the major agricultural occupation. The sheep most frequently seen are Blackfaced and Cheviot but there are some Swaledales. A few cattle are reared on the better pastures and it seems that cattle grazing may become more important as agricultural practice becomes more intensive.

The system of resuming land for planting is arranged so that tenants have ample time to arrange for the sale of their stock at one of the recognised market towns although sometimes the stock may be taken over as well. Intention to resume land is normally notified to the tenant two years before planting. This enables ploughing and fencing to be carried out in the summer before planting. In determining the final utilisation of land every effort is made to connect unplatable areas to permanent farms or holdings by means of grazing strips, thus ensuring complete utilisation and a measure of fire protection.

The sporting is becoming of increasing value. Grouse and blackgame are plentiful and the former maintain themselves on the higher, unplatable heather areas. Pheasants rapidly increase in numbers as the cover increases and the roe deer resists all efforts to reduce its number. There has always been trout in the Rede but salmon are rarely seen nowadays. There have been no difficulties with the resumption and planting of ground as far as the sporting interests are concerned, but it is essential for co-operation regarding heather and grass burning before planting.

Acquisition details and land utilisation are given in the following tables (Tables I and II).

REDESDALE

TABLE I

(1) From	(2) By	(3) Date	(4) Plantations Acquired	(5) Plantable excl. Col. f.	(6) Nurseries	(7) Agricultural	(8) R. W. H.	(9) Unplantable excl. Col. f.	(10) Other Land				Total			
									Land Permanently Transferred		Land Temporarily Transferred			Land not Transferred		
									Description	Acreege	Description	Acreege				
Part Kielder Estate from The Duke of Northumberland	Purchase	31/3/32							Sale of Dudlees	1,095	Elishaw Transfer to Ministry of Agriculture 13/5/48	332			18,722	
Redesdale (1) from W. B. Marr and R. S. Middleton	Purchase	20/3/33									Woolaw Farm Transfer to Ministry of Agriculture 13/5/49	705	28			
Redesdale (2) from W. B. Marr and R. S. Middleton	Purchase	30/10/37	16	13,242	-	3,164	3	137								
Rookan Farm from J. and J. S. Brodie	Purchase	12/10/38														
Byrness Vicarage from The Ecclesiastical Commissioners	Purchase	6/10/41	16	13,242	-	3,164	3	137						1,037		28
														1,095		18,722

R E D E S D A L E

TABLE II

(a) Plantations:-			
Acquired			16 acres
Formed by Commission			8,295 "
(b) In hand, awaiting planting			
Blanks after felling			-
Burnt areas			-
Other land			4,947 acres
(c) Nurseries			-
(d) Agricultural			
Number of tenancies	12	Area	3,164 acres
(e) F.W.H. Number 11		Area	3 "
(f) Unplantable land in hand			137 "
(g) Other land			
Land transferred to Ministry of Agriculture, etc.			2,132 "
Streams, lakes, etc.			28 "
		<u>Total</u>	<u>18,722 acres</u>

Topography

The principal feature of the forest is the broad valley of the Rede running in a south easterly direction from its source near the Scottish border. This is joined from north and south by a series of valleys carrying such tributaries as the Blakehope Burn and Cottonshope Burn. There is thus a great variety of aspects and exposures to be considered. Except in limited areas slopes are not steep although it can be seen that Redesdale forms an intermediate topographical form between the more rounded rolling hills of Kielder and Wark forests and the steeper slopes of Cheviotland. The general topographical form of the hills is a fairly steep well drained slope rising to a rocky outcrop or small crag followed by a gently rounded, relatively poorly drained summit.

The greater part of the area already afforested lies between 700 ft. and 1500 ft. although over a small part of the area the elevation is slightly less than 600 ft. and on the more northerly Catcleugh section where afforestation

is being carried out in the present period the country rises to 1800 ft.

Wool Meath on the Catcleugh - Kielder boundary rises to 1809 ft.

The Catcleugh reservoir, some $2\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide, lies in the north of the forest and was formed by damming the Rede about three miles below the river's source. It is an important feature of the district and adds considerably to its aesthetic appeal.

Geology and Soils

The solid geology of Redesdale is masked to a certain extent by glacial deposits and peat but is of interest since it shows a transition type between that of the North Tyne valley and the Cheviot area. This difference in geology explains to some extent the greater fertility and lower acidity of the Rede valley soils when compared with much of the North Tyne area.

The greater part of the solid formations are sedimentary in nature but immediately north of Catcleugh larger formations of igneous rocks are found. Lumsden Law for example is an intrusive basalt surrounded by andesites contemporary with the Lower Old Red Sandstone. Other igneous rocks include Dalmeny Basalts which form smaller outcrops near the Chattlehope farm and Spithope Burn (amygdaloidal) and just outside the forest boundaries at Cottonshope.

Other than small outcrops of Redesdale limestone that appear on the Rookan in the south of the area and below the Raw Hill and above Catcleugh Lodge elsewhere the three main underlying rocks are of the lower carboniferous period. In the southern half of the forest the principal occurrence is from the Scremerston Coal Group of sandstones whilst in the northern section the area is about equally divided between the Fell Sandstone Group at higher elevations and the Cementstone Group in the valleys. There is a very slight amount of Wenlock stone of Silurian age along the northern fringe of Catcleugh farm.

The geological drift map presents a slightly different picture. All the igneous rocks referred to above are still represented but in rather smaller proportions and the same applies to the limestone.

The main differences in the sedimentary rocks is their reduction in area owing to the presence of peat on the higher ground and the introduction

of boulder clay and alluvial or fluvio-glacial deposits in the valleys. The valley of the Rede and those of most of its tributaries carry considerable deposits of alluvium over much of their length. The boulder clay covers a considerably larger area particularly in the south of the forest where it extends to the Rookan boundary and Mindhope Law (1394 ft.) Its limits are very variable between 900 ft. and 1400 ft. most generally being in the region of 1100 ft. Probably 40% of the forest area carries one form or another of this boulder clay.

The soils, as is usual with those of glacial origin, vary very considerably sometimes in a short distance. The boulder clay itself varies in texture from sticky, tenacious, multi-coloured clays such as are found in the Blackblakehope valley to a sandy clay in the Catcleugh area which could almost be classified as a loam. Sandiness normally increases considerably where the solid sandstone is nearer the surface or actually outcrops and the same is generally true for the quantity of "erratic" stones found in the soil.

Peat is of course an important constituent of many of the soil profiles. Only small amounts of basin bog are found at Redesdale and most of the sloping valley sides below 1400 ft. are free from peat or carry 15 in. or less of relatively mild peat. On the higher and flatter tops above this general elevation, however, the formation of peat is a difficult problem and peat and a small layer of leached sand is frequently the only soil present. This peat is often deep, raw, black and prone to hag-formation.

Vegetation

A number of vegetation types may be distinguished. Their development is closely connected with drainage, grazing and fire and this has to be carefully considered when selecting species for planting. Calluna, for example, shows rapid recovery from both grazing and fire and in places where it may hardly be in evidence before enclosure it may rapidly achieve dominance. The boundaries of each type are normally readily defined on the ground, changes between them being complete within very few feet. They may be said to merge in so far as they appear to be partially interchangeable with alteration in drainage or grazing and fire regimes but the extent

to which such alterations may be effected has yet to be accurately determined. The following main types are considered to be silviculturally important:-

- (i) Almost pure Molinia coerulea on mild, not particularly thick peats. This is the typical "white ground" and the peat is rarely more than 10 in. deep and frequently much less.
- (ii) Molinia and Calluna mixtures on rather worse peats than (i) or sometimes on rocky, sandy or otherwise well-drained sites.
- (iii) Nardus stricta with varying small amounts of Molinia on thin peat or, often, no peat. The soil is normally sandy and well drained.
- (iv) Pure Calluna with occasional small proportions of Eriophorum spp. or Scirpus on the more level higher elevations over thick compacted black peat, often haggly in nature. Not infrequently this is found to be overlying the parent rock.
- (v) Calluna on steeper slopes, sometimes with small proportions of grasses or bracken. Like type (iv) the soil may be shallow but in general the peat is thinner and milder and the site is less of a silvicultural problem.
- (vi) Eriophorum spp., Scirpus, Erica tetralix, Calluna, Narthecium ossifragum, Sphagnum spp. etc. in varying proportions. This is essentially a bog vegetation frequently associated with deep raw peats either in the form of blanket or basin bogs. The vegetation is frequently maintained by fire and/or grazing. Draining or removal of grazing or both normally results in increased Calluna growth although there is some evidence that grasses such as Molinia will replace the bog vegetation in some of the basin bogs.
- (vii) Bracken on sike sides and better drained sites, e.g. under rocky outcrops.
- (viii) Flush vegetation of Juncus communis, Deschampsia flexuosa, Deschampsia caespitosa, thistles etc. The soil in such

sites is often comparable to a brown forest type and in addition to the vegetation already mentioned grasses such as Holcus, Dactylis, Anthoxanthum and others, and herbs such as Digitalis, Oxalis, Prunella (self heal) Geranium (cranesbill) and Parnassia frequently occur. The fern Blechnum spicant is also found in the old woodland areas.

