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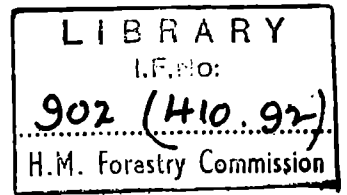
HALWILL

FOREST

SW(CE) CONSERVANCY

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H I S T O R Y

OF

H A L W I L L F O R E S T

1921 - 1951

SOUTH WEST (ENGLAND) CONSERVANCY

HISTORY OF HALWILL FOREST

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## HISTORY of HALWILL FOREST

### CHAIRMAN'S COMMENTS

Halwill was assessed in the beginning as mainly a spruce area and applying that term to the final crop I believe it to have been a correct assessment. The limitations of pure crops of such species as Scots pine and Douglas fir, on which too much reliance was placed in the early years, were speedily demonstrated. In technique silvicultural practice has developed in accordance with improvements in other forests but generally speaking has lagged behind the best practice elsewhere. Three periods are distinguished in the History:

- (a) 1921-29 Direct planting.
- (b) 1930-33 Mound and Turf planting.

(Turf planting had become general in the English/Scottish Border area by 1928).

- (c) 1934-date. Caterpillar ploughing.

This period, as noted below, might well be subdivided.

It was thought at the time that with the development of turf planting (combined with slagging) the problem of establishing spruces on poor sites had been solved. Such expectations proved too optimistic. Similarly with the development of tractor ploughing, but again difficulties arose on certain sites owing to the unexpected luxuriance of growth of heather or dwarf gorse (as at Halwill) stimulated in fact by the very act of ploughing. Under such circumstances the spruces were checked by such surface growth before they began to grow freely and either stayed in check or emerged very slowly. Clearly the silviculture if not the choice of spruces as the main crop was at fault.

Just before the beginning of the war evidence began to accumulate that pines, which did not check appreciably in the surface vegetation, exerted a remarkable influence on spruce

in admixture. The reason was not immediately apparent; it could have been due to shelter afforded by the quicker growing pine, to soil aeration owing to the deeper-rooting pine, to a combination of the two or to some undetermined factor. It did in fact transpire some years later that the emergence of the spruce coincided with suppressing of surface vegetation, the connection being that the long "seeker roots" put out by spruces in check were able to form fine rootlets in the resulting humus. Even so there is probably more to it than that, namely the gradual establishment of what for want of a better term may be termed "forest conditions", embracing shelter, soil aeration, suppression of surface vegetation and profound changes in soil biology of which we know little at present.

So far as I was concerned personally with Halwill the first stages of the above developments were running in my mind during a visit in August 1941 when I gave instructions for certain checked spruce areas to be "reconditioned" with pine on the plan of 2 rows of spruce to 1 row Scots pine, or one-third pine. If I had then known more of the nature of the interaction between pine and spruce the instruction would have been to introduce the pine in bands at least two rows wide so as to get corresponding bands of dead surface vegetation and a quicker reaction. The instruction was disobeyed and only by insistence on my part was work started in 1944. Valuable time was thus lost.

I have said above that I would divide the period 1934 to date. From 1934 to 1941 a purely mechanical solution - tractor ploughing - was relied on. From 1944 onwards the silvicultural aspect (combined with tractor ploughing) began to carry weight though haltingly and not applied in the best way. At an inspection in August 1947 I was proposing band planting, but also agreed to an experiment on "pre-cultivation" including full ploughing.

From 1948 onwards there seems to have been a strong tendency to rely on a mechanical solution of the spruce problem more or

less on the lines of the experiment agreed to in 1947. Reports do not suggest that any great success is being achieved. Unless mechanical methods are combined with correct silvicultural treatment all this is in my view a retrograde movement.

The present status at Halwill of Lawson's cypress and Pinus contorta is interesting. I think both have a part to play, not so much in pure crops as pioneer species with the spruces. In neither case have we any data as to rate of timber production. I have always felt that in some cases Lawson's cypress might with advantage replace pine in mixture with spruce. Contorta grows too quickly and suppresses surface vegetation too slowly to be a good mixer with Sitka spruce, notwithstanding the fact that they occur together in their native habitat. However, it is a less exacting tree than Scots pine and has its proper place at Halwill.

Halwill is difficult extraction country and the nature of the roads and their user requires careful thought. Where timber crops develop so irregularly a good extraction system is necessary and I would like to see more rapid progress.

(initialled) R.

Jan 18th, 1951.

## HISTORY of HALWILL FOREST

### GENERAL DESCRIPTION of the FOREST

#### Situation and Name

The name is derived from the original plantings at Halwill Moor, near Halwill Junction, North Devon. Although the forest is now widely scattered and extended, this still remains its administrative centre and the name has been retained.

#### Area

The first acquisition was made in 1921 at Halwill Moor, an area of approximately 300 acres, consisting in part of open moorland, but mainly of felled coniferous woodlands, planted originally on a similar moorland site. The first plantings were carried out here in F.Y.21, and although the greater part was actually burnt in 1924 and replanted in 1925, a small area of the original planting remains (Compartment 8). Since this date acquisition and planting have continued practically without interruption until the present time. The forest now comprises some 4,500 acres, of which some 3,500 are planted, and less than 500 acres remain to plant.

#### Topography.

The whole forest lies within the North Devon plateau - a gently rolling upland with small and gradual changes of elevation between 200 ft. and 700 ft. Most of the planted areas lie between 250 ft. and 450 ft.

#### Climate.

The climate is comparatively mild, with a relatively high rainfall (45 in. - 65 in.). Precipitation is well distributed throughout the year. Exposure to the westerly Atlantic gales can be severe, there being no salient features between the forest and the coast, some 15 miles to the west. In spite of the mild

climate, frost is an important factor, declivities combining with the ill drained nature of the soil to form frost pockets of frequent occurrence and considerable extent. Mild and damp conditions result in an extended growing season, rendering both early and late frosts dangerous.

#### Soils and Vegetation.

Considering the varying degrees of success which have been achieved in the establishment of plantations, the soil over the whole forest is surprisingly uniform. It is a sticky clay loam, underlain at varying but not great depths by a stiff yellow clay, below which is a considerable depth of stiff blue grey clay. Stone is seldom present, except on the higher flats and knolls, where it gives rise to a drier and better aerated soil.

Despite this uniformity, there are marked and frequently abrupt changes in the site type. These fluctuations have considerable effect on the establishment of tree crops and are confined to no single part of the forest. The same problems have to be dealt with in 1951 as were encountered in 1921. In the early years of the forest, little distinction appears to have been made between the various types, but from 1930 onwards, as the results of the earlier plantings became apparent, more and more stress has been laid on this aspect. (See Appendix I - Chairman's inspections of 1.9.38, 25.8.41, 2.8.44, 1.8.47; also Director (England) 28.5.48).

Briefly, the following types of planting site have now been recognised at Halwill. They are given at this stage in the history as it is felt that they will help to clarify the course of the narrative.

1. Dry sites without peat. Ulex galii dominant, with Calluna and Molinia. The most obdurate types, generally appearing on gentle slopes on open moorland areas long out of cultivation, or never cultivated.



2. Molinia/Calluna co-dominant with associated Ulex and Erica. Patches of shallow peat present. A similar if slightly more favourable type to 1. Slope and run off are generally less than in 1. and there is a tendency to surface waterlogging during the wetter months of the year.
3. Molinia flushes, frequently with relatively deep peat. These occur mainly along the lines of streams and main ditches and also on the lower flats of derelict grazing land, when it is generally associated with a weak growth of heather. A more favourable site than the previous types.
4. Recently abandoned grazing land. The term "recent" implies a period of not more than 15 years. On abandonment they tend to revert rapidly through rushes and/or Ulex to one of the above types; the process is generally complete in 15 years. Normally they provide satisfactory conditions for establishment of tree crops for the first five to ten years.
5. Other types. These are the higher stony areas - clay loams intermixed with shillets. The majority of such sites carried hardwood or mixed crops, prior to acquisition and have given good results with orthodox planting methods; their total area is not great.

It will be seen that types 1 to 4 are closely related, and intermediate stages occur between all of them. The critical factor appears to be the percolation of moisture through the soil; sufficient modification of this factor may cause reversion from one type to another. As a consequence the history of the land prior to planting is frequently of considerable importance. Much of the land afforested was ploughed and cropped during the agricultural boom of the 1880's. During subsequent years much of it went out of cultivation, particularly the wetter areas and the greater part of the Ulex/heather moors, which were then only subject to sporadic grazing. A similar extension of arable, on a

smaller scale occurred in the 1914-18 war, but was not maintained after the slump of the early 1930's. With few exceptions the most successful spruce plantations have been established in the "lapsed" agricultural and grazing land of this period. A similar phenomenon occurred during the recent war, and again the more successful post-war plantings have been formed on land handed back by the War Agricultural Committees.