By far the greater part of the area is covered by types (i), (ii), (iii), (iv), (v) and (vi). Types (i), (ii), (iv) and (vi) are the most frequently found.

Meteorology

The area is subject to an average annual rainfall of about 44 in. with annual variations from this average as indicated in the following table. It will be seen that variation about the average is not excessive, an important factor in tree growth.

Year	Annual Rainfall	Difference from average 44.31	
		+	-
1943	46.11	1.80	
1944	46.19	1.88	
1945	41.33		2.98
1946	42.97		1.34
1947	42.26		2.05
1948	48.09	3.78	
1949	37.14		7.17
1950	48.09	3.78	
1951	46.68	2.37	

Average monthly rainfall figures are also available for the period 1947-51 inclusive and are listed below:

January	.....	3.83	inches	July	.....	3.01	inches
February	.....	3.84	"	August	.....	4.20	"
March	.....	3.15	"	September	.....	3.69	"
April	.....	3.75	"	October	.....	4.42	"
May	.....	2.48	"	November	.....	5.31	"
June	.....	2.68	"	December	.....	4.43	"

Once again it may be seen that no months tend to be exceptionally dry. Luckily the driest months of May, June and July coincide with the beginning of vigorous green regrowth, but even so the 12.06 in. which fall in the

period March to June inclusive does not fall far short of the 14 - 15 in. which represents one third of the annual precipitation.

Complete records of maximum and minimum temperatures for Redesdale are not available but indicate that frosts are liable to occur in all months of the year with the exception of July and August. The following are the records obtained at the station at Kielder at an elevation of about 700 ft. The figures in brackets are the only ones available for Redesdale and are taken at an elevation of about 600 ft. in a sheltered site.

Month	Maximum °F			Minimum °F		
	Highest	Lowest	Average	Highest	Lowest	Average
January	(44) 48	30	39	43	(12) 12	27.5
February	(44) 42	32	37	36	(19) 20	28
March	(47) 46	33	39.5	40	(17) 17	28.5
April	(62) 58	38	48	42	(17) 20	31
May	(72) 64	41	52.5	46	(21) 22	34
June	(85) 72	53	62.5	53	(27) 24	38.5
July	(86) 72	54	63	56	(35) 36	46
August	(82) 72	53	62.5	56	(34) 37	46.5
September	(71) 68	53	60.5	57	(31) 28	42.5
October	(60) 54	40	47	53	(21) 19	36
November	(51) 55	37	46	46	(29) 23	34.5
December	(49) 50	35	42.5	44	(15) 15	29.5

Winds are very strong on occasions particularly from the west and north-west and more rarely from the east. There is no doubt that windblow will prove a problem especially at higher elevations which may not be entirely soluble by drainage and correct choice of species. Fortunately the configuration of the ground affords considerable shelter to large areas of the forest whatever the direction of the wind.

Risks and Protection

Fire has always been the greatest single potential danger to the forest and no doubt this will long continue to be the case. The position is aggravated in these early years by the very large proportion of the area in the thicket or earlier stage and vigorous growth of grasses even when the young trees have almost closed canopy.

There have been some small fires in the main forest block. In 1941 about 2.5 acres were burnt in the Cottonshope area and in 1944 and 1946

35 and 36 acres were burnt on the Raw Hill and Spithope Burn sections respectively. The last two fires occurred in March and February respectively. Stewart Shields has been less fortunate and a fire in March 1943 destroyed a total of 260 acres before it was controlled. The cause of all these fires is uncertain but those at Stewart Shields and on the Raw Hill resulted from Army activities.

The main fire danger season occurs between February and early June and its length depends in the first place upon how soon the snow disappears and drying east winds convert the dead, blowing Molinia to tinder and secondly upon how soon green sappy vegetation effectively masks the dead growth. Frequently the young spruce are festooned with dry Molinia and form a frighteningly inflammable combination. A Molinia fire moves much more quickly than a heather fire and the slower burning trees results in a whole block burning at the same time. Burning Molinia is also prone to be carried upwards in the wind and dropped behind the fire fighters causing spot fires.

It has taken some time for the local agricultural community to adjust themselves to the new era of fire consciousness and although this adjustment is still by no means complete the position is much better than in the times when miles of moorland would be ablaze at the same time. The growing area of the forest with the corresponding reduction in the included agricultural land together with the application of the moor burning regulations have contributed to reduce the possibility of fire entering the forest from outside.

When planning new planting areas it is the present policy to develop smallholdings as fire proof grazing strips through the unplanted area. Where possible these are designed to connect up with larger areas of unplanted grazing at higher elevations. Other precautions include the planning of grazing strips at the edge of public highways and the use of Japanese larch in belts as a species which most rapidly suppresses the growth of heavy grasses and prevents the spread of ground fires.

Fire detection is carried out by the combined use of lookout towers and a motor cycle patrol. Two lookout towers have been built on the Raw and Byrness Hills and a minor lookout is in use on the Rookan. These are all

connected to the Forester's office by telephone and it is possible to pinpoint a fire over most of the area. The use of the motor cycle patrol results in a great saving in manpower. There are some fifteen miles of road in or near the forest area which are used by the public and must be patrolled and the motor cycle is found particularly useful for the investigation of moor burning near the forest boundaries. Its advantages in actual fire fighting are too obvious to require mention here.

Fire fighting is based upon rapid detection and speed of arrival at the fire. Equipment in addition to the normal items includes a Sigmund pump towed by a jeep and a Hathaway pump team in a landrover. Every effort has been made to provide water at all accessible parts of the forest by the construction of dams and water holes. The fire warden at Kielder who has overall control of all men and equipment in Wark, Redesdale and Kielder forests (ten beats in all) rushes extra men and equipment from the nearest available points.

The use of such equipment for detection and fire fighting is a comparatively recent development, partially the result of war-time advances in the quality of the equipment. The need for such measures is emphasised by such tragic fires as that at Chirdon in Wark Forest in 1948 when over 700 acres were burnt in a short time.

Only a very scanty fauna is present on the grazed moorland before afforestation but the increased cover afforded by the trees results in an influx of a variety of birds and mammals some of which must, perforce, be treated as vermin either because of their effect on the trees or their injurious activities on adjoining agricultural land.

The roe-deer, hare, rabbit and short tailed field vole are all found at Redesdale. Of these the roe-deer presents the greatest problem for the others do not occur in serious quantities except for occasional unpredictable plagues of voles. When the roe-deer achieves any numbers it causes considerable damage particularly to contorta and Scots pine and any hardwoods that may be available. Reduction of the deer population appears to be followed by immigration from other areas and it seems unlikely that the deer can be exterminated even if this were completely advisable. It may well be that the campaign against this attractive forest dweller can be reduced when, as is hoped, greater quantities of natural regeneration

appear on sites where it is not immediately required and the animals' grazing becomes less localised.

The rabbit is almost unknown in the upland moors before afforestation but it tends to move up as shelter increases. However, it is still an unimportant member of the forest fauna as is also the hare. Neither the red squirrel nor the grey "tree rat" as yet occurs at Redesdale.

Foxes are common and the cause of some complaint from local agriculturists and hunts, the latter losing both dogs and fox in the thickets. Constant efforts are made at control and the trappers normally account for about seventy adult foxes and the same number of cubs in the year thereby probably maintaining an even level of population.

The only "black sheep" in the ornithological world at Redesdale are the blackgame. They periodically occur in large numbers particularly when the weather is hard and frequently remove all the buds from newly planted pine and larch. They are particularly dangerous when they locate plant dumps for then no species except perhaps Sitka spruce escapes their attention. Of minor importance is the damage done on the "lekking" sites when up to a tenth of an acre of one to three year old crop may be completely flattened.

Stray cattle and sheep, particularly the latter, are a potential menace on all new plantings where these contain hardwoods, pine or Norway spruce. This is especially so in hard weather and all planting has to be surrounded by a sheep-proof fence. It is not improbable, however, that a system of controlled grazing in plantations will be developed in the near future as a result of recent cattle grazing experiments in older plantations, to the mutual benefit of food production and fire protection.

Roads

The very nature of the ground has always rendered Redesdale inaccessible for all types of wheeled vehicles except along established roads or tracks. Rides, however carefully aligned, always require considerable work before they are passable even to four wheel drive vehicles such as the jeep or landrover. One of the main problems involved in the continued development of the forest has been that of access for planting and fire fighting in the more distant areas and more latterly the growing need for easy extraction routes. In the present state of mechanical knowledge the nature of the

ground makes the crawler tractor the only suitable mechanical method of extraction from stump to roadside. It has long been appreciated that there is a limit to the distances over which such extraction is economic and roads have had to be laid out and constructed with this in mind.

Little or no road work was attempted prior to the 1939-45 war. Existing tracks were generally sufficient for the limited transport facilities of the Commission. Planting areas were nearer the road and labour costs less pressing than under modern circumstances. Moreover there was only a growing realisation of the very real danger from fire and the need for policy in the extraction of thinnings.

The presence of a main road through the forest has been a boon in this respect and forms the backbone of the existing and proposed road system. Since the last war roads have been developed from Blakehopeburnhaugh over the Rookan to join Redesdale to Tarsset also to Blackblakehope giving a partial opening of the Blakehopeburn valley. Part of the forest area is touched by the excellent and expensive road system serving the local artillery ranges and it is a pity that more use cannot be made of these than is at present the case. The existing mileage of road actually within the forest area is about eleven including County Council roads and the final proposed figure of normal construction roadway, again including County Council roads, is about thirty representing some 400 planted acres per mile of road.

The system used for laying out compartment boundaries at Redesdale shows two distinct phases. In the early years, in fact until about 1948 the shape and distribution of compartments was based on a grid, either a rectangular system or, less frequently, by triangulation from a fixed high point. Some established paths were left untouched to run through the plantation but other than this no consideration appears to have been given to eventual access. The method presently employed is to align roads and access routes on the area initially. The smaller areas thus obtained are subdivided into compartments, the boundaries of which are designed to give maximum ease of access.

There is a good supply of stone at Redesdale from local quarries and as gravel in the bed of the Rede. Both sources have been employed for road building in the past and it seems likely that this will continue to be the case.

Labour

It is perhaps, surprising to find that there has nearly always been a considerable labour force at Redesdale and that there have generally been complaints of understaffing. At the time of planting Stewart Shields in P.39 to P.41 about twenty five men were employed there and about fifteen in the Redesdale main block. No doubt some of this labour was of a more casual nature than the present day strength of 35 men which is estimated to be about ten below the immediate requirement. Really local labour has always been in short supply owing to the demand for workers for the artillery ranges, the military camps and the relatively prosperous agricultural areas of the lower Rede valley and a large part of the labour has been and still is imported from Otterburn and some men come from as far away as Ridsdale (circa 15 miles). It has not been unusual for men to be brought from beats of Kielder and Wark forests in order to complete the annual planting programmes.

In more recent years the greater intensity of forest work such as drains maintenance and fire protection coupled with the high annual planting programmes, (the period P.47-51 inclusive saw the planting of some four thousand acres) and the resultant beating up and weeding has emphasised the lack of labour at Redesdale and there are still considerable arrears in drains maintenance, access route repairs etc. although the matter has never been quite out of hand.

The introduction of increased mechanisation particularly ploughing for planting and of main drains has reduced the labour problem to a considerable extent since labour is no longer required for much of the preparation of ground. There is also a corresponding reduction in the labour necessary for weeding and beating up.

At present a forest village is under construction at Byrness which it is hoped will eventually provide much of the labour for Redesdale forest. In addition to the original houses in the area, some nineteen in all, the construction of twenty seven new houses is almost complete and others are scheduled for later years. Present plans are based on a final figure of one hundred and fifteen houses.

Most of the men working on the forest were originally recruited from other industries including farming. It is generally found that the local

men take a considerable time to acquire skill in forest operations but are eventually capable of developing it to a high degree.

SILVICULTURE

Preparation of Ground

By far the larger part of Redesdale was open moorland immediately prior to planting. To what extent it was once afforested is debatable although there can be little doubt that a proportion carried some form of forest. Of about 9000 acres now recorded as planted only some thirty or forty acres carry or have carried more mature trees in recent years. Some of these are man made but woods such as Dead Wood and Robs Wood and probably some of the Hindhope Wood are undoubtedly of much older origin and may indeed be a remnant of the original forest.

Planting from 1934 - 1941 was carried out almost entirely on turfs cut by hand from turf drains or hinged; methods which had already been employed for a few years in the neighbouring Kielder forest. In small areas where turfing was difficult direct planting into notches was employed, e.g. rocky bracken slopes, but only to a very limited extent.

Drainage consisted very largely of cleaning any existing sheep drains and reliance upon the turf drains. A main drain system such as is introduced nowadays was apparently not considered necessary particularly on the better sites. An early acquisition report states that "the Dour Hill and Byrness areas will require very little drainage." Efforts are currently being made to rectify this lack of a good drainage system on earlier planting areas and it remains to be seen to what extent it may affect the stability of the crop.

Ploughing prior to planting was begun at Redesdale in 1942 when Solotracs ploughs were used. At first except for some experimental ploughing carried out by Mr. Cuthbertson in 1947 with the R.L.R. and other ploughs the object of the ploughing was primarily to produce turfs and the distance between furrows was governed largely by this motive. However, rising labour charges and shortage of labour together with a growing realisation of the value of the plough in providing drainage, aeration and the suppression of weeds has resulted in a steady reduction of the ploughing distance from 15 ft. plus, to 10 ft. to the present day when all

ploughing is done at five foot spacing except where stony conditions render this impossible. Modern practice also correlates the introduction of a deep main drainage system prior to planting

Many types of plough have been used in the Redesdale area including varieties of the Solotrac, Begg Hill plough, R.L.R. and Cuthbertson. Of these the Cuthbertson has been found to be most suited to local conditions and is used for ploughing and draining. The development of ploughs and tractors and the new double mould-board plough promises to shorten still further the time required for ploughing. Much difficulty has been experienced in preventing the turf from falling back into the furrow when the plough has passed, particularly on steeper slopes. This has now been satisfactorily corrected.

Over such a short period of time it is difficult to judge the relative values of different ploughing distances and hand turfing. There is little to choose silviculturally between hand turfing and the wide ploughing but there are indications that closer ploughing saves weeding and beating up costs and there can be no doubt that its effects provide a stimulus to early growth. This is illustrated on one of the experimental areas mentioned above. In P.47 Sitka spruce of the same stock were planted partly on 15 ft. ploughing with spread turfs and partly on 5 ft. spaced, deep ploughing with the R.L.R. plough. The latter are now about 4 ft. tall whilst the former with an average height of less than 2 ft. look like a later planting.

Complete ploughing has not yet been attempted at Redesdale and it seems unlikely that it would provide advantages justifying the extra cost involved.

The size of the turf, particularly its depth, is another feature in which there has been considerable evolution. Originally the turfs were frequently a foot or more thick. Now they rarely exceed six to eight inches thick even on peaty ground and may be as little as four. Ploughing depths are adjusted to suit the type of ground. Where the mineral soil is near the surface a deeper furrow is ploughed for it is found that erosion tends to remove the turf before the plant is fully established and that grasses more readily find their way through.

Choice of Species

Choice has been based upon four main species, the Sitka and Norway spruces, Scots pine and Japanese larch. Of these the spruces occupy by

far the largest part and an approximation of the areas occupied shows the following proportions:- Sitka spruce 54%, Norway spruce 40%, Scots pine 3.5%, Japanese larch 2.5%. Other species planted prior to P.50 in very small quantities included European larch, Abies grandis, Douglas fir and numerous ornamentals. More recently beech, sessile and red oaks and contorta pine have begun to figure in planting programmes.