## Risks

### Fire

Risk at Halwill has always been high, although the incidence of fire has not been as great as the inflammable condition of the vegetation and crop, and the scattered and inaccessible nature of the forest would lead one to expect. There are two main reasons for this. Firstly the relatively wet climate and heavy clay soil seldom permit conditions of extreme hazard to arise. Drying winds will create fairly severe fire danger within a few hours, but it is seldom that the almost "spontaneous ignition" conditions experienced on the Dorset heathland arise. Except in a strong wind spread of a fire is relatively slow, and the absence of peat greatly reduces the complications of subsequent control. Secondly, the local population is relatively sparse, and entirely rural; trippers do not visit the area, for obvious reasons. Consequently the risk of outbreaks caused by the general public is not great.

The two main sources of fire risk are well defined - the railway line running through the Halwill and Claw Moor blocks and Whiteleigh Moor, a large area of Molinia moorland to the north west of the Halwill block, and bounding forest land on 3 sides. Two serious fires have occurred from these sources - in 1925 in Compartments 2-7 from the railway, and in 1935 in Compartments 85 and 86 arising from uncontrolled swaling on the moorland. A large number of smaller plantation fires have started on either side of the railway. These risks were well

known and localised, and the number of damaging fires arising from them was unduly high. Precautions taken do not appear to have been adequate, and fires once started could not be rapidly brought under control. During, and particularly after the war precautionary measures, in these areas (and throughout the forest) were greatly increased; railway side fire traces in particular were greatly widened; fire traces against the moorland were improved. A tower at Halwill depot gave immediate observation of any outbreaks. Losses since then have been negligible, and the saving in patrols has been very considerable.

A note on the maintenance of fire rides is appropriate at this juncture, as difficulties of access have considerable influence on the degree of fire risk. Very large areas of the forest are wholly inaccessible to wheeled vehicles, except under the most favourable weather conditions. The practice until 1949 was to plough the major fire breaks, and cultivate at frequent intervals. On the heavy clay of this area this reduced these breaks to troughs of sticky mud, inaccessible even to crawler tractors for much of the year. The Windsor carrier, used as a M.D.U. frequently became bogged on fire rides. The present practice is to first level the breaks (a bulldozer is cheaper than ploughing and does less damage to the surface), and thereafter to mow annually or every two years, with a tractor drawn mower. Results have been very satisfactory. Effective fire breaks have been produced, and a tight sward is forming which, with proper drainage, will take wheeled vehicles in dry weather. Maintenance costs have been greatly reduced.

#### Rabbits.

A high population exists in the area; much of the forest is now in thicket, and carries a dense gorse/heather ground cover. Combined with a large breeding stock outside the forest this makes control of the pest both difficult and costly. Efforts are now directed at keeping the population at a minimum

level throughout the forest; complete extermination is only aimed at in and around newly planted areas. Until neighbouring owners can be induced to co-operate in wholesale extermination this is felt to be the only economic policy to pursue. Efforts at achieving such co-operation have not so far met with success; a really concerted effort is required, with the positive backing of the Agricultural Executive Committee.

The present (admittedly short term) policy has kept new plantations practically free from rabbit damage. Recent experience has shown that new plantings do not invariably require to be fenced against rabbits. This is particularly the case when the area is entirely surrounded by our land. Careful observation beforehand can therefore result in considerable savings in fencing costs. Frequent inspections both before and after planting are of course essential.

#### Windblow.

This has been of major importance on certain areas (Morecombe and Witherdon particularly). High rainfall, strong winds and a heavy non-porous soil, which inhibits root penetration and is subject to local waterlogging, all contribute. Douglas fir has suffered most severely, even on relatively dry sites. For this reason alone, the planting of this species at Halwill would not be merited. Both Norway spruce and Sitka spruce suffer sporadic windblow; in all cases bad drainage has been the primary factor. An interesting feature is that in at least 50% of the cases an untrapped spring line lies above the waterlogged area; an extensive draining system exists in the windblown area as a rule, but even when carefully maintained cannot prevent the area between the drains from being waterlogged by surface seepage. Careful original layout, satisfactory maintenance up to thinning stage, and particularly adequate upkeep of drains immediately following a thinning are essential. If this be done windblow of spruce at Halwill should not occur, provided they are regularly and adequately thinned.

### Other Risks

No other risks of major importance have so far arisen. A certain amount of cattle trespass occurs, but does not cause serious damage. Large numbers of starlings roost in the forest each winter, causing local damage - this must be accepted; the cost of scaring off such vast flocks would be prohibitive.

Of insects of forest importance the area appears to be remarkably free, and there are no records of even minor epidemics; although small numbers of the more common parasites are undeniably present. The wet and rather cool climate is doubtless a discouraging factor, combined with the absence of large areas of fellings in mature woods which would provide breeding grounds.

Honey fungus occurs sporadically, the sources of infection being generally old hedge banks which have carried some sort of hardwood crop. Lawson cypress suffers most severely, but even with this species the proportion of deaths is low. A few cases of conifer heart rot have been reported, generally in Sitka spruce on wet sites; no large scale infection exists at present, but a careful watch is being kept. Larch canker is fairly prevalent on European larch, but this species is otherwise unsuitable, and no damage has so far occurred to Japanese larch.

The forest seems to have certain similarities to some of the areas in which group dying of Sitka spruce has been reported. So far, however, no signs of this have appeared. A small block of Sitka spruce, very urgently in need of a thinning, was recently noticed to be going very thin in the crown (Witherdon Compartment P.1920). A thinning has now been carried out, and the area is under observations.

### Labour

Up till 1939 a fairly adequate labour force was maintained. There was some reduction following the depression, but in general a planting programme of between 100 and 200 acres was carried out, and maintenance works were kept up to date, or nearly so.

(There is some evidence that maintenance was falling to arrears in the more outlying areas, by 1938).

The labour force at Halwill was particularly hard hit by the 1939-45 war. At one time the staff was as low as 4 - barely sufficient to run the nursery which was kept on throughout the war. Latterly the position improved somewhat, and prisoners-of-war were drafted in for a time, but by 1944 serious arrears of maintenance existed. Almost all aspects were equally in need of attention, but the arrears of thinnings were the most urgent. Staff has been built up slowly since the end of the war. A primarily agricultural area the labour available is generally of good quality. But the surplus available for forestry is generally limited. The staff reached about 40 in 1948 and remained at that level for some time - too low a figure for the forest in its present state. 14 new houses have been built in the last 2½ years and this has gradually increased the strength to over 50. It is likely that it will be retained at that figure. Good progress is now being made with the arrears and in the year since the main body of this history was written the thinning position has been greatly improved. It has been possible to carry out a reasonable planting programme and substantial areas of checked spruce plantation have been "reconditioned" with pine. Much still remains to be done, but the staff is now sufficient to overcome the effects of the war years in a much shorter time than originally seemed possible.

### Roads

Reference has already been made in these notes to the difficulties of access at Halwill. Prior to 1948 there was no forest block at Halwill which a lorry could enter for more than a few yards. By far the greater proportion of the rides were only accessible to wheeled tractors under exceptionally dry conditions. This inaccessibility had a serious effect on fire protection costs and fire losses generally. Its effect on costs

of preparation of produce are obvious. But perhaps the most serious result seems to have been on the actual thinning of plantations. There seems now little doubt that thinning would have started earlier in most plantations had it been possible to get the produce out with less expenditure of labour; it should be remembered that in the years when first thinnings should have been undertaken crawler tractors were in very short supply. Ever to-day produce can still only be extracted from many parts of the forest by tracked vehicles operating on very long hauls.

Road construction work started early in 1948. Two major projects have been undertaken - a road running from the main Okehampton-Holsworthy road to the Forest Worker Holding at Whiteleigh (completed in F.Y.51), and a central road leading through the Witherdon block (to be completed in F.Y.52). These projects were carried out by the Forest Engineering Branch. The Whiteleigh road is at present of little value to the extraction programme, but gives much needed access to the zone of maximum fire danger on the railway line, and to the holding itself. In time it will serve as the main extraction route for an area of the most promising plantations at Halwill, and will eventually link up with the main Holsworthy-Hatherleigh road at Moorhouse. The Witherdon road, over part of its length at least, is now proving of direct value in the extraction of produce, and will give rapid access to an area of considerable fire hazard.

In addition three smaller road projects have been carried out by forest staff - at Morecombe, Halwill Junction and Westlakes Plantation. These have been made primarily for extraction purposes, cheaply and quickly made, and though rough, have already paid handsome dividends by the reduction of working costs.

The benefits already derived from these roads only serve to enhance the fact that unless revolutionary types of extraction gear are introduced a much more extensive road system will be required at Halwill in the not so distant future; otherwise many of the earlier thinnings will not pay their extraction

costs, and larger material will yield very low returns. This is perhaps not the place for discussion of road policy. Ground conditions are difficult at this forest, and the "professionally" built roads, though excellent in the final results, have been slow and costly in the making. Drainage in particular is considered by the silvicultural staff to be over elaborate, and the resulting deep side ditches are a formidable barrier to extraction. It is felt that the aim should be<sup>that</sup> a much greater mileage of cheaper and rougher roads should be laid down in advance, so that they have a chance to consolidate before heavy usage begins.