There have been the inevitable mistakes and failures. European larch has proved unsatisfactory wherever planted, luckily never in quantity. Japanese larch has also been disappointing so far but is nevertheless something of an enigma. Late plantings are a considerable improvement on the earlier plantings as is indicated in the section on growth. It seems likely that a variety of factors have affected the earlier plantings. The Japanese larch on Byrness Hill are known to have suffered severely from blackgame, sheep and exposure in the earlier years. Moreover much of this area was planted with larch because of a shortage of spruce in the years in question. It should be recorded that some good straight stems are to be found in all crops and the Japanese larch may yet find a permanent niche in Redesdale silviculture.

The history of the two spruces at Redesdale has been one of changing opinions as elsewhere in the Border country and it is not improbable, that the true balance between them has yet to be reached. It has taken time to assess their relative hardiness to frost and exposure and ability to establish themselves on peat and in varying vegetations. Experience has shown the comparative frost hardiness of Norway spruce and its dislike of exposure to blast. It has demonstrated the ability of Sitka spruce to establish itself on deeper peats and above all the checking effect of Calluna upon both species. The rapid growth of Calluna after enclosure has been discussed under vegetation and the need for recognising areas of potential vigorous Calluna growth is vital in the selection of tree species. Present selection of species as far as the spruces are concerned is based on:-

- (a) The depth of peat:- If this is greater than 9 in. the ground is unsuitable for Norway spruce.
- (b) The exposure:- If Norway is to be planted it must be given some shelter to windward.

- (c) Frost:- Frost hollows are very bad for Sitka spruce.
- (d) Heather:- Where a site is considered suitable for spruce but the heather is likely to be vigorous a mixture with pine is employed.

The correct use of spruces on bog areas has yet to be exactly determined and there are a number of small areas at Redesdale where Sitka spruce has been planted pure on deep peat and is in complete or partial check.

The pines have an important role in local silviculture both as pure plantations and in mixture with the spruces, particularly Sitka spruce. Most of the mixtures at Redesdale have been two row mixtures of Sitka spruce and Scots pine. These have proved fairly satisfactory in so far as the pine rarely gets away so quickly that it suppresses the spruce as may be the case with pine - Norway spruce mixtures. However, it seems likely that two row mixtures may give a rough final crop and give rise to difficulties in the thinning stages. For this reason three or even four row mixtures are finding increased favour.

Pine as a pure crop appears to have been limited more to the river flat gravels and sandier sites in the earlier years and its application to the drier Calluna knolls is a comparatively recent development and even its use as a nurse in mixture in earlier years does not appear to have been motivated by a desire to obtain suppression of heather and afford shelter as is the case at present, but more as a silvicultural exercise.

The indications from local private plantations show that Scots pine of quite good quality can be grown up to elevations of 1200 ft. and perhaps higher where shelter is good. There is some tendency to snow break especially at higher levels and all pines are liable to suffer damage from deer and blackgame. It seems likely that both pines will always be silviculturally important as providers of shelter against blast and windblow and as a nurse to the spruces.

At present it is impossible to estimate the probable performance of Pinus contorta. It is used in the same role as Scots pine at higher elevations and on deeper peats and it is hoped that it may assist in establishing spruce on marginal sites. It is perhaps doubtful whether it will form an economical pure crop on the sites where it has so far normally been employed.

The only other conifers planted in any quantity at Redesdale are the Douglas fir and Abies grandis. The former is generally of poor form, much affected by blast, the latter very satisfactory although rather slow in starting. The more detailed selection of species currently practised will no doubt result in the introduction of new species as these become available. Abies procera, Thuja, Tsuga and Picea ormorika would seem to be useful species for limited areas.

Although oak, beech and ash are to be found in the older scrub woodlands as well as birch, rowan and alder no hardwoods have been planted by the Forestry Commission in this forest other than for ornamental reasons. This is probably wise since the general indications are that such plantings even on the better sites would only produce medium quality crops. In recent years, however, increasing attention has been paid to amenity together with a longer term policy of possible soil improvement. Small groups of beech, sessile oak, red oak, Norway maple and hornbeam have therefore been planted and it remains to be seen how well these will become established. A policy is followed of encouraging natural birch and other hardwoods of reasonable form when these occur in conifer plantations.

Planting

A planting distance of five feet has normally always been employed at Redesdale and is still in current use. Small areas are occasionally encountered where the spacing is less but it appears that this either resulted from a surplus of plants or, in the case of Japanese larch fire belts, a desire to obtain more rapid suppression of the vegetation.

Examination of available records shows that transplants have almost invariably been employed at Redesdale. On the few occasions when seedlings of larch and pine have been planted an almost total loss has resulted. 2 + 1 and 2 + 2 have been most commonly used, particularly in the spruces and plants with small well-formed crowns (6 in. - 9 in.) have been more satisfactory than taller plants, particularly on exposed sites. Large numbers of the plants used at Redesdale have been stock from north country nurseries. Apart from the Redesdale nursery, closed down in recent years, Widehaugh, Broxa and Delamere are names which figure largely as a source of supply.

By far the greatest proportion of planting at Redesdale has been done with the semi-circular spade in the centre of the upturned turf. This method is still widely used especially on the peat. It has been criticised in the past as not tending to produce a satisfactory distribution of the root system, a criticism which can be overcome by care in the use of plough and planting spades. It is much less satisfactory on more mineral soils and here an ordinary planting spade is often employed. On limited areas of rocky and uneven ground where it is impracticable to produce a turf, screefing and direct planting are employed.

As mentioned in the section on labour the planting programme at Redesdale has varied considerably with resultant influence on subsequent operations. The dangers of planting too large an area annually are emphasised by those years in which over one thousand acres were planted. Lack of sufficient supervision and of detailed selection of species coupled with the need for using poor quality labour have all contributed to the need for much beating up.

The use of superphosphate or basic slag on poorer areas was begun at Redesdale in 1939 on the Raw Hill but its use subsequently lapsed. At first only spruce was treated in this way but it is now the usual practice to apply the fertiliser to all species planted on deep raw peats. Application should be made at or about the time of planting and the quantity of phosphate made available to the plant would appear to depend considerably upon the weather during and immediately after the application.

Beating Up

There has frequently been too much beating up at Redesdale. The percentage of failure has rarely been very great, seedlings excepted, apart from isolated cases where spruce has been planted on heather ground or as in the P.37 area of Japanese larch on Byrness Hill which suffered severely from black game. Scots pine has shown great ability to recover after apparent death and this has occasionally resulted in both the original and the beating up plants growing from the same hole. It has often been the practice in the past to beat up with a different species particularly where the original choice was somewhat suspect. Thus Sitka spruce is often beaten up with Scots pine. Beating up, however, has been subject to the

same disadvantages as the larger planting programmes and the use of wrong species and over beating up has been uneconomical in the past. Complete figures to show the amount of beating up over a number of years are not available but a few examples can be taken from recent years and the table at the end is of interest. In F.Y.51 the number of Japanese larch used for beating up a planting of seedlings in F.Y.50 was 69% of the original planting. During F.Y.51 the demand for beat up plants including 87.0 Japanese larch was 186.0. In the same period particular efforts were made to reduce numbers by insisting on good planting technique and a sound approach to beating up. In F.Y.52 the demand for beating up plants is 21.0. The relevant areas planted were:- P.48 - 587 acres, P.49 - 1300 acres, P.50 - 1080 acres, P.51 - 490 acres. Over the same period figures available indicate that the spruces have been given a 3% - 4% beating up and Scots pine about 10% of the original numbers planted.

F.Y.	Acres	Thousands of Plants	Earliest P. Year Beating Up.
39	289	70.0	36
40	538	123.0	35 - 36
41	336.0	106.0	36 - 37
42	286.0	79.0	36 - 37
43	200.8	93.0	37
44	426.2	124.0	36
45	932.5	294.0	37
46	879.1	382.0	37
47	599.6	281.0	39
48	469.3	149.0	38
49	-	-	-
50	897	328	42 & 46

Weeding

The principle weed at Redesdale is grass. Subsidiary areas carry bracken and Juncus species which are speedier in their suppressive action but of lesser importance owing to their relative infrequency. Sitka spruce is probably the most satisfactory species in this respect for as soon as its leader is reasonably clear of the grass it requires little

further attention. Norway spruce is generally slower in early growth and since it is normally planted on more fertile soils is very prone to suppression by grasses whilst Japanese larch requires consistent weeding especially in bracken. Weeding is not now normally necessary in the first year after planting but has to be carried out in two to four subsequent years. Although it may have been more beneficial to weed bracken twice annually the labour position has normally confined this to once a year.

Growth of Species

It is generally appreciated that the growth of trees in the earlier stages of plantation life, particularly until the canopy is closed tends to be both uneven and unpredictable apparently being affected by minor setbacks which are probably untraceable. Other important factors must also be the gradual increase in knowledge regarding the selection of species, care of plants and planting techniques.

A few measurements made at Redesdale recently tend to emphasise this aspect although it is reiterated that no immediate conclusion can be drawn. Table III shows the mean dominant height of different species planted in the P. years 34 - 40. Subsequent plantings have not yet reached mean dominant heights of 10 ft. and have not been included.

TABLE III

P. Year	Mean Dominant Height by Species (feet)					
	J. L.	S. P.	N. S.	S. S.	Abies Grandis	D. F.
34	14'9"	13'0"	18'6"	19'0"	-	-
35	14'9"	14'6"	16'0"	13'9"	18'0"	14'6"
36	-	14'0"	14'0"	15'0"	-	-
37	13'6"	16'6"	13'0"	12'4"	-	-
38	-	15'0"	13'0"	14'0"	-	-
39	20'0"	14'6"	11'2"	11'0"	14'0"	17'6"
40	15'0"	11'6"	Below 10'	Below 10'	-	-

It is of interest to note that Japanese larch planted in F.Y.s 39 and 40 already exceeds in height that planted in F.Y. 34. The results for Scots pine show a similar tendency as do those for the Douglas fir which however has been planted over very limited areas. The Norway

and Sitka spruces on the other hand show rather less erratic performances.

These figures cannot be explained entirely in terms of differing site conditions although no doubt these have played their part in the growth of the spruce concerned. Reference to Table IV shows that all species have made reasonably steady growth during the last five years, particularly those which showed the greatest variation in total height. Since most of the plantations under consideration would be closing canopy in the period under review the indications are that the differences at present determinable between these P. years are largely due to different growth in the earlier years and might be traced to the use of aged or sized plants, care of planting, weeding, beating up etc.

TABLE IV

P. Year	* Main Annual Height Increment over last 5 years by species					
	J. L.	S. P.	N. S.	S. S.	Ab. Grandis	D. F.
34	2'0"	1'6"	1'6"	1'9"		
35	2'0"	1'6"	1'6"	1'3"	1'9"	2'0"
36	-	1'6"	1'6"	1'9"	-	-
37	2'0"	1'6"	1'3"	1'3"	-	-
38	-	1'6"	1'6"	1'0"	-	-
39	2'3"	1'9"	1'3"	1'3"	2'0"	1'9"
40	1'9"	1'6"	-	-	-	-

* All lengths worked out to the nearest three inches.

In general the figures also demonstrate the slow early growth of trees in this area. Steady height increment only really begins as the canopy closes and Japanese larch and pine appear to be more affected in this respect than the spruces which normally begin to grow steadily as soon as some suppression of the immediate vegetation has been achieved.

There is little information regarding older plantations in the area. Scots pine can be seen growing quite well in small plantations on neighbouring land. A report on the area prior to purchase dated 1932 mentions the conifer wood at Blakehopeburn from which much of the better timber had already been felled. Scots pine, then 80 years old, were 65 ft. tall with an average q. g. b. h. of 9 in. - 10 in. At Catcleughⁱⁿ an 80-90 year old

plantation in a rather exposed position but quite a good soil type the Scots pine is 65 ft.- 70 ft. tall and the mean q.g.b.h. of 25 codominant trees was 13 in. and of the same number of Norway spruce was 12 in. In Scots pine plantations in the same area but rather more sheltered, pine about 33 years old had a mean q.g.b.h. of 8 in. and height of rather more than 50 ft. Both plantations had received little attention in the past. It is interesting to note that the Scots pine in the older plantations are still sound but 80% of the Norway spruce have varying degrees of butt rot up to 14 ft. up the stem, a fact which may be some guide to probable rotations. It is probable that trees grown in a completely woodland atmosphere will be generally of higher quality class than those found in the older plantations which have all suffered to a certain extent from neglect and exposure. The very limited information at present available indicates that the spruces will generally be of Quality Class III and IV, occasionally II, whilst Scots pine in some areas may reach Quality Class I and will frequently be Quality Class II.

Subsequent Treatment

Redesdale is only just entering the stage of brashing and first thinnings and there is as yet little of value to report. It appears that the spruce in most areas will be ready for thinning twenty years after planting. Larch and Scots pine may be rather earlier. A little complete brashing of Japanese larch and Scots pine has been carried out but the P.34 spruce plantations have not yet killed off the lower branches sufficiently to allow for dead brashing.

The old scrub areas of Dead Wood and Robs Wood which were underplanted with Douglas fir in P.49 are now being cleaned to allow the conifers sufficient growing space.

History of Redesdale Forest

APPENDIX I

Notes from Inspection Reports

Notes on Chairman's visit to Redesdale 5.10.34

A small corner of the P.36 area was inspected and the Chairman said he would like a certain amount of Sitka spruce planted on good ground in each P. year to compare it with Norway spruce. He also pointed out that Tsuga was the ideal species for planting on very steep slopes.

The Divisional Officer suggested that, as eventually several miles of the main Newcastle-Edinburgh road would be planted on both sides, there was an opportunity for making an avenue which in years to come might prove a feature of the forest. Sequoia gigantea was suggested as a suitable species, alternatively with slightly recessed Sitka spruce.

Chairman's comments

The new road at Redesdale is a very creditable piece of work. I have told the Minister of Labour (Mr. Stanley) so.

I like Mr. Hopkinson's idea for an avenue along the main road.

Chairman's inspection of Redesdale Forest 19.9.38

(1) Part of the P.34 area was inspected and was considered satisfactory, but the Chairman criticised the ornamental belt as it was not complete. He pointed out that the longer the belt was incomplete the longer the fire danger would exist. The Divisional Officer suggested filling up this belt with Japanese larch; the District Officer said he would prefer birch; Chairman suggested a mixture of both species.

(2) The Chairman noticed some heather areas on Blakehope and suggested that they might be ploughed.

Chairman's comments

(1) Both species put in clumps of groups pure - not in mixture. This would give some variety to the roadside.

(2) It struck me generally in these Northern Areas that there were heathery areas which would be better ploughed than turf planted and that as soon as

convenient experience of tractors and ploughs should be obtained in this district.

Tour of the Commissioners, 1.6.39

The Chairman criticised the close planting of Japanese larch in the roadside belt as he considered it unnecessary. Divisional Officer pointed out that it was an instruction to plant closer than usual.

Visit of Chairman to Redesdale Forest 27.5.50

Blakehopeburnhaugh

Selection of Species. The Calluna and Calluna/Molinia areas in P.49 were planted with pure Sitka spruce due to lack of Scots pine for mixing. The Chairman considered that if the right species is not available one year, the programme is better deferred on that ground. In this case two rows on the Calluna ground could have been left unplanted until Scots pine was available to complete the mixture, which is a silvicultural necessity on this type of ground. Silvicultural considerations must outweigh the achievement, on paper, of a certain acreage planted.

Blacklakehope

Turfs. The P.50 area was ploughed at 15 ft. and the turfs spread by hand. No main drains have yet been put in owing to lack of machinery. The Chairman was very critical of the high turfs, 9 in. - 12 in. high, on this fibrous Scirpus peat, into the top of which plants had been inserted with the semi-circular spade. On this type of peat the roots must go right through the turf, which must be shallow enough to allow this, though large enough in surface area to suppress the surrounding vegetation.