## SILVICULTURE

### Progress of Establishment

The history of the forest is primarily the history of the attempts to establish spruce on the damp shallow soils of the area. Other species have, of course, been involved, but from the start Norway and Sitka spruce have been regarded as the principal crop. The development falls naturally into three periods, defined by the principal planting methods employed.

Period I. 1921-1929 inclusive. Planting carried out on natural surface - some hand drainage employed.

Period II. 1930-1933 inclusive. Mound and turf planting employed. Turf and main drains cut by hand.

Period III. 1934 to date. Bulk of planting carried out on land previously prepared by power ploughs.

Each period represents a distinct advance towards satisfactory establishment and it is proposed to discuss them separately in detail.

#### Period I - 1921-1929

The planting method was generally notch planting with spade or mattock. A certain amount of hand draining was done, prior to planting; on the wetter sites this draining subsequently proved insufficient in many cases and led to check and windblow on sites which would otherwise have given good results. (See



Appendix I - Chairman's Tour 29.8.32. Compartments 8-11).

Heavy gorse, heather and Molinia were normally cut and burnt off prior to planting.

In this period all the site types mentioned under 'Soils and Vegetation' (pages 5-7) were planted. Some discrimination between the various types was attempted in the choice of species, but with a few exceptions no modification of planting methods was attempted for special conditions. By 1927 it was apparent that certain types of land were inducing check conditions and that the best results were being achieved on land which had at some time been cultivated. A small area on Ball's Moor (Compartments 42 & 43) was strip ploughed at 5 ft. spacing with a specially made horse plough in F.Y.28. Similar work was done in Compartment 43 in the following year. Results, however, were not convincing. The furrows were shallow and little soil disturbance was effected. Scots pine on a Molinia/heather flat shows little better growth than when flat planted on similar sites. Douglas fir on an adjacent Ulex/heather site failed completely and was replaced with Sitka spruce which is still in check. Sitka spruce on a Molinia site has done well, but no better than adjacent turf planting. Apart from this ploughing experiment a small amount of turf planting was carried out from F.Y.24 onwards, but only in the wettest Molinia peat areas, and generally with insufficient drainage.

#### Choice and Distribution of species.

Norway spruce. This was the most extensively planted species during this period. On pure Molinia sites (as at Morcombe Compartments 23/24 and parts of Halwill Moor) plantings of this period have done exceptionally well provided good drainage was maintained. It was also planted on some of the wetter parts of the former mixed woodland areas (e.g. Compartment 14 - Upcott). On Molinia/heather moorland (Halwill Moor parts of Compartments 8-11) and on the former conifer sites on such moorland (Halwill Compartments 1-7 and Quoditch Compartments

37-40) results have been<sup>very</sup>/variable. The moister areas, small Molinia flushes and the margins of main water courses have grown well; the heather areas still remain in complete check; the crop presents a mounded appearance with every variation between these extremes. Little Norway spruce was planted on the Ulex areas in this period but, where it was done, it is either in complete check or dead. Plantings of Norway spruce or any other species on recently abandoned agricultural land during this period were small, but where carried out were successful.

Sitka spruce. This species was also extensively planted during this period, generally on somewhat similar sites to Norway spruce, but with a greater extension into gorse and heather sites, and on the more exposed moors. On Molinia flushes it has grown well, (e.g. Morecombe, Brockscombe, Compartments 42, 43 and 45) although more susceptible to frost damage in the early years. Generally it has shown itself more tolerant of Molinia/heather conditions, but strong check occurs where heather is present in any quantity. Where dwarf gorse conditions persist (as in Compartment 44 and Witherdon Compartments 20-26) Sitka has checked almost completely, except near main water-courses and even subsequent beating up on mounds has been swamped and completely checked by the gorse. (See Appendix I - Chairman's Inspection of 20.8.31.) On former mixed woodland sites (e.g. Upcott and Westlakes - Compartments 12 and 14) this species has given small stands of exceptional quality and volume.

Scots pine. Relatively small areas of this species were planted between 1924-30, mainly at Witherdon and Brockscombe. The sites are mainly of a stonier nature and appear originally to have been Molinia/Calluna associations, with a certain amount of bramble and bracken. Except on waterlogged flats good growth has been made and the plantations have reached the brashing stage in many cases. There are marked indications now, however, that growth is falling off seriously. Similar results have been obtained where Scots pine was used during the same period to

replace completely failed Douglas fir areas at Witherdon. Unfortunately we have no examples of Scots pine being used during this period on the Ulex/Calluna type of site - information on such crops would have been valuable at the present time.

Douglas fir. This species was extensively planted between 1924-1927, principally at Witherdon (Compartments 19, 20, 24 and 29), Upcott Ball's Moor and Morcombe Wood. (Ref./Assistant Commissioner's memo. circa. 1923.) It has not proved a success. On Molinia/Calluna, Ulex/Calluna sites it failed completely and was replaced. On the moister woodland sites such as Morcombe it has grown rapidly, but is subject to severe wind-blow, unless great care is taken with thinnings and drainage upkeep; it is of inferior form to either Sitka spruce or Norway spruce on such sites, and has not the volume of the Sitka. On the drier woodland sites (Westlakes and Witherdon, Compartment 29) it grows well and is relatively stable, but the crown thins out rapidly when exposed. Sitka spruce/Douglas fir mixtures appear to be the only satisfactory way of raising this species at Halwill.

Japanese larch. Small areas were planted at Witherdon (Compartment 29) on dry woodland sites, mainly in mixture with Beech. These have done extremely well despite heavy initial rabbit damage, and a very satisfactory mixed crop has resulted. A small area on degraded Molinia/Calluna grazing land in Compartment 8 has been less successful, however.

European larch. Early plantings of this species have entirely failed, even on the very rare bracken sites, and have been replaced with other species.

### Period II - 1930-33

This short period marks the extension of turf planting methods, used occasionally in the preceding period for wet Molinia areas, to a much wider variety of sites. The general method was to lay out the main drainage system beforehand, and then take out turf drains about 9" deep, at a spacing between

25 ft. and 30 ft. which where possible were given a continuous fall to the main system. The turves from these drains were spread inverted at 5 ft. x 5 ft. and the plants notched into them. On the drier heather patches it appears that drains were not always cut, the turves being cut in situ. Contemporary records are not complete on this point, but it can be gathered that the objects were twofold:

- (a) to raise the plant to some extent above the surface waterlogging which the impervious nature of the soil will cause at certain seasons of the year - even on dry gorse sites;
- (b) to give the plant a cleared space in which to establish itself and suppress the vegetation in its vicinity.

The species used during this period were almost entirely Norway and Sitka spruce. Three types of site were planted:

1. Fairly recently abandoned grazing land, reverting to Juncus vegetation (Compartments 88 & 49-51).

Complete success achieved with both species. The initial check caused by flat planting was greatly reduced and the plants have grown well from the start (P.30 and P.32). (See Report of the Chairman's Inspection of 29.8.32.)

2. Grazing land longer out of cultivation, heather and gorse tending to appear in the ground vegetation (Compartments 52-55 and 60/61).

Establishment has been effected over the greater part of the area. Initial check appears to have been fairly prolonged, but has now been overcome, except on the areas with a good deal of heather present. The crop in Compartment 69 is now at the brashing stage on the more favourable sites. Sitka spruce has shown itself more tolerant of heather sites than Norway spruce, which is still in complete check in parts of Compartment 68,

although both it and subsequent Sitka spruce beat ups still appear quite healthy and capable of growth.

3. Ulex/Calluna/Molinia sites. (Lashbrook, Compartments 65-67 and Highermoor, Compartment 15).

Plants after fair initial growth checked abruptly 2 or 3 years after planting, were swamped by encroaching ground vegetation, and have remained in check ever since. Weeding has produced no effect, and even plants with their leaders well clear of the gorse remain in check. The plants remain healthy in appearance, but there are now signs that they are dying back.

During this period beating up checked areas from the preceding period, mainly with Sitka spruce on turves, was put in hand (See Appendix I - Reports of the Chairman's visit of 20.8.31 and of 29.8.32). Large plants grown in turf nurseries near the site were used, and considerable areas were so treated. Results were comparable with those achieved on new plantings, i.e. on the more favourable Molinia sites and Molinia sites with a little heather good results were achieved, particularly when the method was combined with additional drainage; on the more obdurate sites the "beat up" plants have made no progress.

Some experiments with 2 yr. seedlings on mounds and on shallow ploughed furrows were carried out, both with Sitka spruce and Norway spruce. These experiments were all conducted on the better type of site (mainly in Compartment 49) and no significant difference in growth is apparent at this date, either between seedlings and transplants or ploughed or turfed areas. The same plough was also used at this stage for taking out turf drains.

Period III - 1934 to Date.

By the start of this period major difficulties had become apparent. Relatively small areas of the original plantings had been completely successful; the typical crop was an uneven patchwork with good growth on the better sites, small or large areas in complete check, and all gradations of height

and quality between these. Where good growth occurred it was tending to ameliorate these conditions in adjacent checked areas and slowly close the gaps, but this was obviously a very slow process.

The following facts had been learned from previous plantings:

- (a) That cultivation of the soil, even many years prior to planting, greatly helped initial growth.
- (b) That even on the best sites the additional aeration achieved by raising the plants on turves above the level of surface waterlogging was of considerable value.
- (c) On heather and gorse sites trees went into check soon after planting, and that unless root competition could be delayed until the trees were well established, no final success would be assured.

It seemed likely that ploughing would achieve all three of the above effectively and economically, and from 1934 onwards almost all new planting was carried out on ground so treated.

#### Ploughing Methods

##### 1. Double Furrow.

This method was used almost exclusively from F.Y.34 to F.Y.42. The plough mainly used was the Oliver double-furrow pulled by a Class 4 crawler tractor. The normal method was strip ploughing at 5 ft. spacing, and gave a furrow of about 8 in. deep. It was first used in Compartment 70 at Garlands Moor, and the greater part of this area (Compartments 70-87), all Claw Moor (Compartments 88-103), Quoditch (Compartments 113-120), Cookworthy (Compartments 105-108), Cookbury (Compartments 109-111), Holsworthy (Compartments 124-131), Leworthy (Compartments 134-139), and Ashbury (Compartments 144-145), were treated with this method.

## 2. Single Furrow, deep ploughing.

Double furrow ploughing did not check the heather and gorse vegetation completely, and in F.Y.43 trials with the Massey Harris grub breaker were conducted at Kigbeare, Compartment 151, ploughing to a depth of 12 in. - 14 in. at 5 ft. spacing. (Appendix I, Assistant Commissioner's Visit 23/7/41, and Section on "Experimental Work"). In F.Y.46 R.L.R. ploughing was carried out in Compartment 152 to a slightly greater depth.

## 3. Single Furrow, intermediate depth.

In F.Y.47-49 use was made of the Ransome Unitrac and Solotrac at Ashbury (Compartments 156, 158-9, 162-3), ploughing to a depth of 8 in. to 12 in. This was mainly on recently abandoned grazing land. It was not considered that very deep ploughing would give more effective control of the gorse, and might even give conditions unfavourable for the growth of spruces. (In the above three methods planting was normally done on top of the furrow slice. The furrows were normally ploughed to drain the area as thoroughly as possible, irrespective of the vegetational type.)

## 4. Complete Ploughing.

On an experimental basis small areas at Kigbeare (P.46), Wadland (P.49) and Whiteleigh (P.50), were completely ploughed with or without subsequent disc harrowing, in an endeavour to provide a really effective check to the gorse.

### Results of Ploughing.

These were at first encouraging. One of the first features noted was the appearance of better quality grasses on almost all types of site. The trees grew well with very little planting check in the early stages. On the better

sites this good growth has been maintained, and crops equal in quality and size to those on adjacent turf planted sites, but several years older, have been achieved, (e.g. (Compartments 88 & 112). On Molinia/heather sites the range of the spruces - particularly Sitka - has been successfully extended.

On the gorse/heather sites the initial improvement was not, however, maintained. After a year gorse made its appearance at the edge and between the furrows. Heather also appeared after a short time. Within a few years these species, and particularly the dwarf gorse, had recolonised the site. Grasses except for sparse Molinia had disappeared and the spruces went into complete check. The ploughing has in fact stimulated the gorse which is now the dominant vegetation. An even more disconcerting feature has been that on areas formerly predominantly Molinia sites with a high proportion of heather, and even on the drier types of grazing land, ploughing has encouraged the gorse which has now assumed, or is tending to assume, dominance.

The deeper single furrow ploughing was introduced in an endeavour to smother the gorse more completely. This it achieved for a slightly longer period, but in the experiment at Kigbeare there is now little to choose between the deep ploughing and shallow ploughed controls.

The Chairman in a visit in 1941 instructed that when such gorse sites were planted in future, special measures should be used to ensure that the spruces got away with the minimum of initial check, so that when the gorse returned they would have made sufficient growth to overcome and eventually suppress it. He advocated the use of large Sitka spruce plants, slagging, and the admixture of Scots pine with the Sitka. Slagging has so far been carried out on a limited scale, but the other measures have been



carried out on all sites of this nature (few such areas have been planted since 1947). Both Scots pine and Pinus contorta have been used and are growing well, but their effect on the spruces can hardly be judged as yet.

#### Other Work.

Reconditioning. (Appendix I - Visit of Chairman, 25/8/41.)

In 1941 the Chairman gave instructions that the interplanting of the extensive areas of checked spruce with pines should be undertaken, with the object of bringing the spruce out of check. Shortage of labour prevented the work being started until 1944. A survey made in that year showed that there were nearly 800 acres of such crops. The work has been carried on annually since that date and forms one of the major operations. A rough survey made in 1951 shows that about 200 acres still require treatment. Scots pine has grown well on the ploughed sites, though it is still too early to assess its effects. On unploughed areas, such as Witherdon, Pinus contorta appears likely to give better results.

#### Thinning.

Relatively little thinning has been done at Halwill. Owing to labour shortage no thinnings were tackled till 1944, by which time much of it was overdue; some serious windblow resulted - mainly in Douglas fir. To date most of the thinning has been in the small area of acquired plantations at Witherdon, and in the early crops planted on former woodland sites. Because of the tendency to windblow a policy of "light and often" has been pursued, which has inevitably reduced the total area thinned. Small patches of the earlier moorland plantations have also been thinned with good results; but the patchy nature

of such areas throws an additional strain on a labour force already fully extended by arrears of other maintenance work caused by wartime labour shortage. Arrears of thinning are still considerable, and, though these are now receiving priority, it may be necessary to adopt a less cautious thinning policy to ensure that all underthinned areas receive adequate treatment before it is too late.

#### Notes on Species used During Period 1934-1951.

##### Sitka spruce.

Sitka spruce is the principal species planted, and the one to whose establishment the major part of the ploughing trials have been directed. Excellent growth has been made on Molinia areas and resumed grazing land except in frost hollows where it may remain in check for a number of years. Ploughing has extended its range well into the better Molinia/heather sites where fair to satisfactory results have been obtained. An encouraging feature, particularly obvious in Compartment 108, is that once it has established itself on a ploughed site and has reached a height of four to five ft., it does not appear to be affected by the subsequent recolonisation of the area by dwarf gorse. It has also shown itself capable of standing severe wind exposure.

On the Ulex/heather sites, however, no form of ploughing yet tried has enabled it to grow sufficiently rapidly to survive the effects of the gorse. The results of full ploughing are not yet conclusive.

##### Norway spruce. (See also "Mixtures")

Good results have also been achieved with this species on the better sites and ploughing has extended its range somewhat on the heather ground; but it is less tolerant of heather sites than Sitka, and is killed rather

than checked on gorse sites, where its use is not recommended, even in mixtures. On exposed plantation edges it suffers severely from windblast. Generally it should be confined to the better spruce sites, particularly where there is some risk of frost.

Japanese larch.

This has been planted direct on the few dry bracken slopes which occur, and is growing well. Plantings on ploughed ground on the drier parts of resumed agricultural land have given very rapid growth, though tending to be windswept at the base. It has not been successful on gorse/heather sites.

Scots pine.

This species has been used almost entirely as a 'beat-up' for checked spruce areas and in mixture with spruces in recent planting. Results to-date are satisfactory.

Pinus contorta. (See also "Mixtures")

As for Scots pine. Growth has been extremely rapid, even on the most difficult sites; it is felt that its possibilities as a pioneer species should be more fully investigated at Halwill.

Lawson's cypress.

Small pure plantings on resumed agricultural land have produced young stands of high quality. Limited trials of this species, in mixture with Sitka spruce and as a beat up at Claw Moor (Compartment 103) on Ulex/heather ground, have given encouraging results. Although it is of poor form on this site, it remains vigorous and is now beginning to bring the Sitka spruce out of check. More extensive trials are merited.

Abies grandis.

Small blocks have been established on resumed grazing ground and have given excellent results. Growth is equal to or better than Sitka and the species is definitely more windfirm than Douglas fir. So far the species has not been tried on the poorer sites, but it appears to have interesting possibilities.

Tsuga.

Tsuga has been planted on similar sites to Silver fir, also on a small scale. It has also grown extremely well and does not appear so susceptible to frost as was first expected. The Chairman instructed that this species be used to beat up checked Sitka spruce areas where frost danger was not great, but so far this has not been tried. Like Abies grandis, the possibilities of this species are worth investigating.