Planting limits. The bulk of the ground planted in F.Y.50 was, in the original acquisition report considered unplantable, and the Chairman was of the opinion that it should still have been so considered, in the absence of pilot plots on such land to guide us. Pilot plots ought to have been put down 15 years ago. Only the lower slopes, the P.50 area, with grassy flushes are known ground and "safe". The balance, about 600 acres of the 1000 acres planted, is either hard heather covered compact peat over rock with leached sand and a pan (which was seen), or deep fibrous Scirpus peat, all at high elevation, i.e. over 1000 ft.

Report on the Chairman's visit

May 27th 1950 - Redesdale Forest

The Chairman expressed doubt as to the chances of success of the P.49 Sitka spruce turf planted on the difficult Scirpus - Molinia - Calluna peat on the north facing slope of the valley. The planting was inspected thoroughly and it was agreed that the turves used were much too deep, and that they will almost certainly shrink and disintegrate in quite a short time leaving the plant exposed and without adequate moisture. The plants should be planted deeper into much shallower turves to ensure that the root system gets into the "vegetation sandwich" between the turf and the ground surface. The site here discussed is very exposed with an elevation rising to over 1,200 ft. The drainage is poor, Lord Robinson did not consider it advisable to continue planting this difficult type of ground until more experience and knowledge had been gained from trial plots laid out in advance. It would be much wiser to plant up the better types of land such as that found on the opposite side of the valley (south aspect) where the drainage is better and the vegetation contains much less Scirpus and Calluna.

History of Redesdale Forest

APPENDIX II

Supervisory Staff

Conservators

1946 - 47	Mr. R.E. Fossey (Acting)
1947 - 50	Mr. G.J.L. Batters
1950 to date	Mr. C.A. Connell

Divisional Officers

1934 - 39	Mr. A.O. Hopkinson
1939 - 48	Mr. R.E. Fossey
1948 - 50	Mr. W. Forsyth
1950 to date	Mr. P.F. Garthwaite

District Officers

1934 - 39	Mr. G.J.L. Batters
1939 - 46	Mr. W. Forsyth
1946 - 48	Mr. S. W. Rogers
1948 - 49	Mr. S. Forrester
1949 - 50	Mr. P.F. Garthwaite
1950 - 52	Mr. P.J. Langley
1952 to date	Mr. B. J. Allison

Foresters

1933 - 34	Mr. J. T. Kirkup
1934 - 51	Mr. J. F. Scott
1951 to date	Mr. W. L. McCavish

History of Redesdale Forest

APPENDIX III

Other Features of Interest

The gradual development of this beautiful forest on both sides of a frequently used road into Scotland is of sustained interest to travellers who frequently pause in the forest area. The Rede valley has considerable historical interest and was the scene of frequent border skirmishes in which the Douglas Clan and the Percys were frequent contestants. That the country carried considerable woods in the past is indicated by descriptions of some of the border raids. Thus one report contains the following statement. "In a raid on Redesdale in 1598 they (the Scots) brought 100 men to cut wood, did so, and carried it away as wont", and there are other and earlier references to the forests at Redesdale and Cottonshope. Nowadays, fortunately, fighting border raiders no longer require to be estimated for although the possibility of raids for Christmas trees has to have annual consideration.

Roman remains are to be found in the vicinity. High Rochester between Stewart Shields and Redesdale is the site of Bremenuim, a Roman settlement and the remains of a considerable camp exist at Chew Green not far from the Spithopehead boundary. The Roman road Dere Street and others occur near the forest and the Pennine Way passes through the forest. At Carter Bar is the site of the fierce Redeswire Fray of 1575.

Redesdale holds something of interest to both the ornithologist and botanist. Birds are numerous and on the increase in the afforested areas. Nesting boxes are being employed to increase the numbers of titmice, red-starts and pied flycatchers. Birds of prey frequently seen include the kestrel, sparrowhawk and short and long eared owls, the merlin is infrequent and buzzard, golden eagle, osprey and peregrine falcon are occasionally seen. Other interesting birds include the raven, ring ouzel, dipper, goosander, curlew, snipe, woodcock, golden plover, red grouse and blackgame. Grey geese, whooper swans and great crested grebe occur as migrants in Catcleugh reservoir. Rare birds recorded

recently include the great grey shrike and the golden oriole whilst snow buntings are frequently seen during hard weather.

A great variety of wild grasses occurs at Redesdale and amongst other interesting plants are the Grass of Parnassus (Parnassia) and the insectivorous plants Butterwort (along the river banks) and Drosera (on the higher elevation bogs). The foxglove and stonecrops grow in profusion. Amongst numerous interesting insects those which catch the eye include the Emperor moth and the Northern Eggar.

Mammals have already been discussed (see Risks); snakes (both the grass snake and viper) are not uncommon. The vipers at Redesdale have a reputation for both size and virulence and specimens of eighteen inches and more in length are not infrequent.

The establishment of the forest is undoubtedly affecting the environment and will no doubt be accompanied to various degrees by a change in flora and fauna.

Redesdale

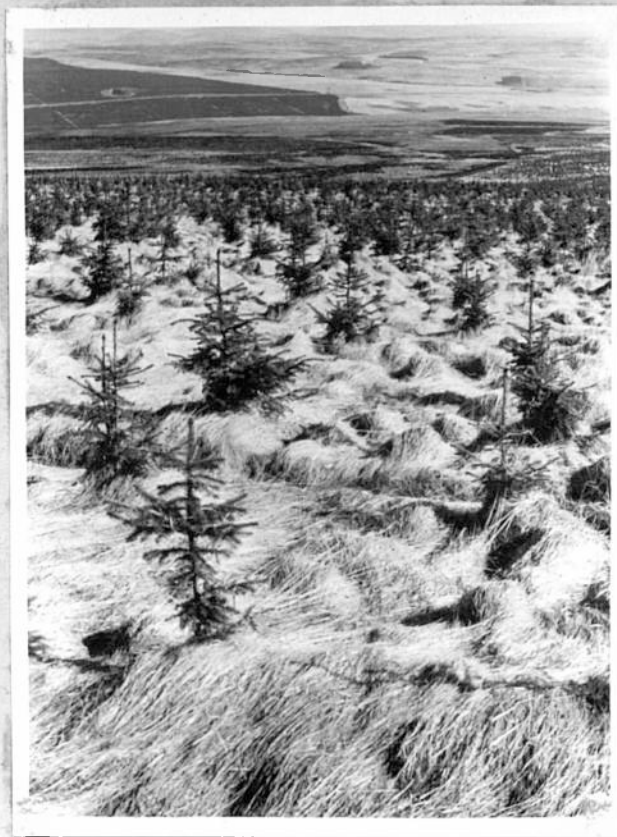


View S.E. along the Rede Valley. The top picture is certainly pre 1934. These photographs have been taken from the same site and the stability of the vegetation complexes in the near and middle distance is of considerable interest.

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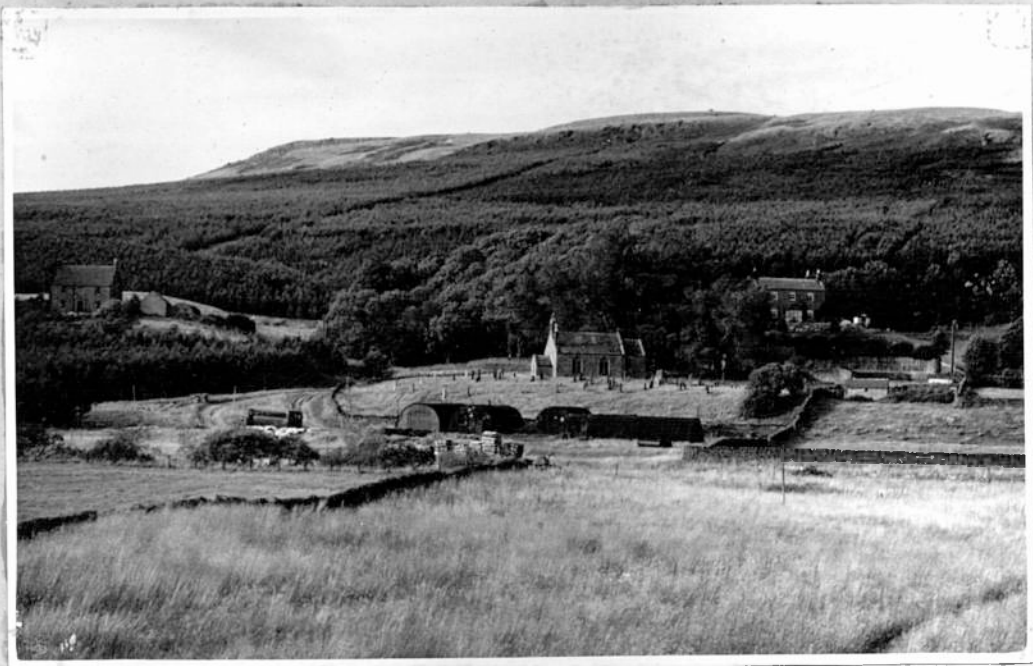


Spring views of Sitka spruce in Molinia. Top: view from the Rookan towards the North. Bottom: view from the Rookan towards the East. The photographs indicate the inflammability of the vegetation. In the far distance on the lower picture the P.34-5 etc. areas may be seen and the main road through the forest. These are some five miles away.