(Tsuga plantings have been merely confined to grazing land reverting to Juncus - with satisfactory drainage, the most favourable type of site at Halwill.)

Picea omorika and Picea alba.

Both have proved to be unsuited to this area.

Beech.

No pure planting of this species has been done but one or two small areas of conifer/beech mixtures have been tried - Norway spruce and Japanese larch being the nurses. It has proved more tolerant of heather and gorse than Japanese larch, which in the mixture has almost died out. The beech is maintaining equal growth with the Sitka spruce beat ups, and is of good form, although early failures from frost have been heavy. Ride rows, and neighbouring private woodlands indicate that this species can do well in the Halwill area, and its extended use is proposed. With a pine nurse and with full ploughing it may

offer better promise than the spruces on gorse and heather areas.

#### Mixtures.

(a) Pinus contorta/Norway spruce. This mixture has been planted on ploughed ground on resumed grazing land, reverting to heather, at Cookworthy (Compartment 108) and at Brockscombe. It has given more promising results than pure Norway spruce on similar ground. The Pinus contorta has outgrown the spruce, and is now having to be lopped back, but the spruce is in no way checked and is responding well to the additional light.

(b) Pinus contorta/Sitka spruce. A mixture of Sitka spruce with 20% Pinus contorta was used in certain areas at Claw Moor (Compartments 101 and 108) and at Cookbury on gorse/heather sites. The Pinus contorta have grown well and are now tending to bring the spruce out of check. The mixture is one which will require careful attention, as the pine are well ahead of the spruce, and are liable to suppress it before it really recovers from check. At Cookbury the pine has been heavily pruned (F.Y.50) and, except on the worst sites, the spruce have responded already to the additional light.

#### Experimental Work.

Considering the number and magnitude of the problems which this forest has presented, surprisingly little experimental work has been done. Most of the information obtained has been derived from the results of actual plantings; with the fate of more than one-fifth of the total plantings still in the balance, this might be considered a costly way of acquiring knowledge; but against this must be set nearly 3000 acres of potentially productive plantations whose formation would have been considerably delayed had it had to wait on the results

of carefully conducted and comprehensive experiments.

Experiments have been aimed at two objectives - soil nutrients and soil cultivation.

Soil Nutrients. These experiments have all been concerned with the addition of basic slag either at planting to facilitate establishment, or after planting in an endeavour to bring trees out of check.

F.Y.22. Research Branch Experiment - Compartment 10. Basic slag added to both Norway spruce and Sitka spruce transplants at planting. Unslagged controls were left. The site appears to have been originally a Molinia/Calluna one. The result was that the unslagged controls had died out completely by F.Y.38., slagged plants were satisfactorily established (Appendix I, Chairman's visit of 1.9.38.).

F.Y.29, Compartment 44. Forest Experiment. The original planting failed and the area was almost completely beaten up with Sitka spruce on mounds, 2 oz. of slag being added at planting. The site was a gorse/heather one. Immediate results were the rapid initial growth in Sitka spruce. This was unfortunately followed by an even stronger growth of the gorse and the spruce went into check. There is now no difference between the beat up spruce and the originals. Gorse growth is exceptionally strong. (Appendix I, Assistant Commissioner's visit 2.3.44.)

F.Y.37. Compartment 92. Forest Experiment. 2 oz. slag was added to P.35 Norway spruce and Sitka spruce already in check on gorse/heather sites. Encouraging results were noted in 1939, (Appendix I, Assistant Commissioner's visit 11.5.39.) but further assessments have not been made. No significant difference is apparent in 1951 and it would appear that much the same has happened as in Compartment 44. (Note - Compartment 94. P.34. Much better growth occurs here on an area which a few years before planting received a dressing of African phosphate to improve grazing. This

is not, however, conclusive, as better growth normally occurs on grazing land irrespective of previous manurial treatment.)

F.Y.46. Kigbeare, Compartment 152. Forest Experiment. Norway spruce, planted on full ploughed and harrowed ground, received slag dressing at planting. Fair growth continues, but the gorse is now returning. The results were inconclusive; no controls were employed, and any results achieved cannot definitely be attributed to either slagging or full ploughing.

#### Conclusion.

It is quite definitely known that phosphates are deficient in the Halwill soils. The above experiments are somewhat inconclusive but the indications are that spruces will respond to basic slag. However, as the gorse will also respond, and appears eventually to restore the trees to a state of check, it appears that slagging on sites where gorse is already present is of little value. On the site in Compartment 10, slagging definitely brought the trees out of check, but present ploughing technique will effect this on similar sites and is less costly. The value of slagging may, in the future, be on completely ploughed sites, to stimulate initial growth of the trees so that they are out of danger before the gorse returns; the gorse should be sufficiently checked on such sites to receive less stimulus than the trees. It may be, however, that clean ploughing will achieve the desired result without further assistance; but if the results of the present clean ploughing experiments are unsatisfactory, controlled experiments on these lines may be desirable.

#### Ploughing Experiments.

The earlier ploughing experiments, including that at Kigbeare Compartment 151 in F.Y.43, have already been discussed. The complete ploughing experiment in Compartment 152 is discussed in the preceding sub-section. Additional complete ploughing

experiments have been laid out recently as under.

F.Y.49. Wadland Down, Compartment 161. The area was full-ploughed in early summer with Solotrac. The furrows were flattened by tractor but no other treatment was used. The site divided by a bank, one half recently fair quality grazing, the other degraded grazing; Molinia with high proportion of heather, dwarf gorse coming in. Controls - strip ploughing immediately adjacent to each part on similar sites, and planted with same species - Norway spruce/Scots pine mixture. Results in the winter of 1951 showed that there was little to choose between experiment and controls. Plants in the experiment appear somewhat larger but rather less healthy. Very little vegetation has come in on either half of the experiment - a little heather and Molinia on the poorer half at the furrow edges, some finer grasses on the better portion. Heather and Molinia are returning strongly on the poorer control, but an excellent crop of fine grasses is present on the other.

F.Y.50. Compartments 57, 122 and 123. Former fire areas, strip ploughed and planted F.Y.38 and F.Y.40 with Norway spruce. The site was originally a Molinia/heather one. Norway spruce was making only moderate growth; and the worst checked areas were those which were burnt. Original crop which remains is satisfactory, with a fair proportion of heather in the ground vegetation. Bare areas were completely ploughed and disced in 1949 and planted in F.Y.50 with Sitka spruce pure and Norway spruce/Lawsons cypress mixture. Results are inconclusive to date. An excellent crop of grasses has come in, with no signs of heather so far. Cultivation was carried out under wet conditions, and the clay was much compacted. Planting was carried out on the flat and the recent wet season has made the area very waterlogged - a condition reflected in the



colour and growth of the spruces. This area is not fully typical of the worst conditions at Halwill.

### Summary and Future Problems.

#### (a) Establishment of crops.

Present technique is capable of establishing tree crops on all but the worst types of site at Halwill - those with a high proportion of gorse and heather in the ground vegetation. Future research must be directed towards discovering a technique which will result in the successful afforestation of such areas. At present the most profitable line of research appears to be that of clean ploughing, with or without subsequent cultivation. Before proceeding with this, however, careful experiments must be conducted and sufficient time be allowed to elapse for a proper assessment of their findings. At present we are in much the same position with regard to strip ploughing as we were in 1936 about strip-ploughing - the method seems sound in theory and the results to date seem satisfactory.

A further line of enquiry in this problem is the use of a species other than spruce on the worst areas, either as a pioneer or final crop. Pinus contorta planted pure, and subsequently clear felled when it has suppressed the vegetation, seems a possibility. Alternatively it might be thinned out and underplanted with more desirable species at pitwood size.

#### (b) Reconditioning.

The use of pine beat-ups as a nurse to checked spruce on ploughed ground appears to promise well. But there are large areas of the earlier ploughings where the spruce has entirely disappeared, and an exceptionally strong growth of gorse is present. If complete ploughing is successful such areas will have to be so treated. The old furrows, and the heavy vegetation have so far prevented this being successfully carried out. It is generally impossible to burn off the vegetation safely. A method of clearing this cheaply will have to be devised before

such areas become due for treatment, so that a three or four furrow plough can be used on the original furrows. The dozer rake is a possible solution, and it is hoped to try this in the near future.

(c) Maintenance.

Irrespective of the plantations now in check very serious arrears of maintenance exist in established plantations. This is mainly attributable to shortage of staff during war time. This is not in itself an insoluble problem, the labour force being now at a reasonable strength, but it is mentioned here because the priority treatment of established crops will occupy the labour force for a considerable time; for some years such operations as new planting, reconditioning, and even the beech underplanting of Scots pine areas, may have to be subordinated; on the other hand such a hiatus will provide a good opportunity for experiments in new technique of establishment.

(d) Supervision.

The forest is now becoming too large for control from one centre. In the near future it will be advisable to convert it into two separate units.

(e) Acquisitions.

It will be seen from the foregoing points that new acquisitions are not immediately desirable. Plenty of moorland is available in the area, but there will be little point in taking this over until the method of satisfactory afforestation is worked out for such sites. Considerable areas of derelict woodland also exist. The longer these are left, the more costly will their ultimate afforestation be; we know moreover that good crops can be grown on these sites. The most satisfactory programme will be to acquire such areas, a little at a time, planting them as labour can be spared from other operations.

COMMENTS BY STATE FOREST OFFICER.

From what I have seen at Halwill Forest so far, it appears that the same applies as does at Hartland and Wilsey Down in that too much emphasis has been put on the drainage of Molinia areas which has been still further intensified of late by ploughing down hill instead of contourwise. This has resulted in the drying out of the soil and the intrusion of heather and gorse on an area where the spruces were planted because the original vegetation was Molinia. The root competition is then too much for the spruces which go into check and the introduction of pine is necessary, especially Pinus contorta.

For the future, it is suggested that ploughing in a contourwise direction with a slight fall and with the ridge on the downhill side of the furrow, will enable the spruces to reach sufficient size to be able to compete with any subsequent growth of gorse or heather. There is an excellent example of this at Hartland Forest (Compartment 104).

J.B. STOCKS

8/2/51

## HISTORY OF HALWILL FOREST

### APPENDIX I

#### Notes from Inspection Reports

(The extracts are designed to underline silvicultural points in the History; to draw attention to instructions which have initiated major changes of policy; or to indicate future lines of treatment for problems yet unsolved.

#### Memo. from Assistant Commissioner (England & Wales) to Mr. C.O. Hanson (undated circa. 1923)

This contains the suggestion that more pine and Douglas fir should be used in place of spruce - particularly Norway.

Frost damage was seen to be serious. Frost-tender plants had been planted in obvious frost-hollows. It would be more expedient to use larger plants.

Note: These species - Scots pine and Douglas fir - were abandoned as pure crops in 1928 as they proved unsuited to this area.

#### Tour by Chairman and Vice Chairman - 20.8.31.

Compartment 15. The mound planted Sitka spruce and Norway spruce (P.30) appeared very satisfactory.

Compartment 22. P.24 Sitka spruce and Norway spruce had produced very poor results. The remedy suggested was thoroughly to drain the land and, after two years, beat up with Sitka spruce grown in a turf-nursery like that at Corroul. The plants in this nursery should be good 2 + 1 or 2 + 2 and at the end of the two years should be about 2 to 3 ft. high.

Note: The higher area originally notch-planted shows much better growth.

#### Report by Mr. O.J. Sangar, June 1933.

This gives an excellent picture of results at this date and is included complete as Appendix IV.

Tour by Chairman, 29.8.32.

Compartment 49. Sitka spruce seedlings planted this year on ploughed strips and turves were considered very satisfactory. Sitka spruce transplants, planted at the same time, also appeared satisfactory.

Compartments 8-11. P.21-23. Proposed treatment for several badly failed areas was to cut all new drains needed in F.Y.33 and to beat up in F.Y.35 with plants from the turf-nursery, which latter should be treated by the "dumping" method. Beat up could take place in F.Y.34 if the Sitka spruce should be large enough.

General. The work of making good all older plantations should be continued. In forming new plantations the use of spruces (Norway and Sitka but more particularly good 2 + 0 Sitka) on mounds was to be extended.

Note: Treatment advocated for Compartments 22 and 8-11 in these reports was continued on a wide scale for several years (till about F.Y.38) and continues on selected sites only to the present. On sites such as Compartments 8-11 where impeded drainage and Molinia-peat conditions are present it is successful. On Ulex sites - Compartment 22 - no satisfactory results were achieved.

Visit by Chairman 18.8.36.

Compartment 8. The formation of canopy in this compartment was noted, the best groups being on the wetter sites.

The Chairman detailed the use of Tsuga for delayed beat up of spruces, as a mixture with Sitka spruce and also as a pure crop in selected areas not affected by frost. Also he wished to see Lawsons cypress used as a mixture with Sitka spruce, as a plant for beating up spruces and its continued use on rides; likewise beech.

Note: Tsuga has so far only been used as a pure crop on selected sites - with excellent results, e.g. Compartment 113.

Observation. "Tractor ploughing has obviously solved the main problem of establishing spruces at Halwill. Some of the plantations so treated look very well indeed. The earlier plantations are gradually improving but progress is very slow compared with ploughed areas."

Note: Lawsons cypress with Sitka spruce has given good results in obdurate sites - e.g. Compartment 101. Shortage of plants has prevented its being used as widely as is desirable.

Visit by Chairman 1.9.38.

After considering the irregular development of crops on the Halwill moors, the Chairman considered that where areas on which it was known that check was likely to occur could be identified by the vegetation and soil conditions, such areas should be slagged at the time of planting, and that where backward areas were beaten up, slag should be applied to bring about a more even crop. This was decided after seeing the result of experiments in Compartment 10.

Note: Other slagging trials between 1929 and 1946 have not given such unequivocal results as in Compartment 10. Basic slag was in short supply during the war years and no satisfactory work has been done since 1946 - possibly because no really obdurate sites have been planted since that date.

Visit by Assistant Commissioner 23.7.41.

Compartments 144-5. Unevenness of the ground had prevented really good ploughing but the Assistant Commissioner considered that better results could have been obtained with a single furrow plough instead of the double-furrow which was used.

Compartments 88-89 and 92. Plots of Norway spruce and Sitka spruce slagged in F.Y.37 showed satisfactory results.

The Assistant Commissioner expressed the following views:

Vegetation on checked areas generally showed a soil deficiency in phosphates, confirmed by the response to slag.

The double furrow plough did not cultivate to a sufficient depth and merely served as a mechanical turf producer.

He proposed deeper cultivation and said he would enquire about a single furrow plough for the job.

On areas suspected of being liable to check, an admixture of pines should be made at planting - two rows of spruce to one of pine. The poorer areas should if possible be slagged at the time of planting. (Slag at this time was not available at Halwill.)

Note: Better results have definitely been achieved on single furrow ploughing, but little advantage appears to have been derived from ploughing very deeply. Beyond a certain depth the return of gorse seems to be accelerated by the extra drainage achieved, and the furrow slice is a less suitable root medium.

Visit by Chairman - 25.8.41.

Compartments 92-94. Part of a block which was causing some concern. The area had been tractor ploughed and planted with spruce in F.Y.'s 34/5 and now much check was evident among the spruce. Where not affected by coppice growth, certain slagged areas had so far shown good growth, more noticeably in the Sitka spruce than in the Norway spruce. The Chairman considered that as this area had been efficiently drained by ploughing at 5 ft. intervals and a good disturbance of the soil obtained, our approach to this problem on other areas should be either to slag them or depend on a mixture of pines with the spruces to get them away. The Chairman's opinion was that deeper ploughing would have little effect and, by bringing up more clay, might even retard the growth of the spruce. He thought we should depend in future on admixture of pines - preferably Scots pine, the arrangement to be two rows of spruce to one row of pine.

General. It was stated that it was now obvious that tractor ploughing had not completely solved the problem of the establishment of spruce on the heavy Halwill Moors and that future policy should be to continue with the ploughing and effect the introduction of pine - preferably Scots pine at the time of ploughing on the areas where the vegetation and soil conditions indicated that the spruces were likely to check.

File 292/29. - Inspections Halwill Forest. Minute of 22.9.41. - Chairman's comment on Mr. Broadwood's Report. "I agree with the general conclusions reached by Mr. Broadwood. On certain types of ground, which are identifiable in advance, tractor ploughing is not a complete solution. It does, however, go a long way and with supplementary measures there need be no long check. These measures are:

- (1) Use of large Sitka spruce.
- (2) Slagging.
- (3) Admixture of Scots pine.

Local experience is now sufficient to indicate when and where one or more of these supplementary measures should be applied.

I was disappointed with the development of Compartments 7, 5 and 3, which I had expected to close up quicker. At present there are patches of Norway spruce on heather ground which may take anything up to 20 years to close up. I think we are justified in introducing Scots pine into the worst of these, starting next planting season. Not more than one-third of a full crop of Scots pine will be required, the plants should be stout and well planted so as to require a minimum of weeding."

Note: The large-scale use of pines for reconditioning checked spruce areas dates from this inspection although the first work was not done till 1944. It has been going on ever since that date, both Pinus contorta and Scots pine being used. The pines are mainly growing satisfactorily, but it is too soon to judge their effect on the spruces.



Pine/spruce mixtures - principally Pinus contorta have been in use since F.Y.37 and continue to be used. The earlier plantations are now showing good results but as these were on rather better sites, too much weight cannot be placed on their evidence.