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Byrness Hill before planting (pre 1937).



Byrness Hill 1952



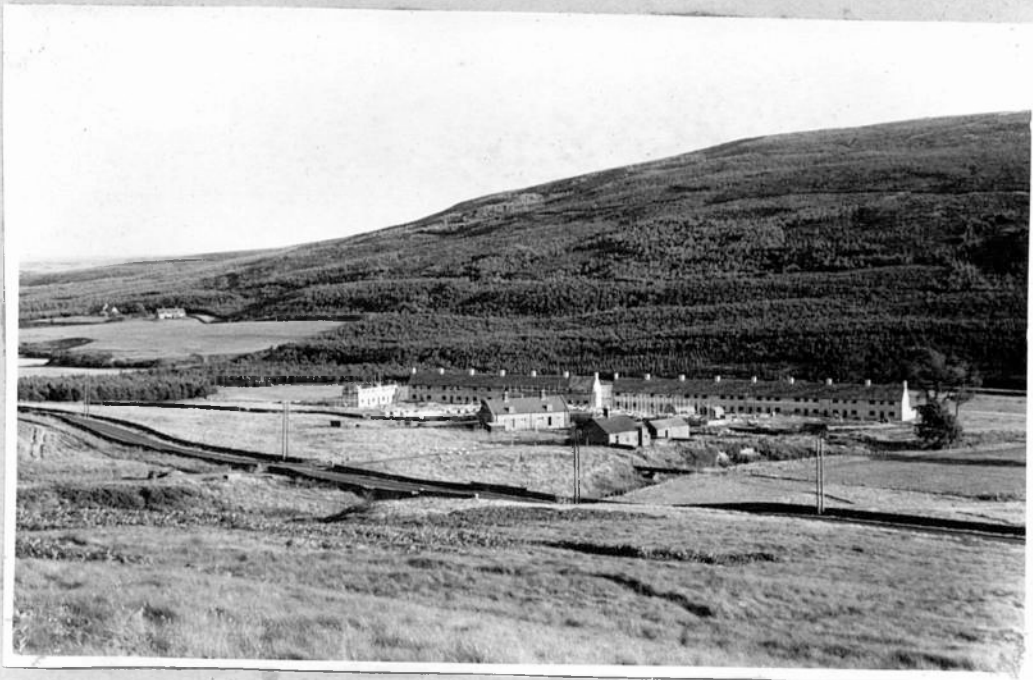
Hindhope Wood pre-1935

All of this is now
planted.

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Byrness Hill from the Raw.



Raw Hill from Catcleugh

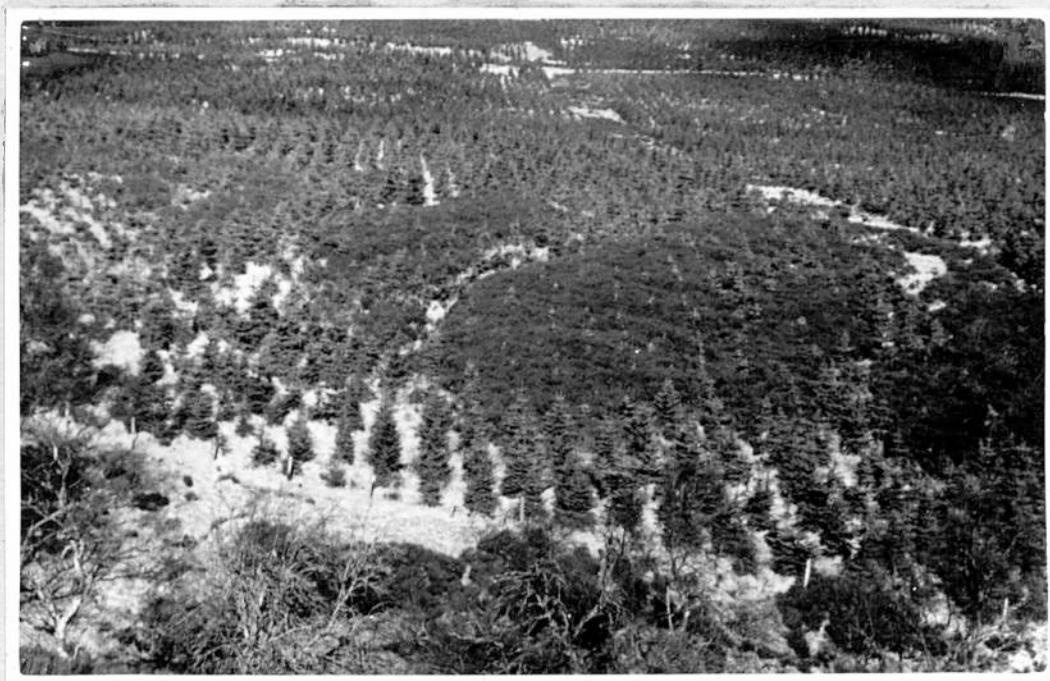


Houses at the new Byrness village

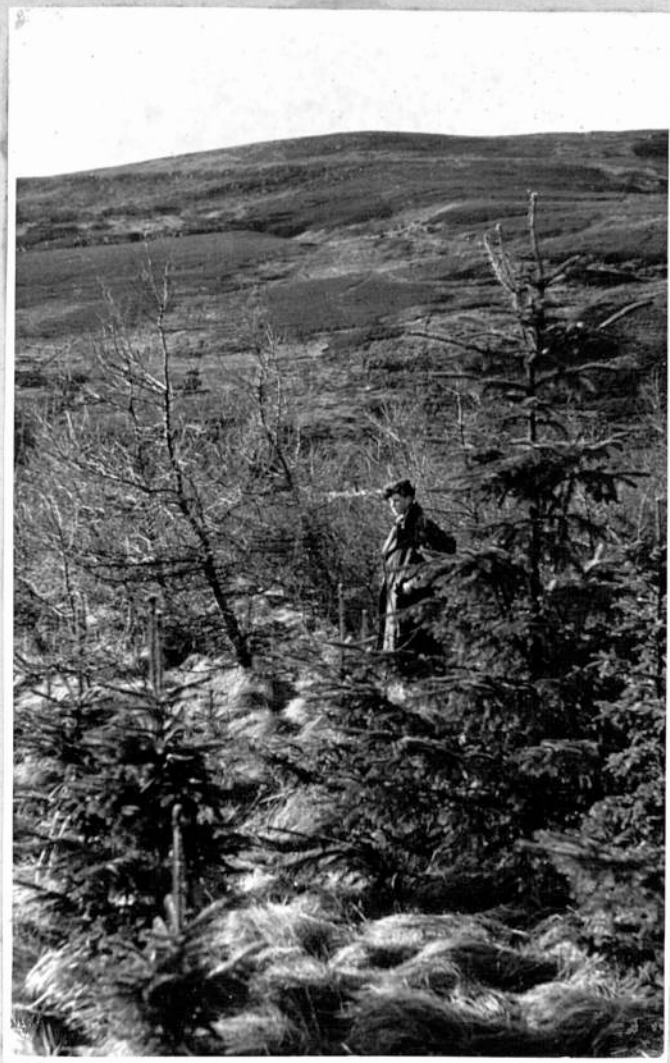
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HISTORY OF REDESDALE FOREST



Sitka spruce in molinia and heather. The poor growth in the latter is clearly seen.