Visit by Assistant Commissioner - 2.3.44.

Kigbeare Common, Compartments 150/151. Deep ploughing experiment. A comparison was drawn between single furrow (Massey Harris Grub Breaker) and Oliver double furrow ploughing on the P.43 experimental plots.

(1) Sitka spruce on the single furrow had a better colour than on the double furrow.

(2) Weed growth was appearing more rapidly on the double furrow.

(3) Both types had at the time of ploughing turned out furrows consolidated like cheese. Weathering had taken place to a depth of 3 in. in spite of a mild winter. It was suggested that advance ploughing might be beneficial.

(4) A marked improvement of the plants on both types of ploughing was noticed compared with mound planting.

General. A wide deep single furrow has a great advantage on heavy clays as it gives greater smothering effect on weed growth, deeper cultivation and aeration and greater drainage effect.

Assistant Commissioner's comment. "In my view we need to plough here deeply enough to give us a yellow cap to the furrow skin. This ploughing was of an intermediate depth. I would like some plots with really deep ploughing, as we understand it, to be undertaken at a convenient time."

Compartment 44 - Sitka spruce P.29. The original crop had almost entirely failed. The area was replanted with Sitka spruce on mounds with 2 oz. of slag per plant, with no apparent result and beat up plants were going back to originals. The Assistant

Commissioner instructed that this and similar areas should be left alone and labour directed to more important work. He considered the main cause to be lack of aeration and drainage and that eventually such areas would have to be deep ploughed and replanted.

Compartments 42 and 44. Sitka spruce beat up plants in Scots pine were seen to be doing well. The Scots pine was rough and blasted but canopy was closing. It was considered that in some cases it might be better to accept a rough pine crop, to be felled early and replanted with spruces; this as an alternative to endeavouring to raise a mixed crop which might develop into a very open mediocre plantation.

Assistant Commissioner's general comment. It was generally agreed that we were still far from solving the difficulties of the treatment of the Halwill clays. The Forest had been going for over 20 years and little progress had yet been made. Deep ploughing would undoubtedly help as two-furrow had in the past to a small degree but he felt that a completely new species was required. The lack of phosphates was a character of the district but the physical aspect of the soil was the greatest problem with the species used at present. Until further progress was made towards solving these difficulties, it was considered inadvisable to proceed with acquisitions on similar sites.

Note: Further assessment of these plots was rendered futile by very severe frosting in Spring 1945. But even at the end of 1944 Mr. Ballance comments that the typical "Halwill check" was setting in on the poorer areas. In 1951 the gorse has come in strongly and large areas are in definite check, though there are considerable areas which may yet grow on and help to bring on the remainder.

Chairman's inspection - 2.8.44.

General remarks by District Area Officer on District Officer's Report. The first part of the inspection was designed

to indicate to the Chairman that even with double furrow ploughing the old moorland types are difficult, but that on old cultivations reasonable success can be achieved, at any rate in the matter of getting a crop started. It would appear that success, at any rate to some extent, depends on getting the crop away before complete colonisation by dwarf gorse etc. takes place. In view of this it is thought that single furrow deep ploughing, with its greater "smother" effect, will be an advance on the double furrow Oliver plough, particularly on the difficult old moorland types. The supplementary measures indicated by the Chairman in his remarks of 22.9.41 will also be introduced on any new planting. It was unfortunate that time did not permit a visit to the deep ploughing experiment at Kigbeare.

Visit by Chairman 31.7.47 and 1.8.47.

Holsworthy block, Compartments 126/128 & 130/131. The Chairman was greatly interested in the effect of shelter from hedges, banks or belts and the marked difference in appearance of planted trees in their vicinity. He indicated the principles whereby mixed crops of pine and spruce should be planted in rows or belts across the furrows, for the nurse trees to provide suitable rooting space for the spruces.

The question of pre-planting cultivation of such sites (i.e. the "hard" gorse and heather moors) for the planting of spruce was discussed. It was indicated to the Chairman that the soil conditions of North Devon were adverse to deep cultivation and that the most important aspect of the preparation of ground was to create conditions which would swamp out the dwarf gorse for a few years. It was suggested by the local staff that the best method might be the complete shallow ploughing of these gorse areas. From evidence available this would foster the growth of grasses such as "Yorkshire Fog", after which shallow planting furrows could be run out with a ridging plough. The Chairman indicated that a small-scale experiment on these lines would be

undertaken in the coming year if possible.

During his visit the severe shortage of labour was brought to the Chairman's notice. The Chairman instructed that every attention must be paid to the adequate thinning and maintenance of the best plantations; if necessary at the expense of planting and the nursery. It was agreed, however, that preparatory ploughing for new planting should proceed.

Note: Small areas of experimental full ploughing were tried in F.Y.'s 49, 50 and 51 and are described in the main report. It is too early yet to draw conclusions from the results. The third part of this extract draws attention to the serious arrears of maintenance work arising in part from wartime labour shortage. Every effort has been made to catch up with the more necessary work, but much remains to be done.

#### Inspection by Director (England) - 28.5.48.

The Director discussed in some detail the question of full ploughing on certain areas at Halwill.

Three typical vegetation associations were quoted.

1. Ulex nana with Molinia and Erica - typifying dry conditions on mineral soil.
2. Molinia, Erica with Ulex nana - on shallow peat conditions.
3. Molinia on peat.

Peat is considered deep if over 10 in. in depth.

In the past single furrow ploughing had had no appreciable effect on Ulex sp., regrowth occurred in several years' time and the Ulex competed directly with the tree with adverse results.

The Director instructed that full ploughing experiments were to be carried out in the Ulex types. An area should be marked out and defined in the Plan of Operations with a description of vegetation, as an area on which strict check should be kept.

Note: An area at Wadland Down Compartments 162/3 in F.Y.49 and two areas at Whiteleigh Moor in F.Y.50/51 have been so

treated. The Wadland Down area is the more typical of the problem under investigation.

The Director then indicated the main lines on which the drainage problem as a whole at this forest should be tackled.

1. Survey main system as a whole, ascertain its exact location, its relation to the extraction system and whether the present system was sufficient.

2. Get the main system in good condition to ensure that the drains run and lay out new drains as determined in the survey. This must be fitted into the limitations of the labour force and the necessity of carrying out other important work, particularly thinning.

(Note F.Y.51. An extensive survey of the Witherden drainage system was carried out by the Forest Engineer early in F.Y.50 and complete plans drawn up for improvement.

Subsequent research by District Officer and State Forests Officer, however, indicates that actual areas of impeded drainage were relatively localised in this block. The greater part of the "clay bogs" were judged to be dry heather sites, requiring cultivation to increase absorption and percolation rather than drainage.)

State Forests Officer's observations. The Director considered that from results to-date more use could be made of Pinus contorta Lawson's cypress and Abies nobilis in the afforestation of the worst Ulex types. This with the exception of Abies nobilis had been the experience of local staff and this would be the future practice - subject to plant supplies.

Note: As much use as possible will be made of these species in future programmes. Supplies of plants have been restricted in the years following this report, but a considerable area of Norway spruce/Lawson's cypress mixture was planted at Whiteleigh in F.Y.50.

Visit by Director General - 5.8.48.

The question of full ploughing was again discussed on much the same lines as on the Director's visit of 28.5.48. The Director General also considered that limited trials of this method should be put in hand.

A small area of full ploughing in Compartment 152 was inspected. This was Norway spruce P.46 and had been ploughed and disced prior to planting. The Norway spruce were healthy, but gorse and heather were making their appearance fairly strongly. The area had had no drains cut prior to planting, nor had grass seed been sown at time of planting as had originally been intended. It was considered that both these might have been an advantage.

Note: The Norway spruce are still growing well but there is a marked increase in the gorse, and the future of this crop is still very much in the balance.

Visit by Director (England) - 7.7.50.

The question of establishing crops on the obdurate gorse areas was again discussed. Mr. Sangar stated that there was little doubt that full ploughing was the correct solution. The problem confronting us was to achieve the best technique and this was a matter for experiment by Conservancy Engineers. He suggested the following possibilities.

Single furrow ploughing both ways, disc down and ridge up with hand plough or similar implement.

Double furrow plough - one way - same subsequent treatment.

Disc plough and cross plough - it was possible that planting ridges would be achieved thereby.

Note: This discussion arose out of a comparison between orthodox ploughing with subsequent harrowing and stump-jump trials at Whiteleigh Meadow. The stump-jump had been unsuccessful but it was pointed out that this was a

specialised modification of a disc plough and gave no true comparison. It is hoped to carry out disc ploughing trials in F.Y.51.

Witherdon block, Compartments 21-30.

The Director commented on the condition of the pine areas in this block. These were planted between F.Y.24-27 and though they have made fair growth in some areas, their promise as pure crops is not great; he considered, however, that conditions were now ideal for the introduction of beech. The Director advocated that this work should be carried out as soon as possible as there were now good supplies of beech available. The most suitable method would probably be the removal of every alternate 3 rows of pine, replacing these with beech. The operation was to be carefully planned in conjunction with other items in the Plan of Operations.