Sitka spruce and Japanese Larch. The distorted form of the latter is typical of much of the Japanese Larch at Redesdale.

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Cuthbertson plough in action



Fire pump towed by jeep on the Rookan Road

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HISTORY OF REDESDALE FOREST



Old tree trunk and Scots Pine stumps uncovered in peat at high elevations.



Hindhope Burn & part of Hindhope Wood



Short eared owl on nest

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RESDESDALE FOREST

1

View S.E. along the Rede Valley. The top picture is certainly pre 1934. These photographs have been taken from the same site and the stability of the vegetation complexes in the near and middle distance is of considerable interest.

2

Spring views of Sitka spruce in Molinia. Top: view from the Rookan towards the North. Bottom: view from the Rookan towards the East. The photographs indicate the inflammability of the vegetation. In the far distance on the lower picture the P.34-5 etc. areas may be seen and the main road through the forest. These are some five miles away.

3

Top: Byrness Hill before planting (pre 1937).
Middle: Byrness Hill 1952
Bottom: Hindhope Wood pre – 1935
All of this is now planted

4

Top: Byrness Hill from the Raw
Middle: Raw Hill from Catcleugh
Bottom: Houses at the new Byrness village

5

Top: Sitka spruce in molinia and heather. The poor growth in the latter is clearly seen.
Bottom: Sitka spruce and Japanese Larch. The distorted form of the latter is typical of much of the Japanese Larch at Redesdale.

6

Top: Cuthbertson plough in action
Bottom: Fire pump towed by jeep on the Rookan road.

7

Top: Old tree trunk and Scots Pine stumps uncovered in peat at high elevations.
Bottom Left: Hindhope Burn and part of Hindhope Wood.
Bottom Right: Short eared owl on nest.

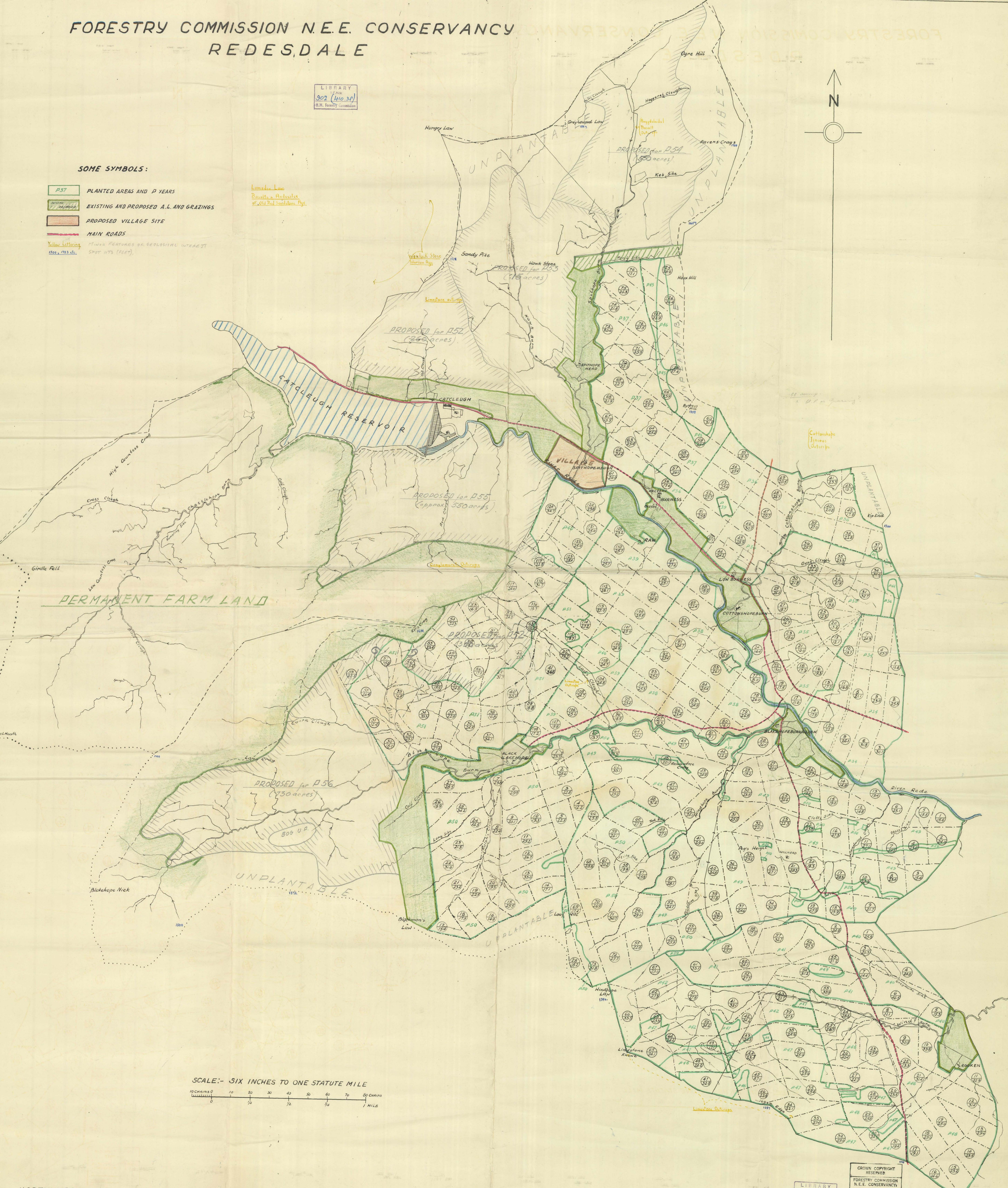
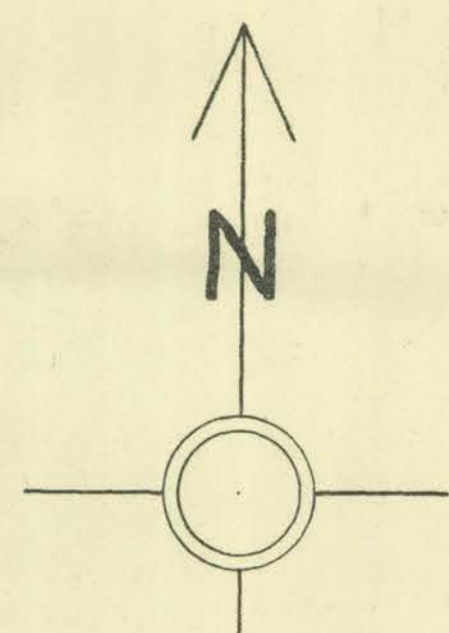
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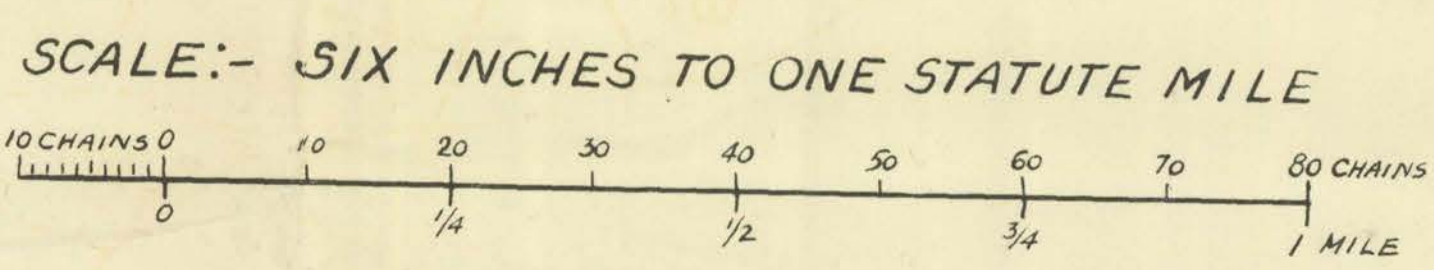
SOME SYMBOLS:

- P37 PLANTED AREAS AND P YEARS
- EXISTING AND PROPOSED A.L. AND GRAZINGS
- PROPOSED VILLAGE SITE
- MAIN ROADS
- Yellow Lettering MINOR FEATURES OR GEOLOGICAL INTEREST
1900, 1833 etc.
SPOT HTS (FEET)

*Limestone Low
Basalts and Andesites
of Old Red Sandstone Age*



PERMANENT FARM LAND



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