The Director also considered that much more use might be made of beech at Halwill, possibly with a pine nurse, and instructed that this be tried in F.Y.51 on the clean ploughed area at Whiteleigh.

Note: The Conversion of the Scots pine areas has been included in a working plan drawn up as from F.Y.51 and it is hoped to complete the work in F.Y.55. However, the compilation of this plan has focused attention on the quantity of equally important maintenance operations which remain to be brought up to date; only if exceptionally favourable conditions pertain can the operation be carried out to schedule. Small trials have been put in hand at Witherdon and Brockscombe (Compartment 47) for F.Y.51. A beech/Scots pine mixture is being tried at Whiteleigh in F.Y.51.

HISTORY OF HALWILL FOREST

APPENDIX II.

Supervision

Date	Divisional Officer	District Officer	Forester	Remarks
Acquired 1920	C.O. Hanson	A.H. Popert		
1921	"	G.W. Lowe	T. Brown	Resigned 1929
1928	"	W.P. Russell	"	
1929	"	"	E.R. Smale	
1931	F. Scott	"	"	Trans: 2.12.31
1932	"	"	G.S. Davis	from 2.12.31
1933	"	"	C.R. Wellington	
1934	"	R.G. Broadwood from 8.10.34	"	
1938	R.G. Broadwood	"	"	Mr. Scott transferred 1.4.38
1943	J.E. James	"	"	
<u>Conservancy</u>				
1946	A.H. Popert from 1.4.46	G.F. Ballance	"	
1948	"	D. Grant	"	
1949 to date	"	R.M.G. Semple	W. Wilkinson	



# HISTORY OF HALWILL FOREST

## APPENDIX III

### Discussion at Forester's Office, 27th March, 1951

Present: Lord Robinson  
Mr. O.J. Sangar            Director (E)  
Mr. A.H. Popert           Conservator S.W.(E.)  
Mr. J.B. Stocks            S.F.O.  
Mr. L.B. Gladwell        Conservancy Engineer  
Mr. R.A. Innes            District Officer (Chairman's staff)  
Mr. R.M.G. Semple        District Officer  
Mr. J.P. Newton          District Officer  
Mr. W.E. Wilkinson      Forester

A general discussion was conducted by Lord Robinson - the past history of the forest, the experience gained therefrom, the problems now confronting us and the methods of approach to a possible solution. Lord Robinson stressed that we should by now have all the evidence we require actually on the ground - either here or at other forests. The task was first to collect this information and then to interpret it correctly.

The original intention at Halwill was to plant spruces. In the early years these were flat planted, with a certain amount of hand drainage. At the same time other species were tried at Halwill - principally Scots pine, Douglas fir and Japanese larch. The first two had been generally unsuccessful; Japanese larch had given good results only on selected areas - the drier stony knolls, former woodland or well-drained agricultural sites. The choice of species, therefore, tended more or less exclusively towards the spruces (Sitka spruce and Norway spruce) after about 1928. From 1929 to 1932, planting was carried out on turfs, but from 1932 onwards ploughing techniques were introduced - normally fairly shallow single or double furrow ploughing - both an extension and improvement of the turf-planting methods.

It was found that ploughing, whilst giving good initial results and being a definite advance in the establishment of spruces, was still only a partial solution. Various supplementary measures were therefore introduced, and in 1941, following on a visit by the Chairman the stipulated (if not the actual) technique

for new planting can be summarised as follows:

- (a) Molinia sites. Plough and plant spruces.
- (b) Molinia with some heather. Plough. Plant with large spruces.
- (c) Sites with fairly high proportion of heather. Plough. Plant Sitka spruce using basic slag.
- (d) Worst gorse heather sites. As (c) but with an admixture of pines - one third of the crop - as a nurse to the spruces.

At the same time the Chairman instructed that the inter-planting of the worst checked spruce areas with pines should be put in hand at an early date. Unfortunately this was delayed until F.Y.45, and as Lord Robinson pointed out the gaining of much valuable information has been seriously postponed thereby. A survey made in 1944 showed that there were nearly 800 acres of spruces requiring treatment on these lines. To date some 450 acres have been treated and the work is continuing; it is as yet too early to assess results, even in the earliest areas in Compartments 3, 5, 6 and 7.

The general planting techniques outlined in 1941 have been continued up to the present time. Little use has, however, been made of slag, which was for some time in short supply; in addition few really obdurate sites were tackled after 1943.

In 1943 deep ploughing was tried on an area at Kigbeare. It did not, however, appear to give improved results and has not been continued. Lord Robinson considered that this method, by bringing up a thicker layer of raw clay, might even give poorer results than shallow ploughing and was certainly more costly. Mr. Sangar endorsed this view.

The full ploughing experiments of 1946, 1949 and 1950 were discussed. It was too early to assess the results of these, but Lord Robinson was not optimistic. He considered that the cultivation might eventually encourage gorse rather than suppress it and that the loosened soil might eventually consolidate, giving a lesser degree of aeration than before.

Lord Robinson considered that the solution lay in a silvicultural rather than a mechanical method; i.e. the supplementing of present ploughing technique by silvicultural means, to reduce the initial check period of the spruces to the absolute minimum. The principal factor in such a method would be the introduction of a nurse species to create conditions of soil (and possibly shelter) favourable to the growth of spruce. Lord Robinson explained that the effect of a nurse crop - in this case of pines - was first to kill the vegetation beneath their branches, eventually developing a humus layer in their immediate vicinity. A "side effect" was thus set up, and into these zones of humus and dead vegetation the roots of the nursed crop extended. This effect had been amply demonstrated at Allerston and elsewhere. Once the spruce roots reached the humus, the trees tended to come out of check.

Once the "side effect" was understood the principles of introducing a nurse crop became clear. The nurses must be in sufficiently intimate mixture with the nursed crop to allow for a large proportion of the latter to derive benefit from the humus zones at the earliest possible opportunity. Lord Robinson advocated bands of pines interspersed with the spruce crop in the ratio of say 2 nurse trees to 4 main crop. Mr. Sangar considered that an even higher proportion of pines to spruces might be desirable. On ploughed ground the bands should run across the furrows.

The various species available to us as nurses were then discussed. Scots pine achieves good control of ground vegetation and does not grow so fast as to suppress the spruce. It is however rather a slow starter on the worst Halwill sites. Pinus contorta gets away rapidly, but has less effect on the ground vegetation and needs careful control to prevent suppression of the spruces. The desirable pine nurse might be intermediate between these species e.g. mountain pine. Lawson cypress from evidence at Halwill appeared tolerant of the

worst conditions, suppressed the vegetation effectively and did not grow too rapidly. Wider and more systematic use of this species should be made at Halwill. The Chairman considered that Japanese larch might be another useful nurse species. Mr. Semple agreed from observations in the Halwill area and stated that leaf fall had a very rapid effect on the ground vegetation. Mr. Sangar pointed out that its rapid growth was an adverse qualification for a nurse species. On the other hand its canopy was relatively light, and on the poor sites on which it would be used in this capacity its growth had proved comparatively slow. It appeared, in fact, that on such sites it was unlikely to reach more than pitwood size.

Reverting to the subject of ploughing, Lord Robinson and Mr. Sangar considered that there was insufficient evidence to support the theory of over-drainage resulting from direct downhill ploughing. It seemed unlikely that soil conditions at Halwill could ever be too dry; the increase of gorse and heather after planting could be attributed to the joint effects of the exclusion of grazing and the stimulation of dormant gorse seeds by cultivation. The clay itself was so impervious that the mere impeding of run-off by contour ploughing and similar practices seemed unlikely to have any marked effect on growth. Other factors, such as the deposition of added nutrients in site, would have to be taken into account when assessing certain observed results put forward by Mr. Stocks and Mr. Semple. Lord Robinson was of the opinion that the ideal ploughing direction was at a fairly wide angle to the contour.

The thinning programme was then discussed, in relation to present and future road projects. Mr. Semple stated that in the next 5 years more than 100 acres per year would have to be tackled in small scattered blocks to bring the programme up to date; this, moreover, took little account of the repetition of thinnings carried out in the first 2 years of this 5-year period.

Mr. Sangar stated that, after observing the growth of Norway spruce at Halwill, he felt that we should concentrate on this species much more in future planting schemes; it was desirable to achieve a more even balance between Norway spruce and Sitka spruce in the Directorate, and Norway spruce appeared to be almost as well suited as Sitka spruce to the less exposed Halwill sites. Mr. Semple stated however that in the past Norway spruce had been confined to the more promising sites, and to frosty areas with a greater accumulation of peat. This might tend to create a false impression. Lord Robinson considered that Sitka spruce which gave a much higher volume yield was the species which best fulfilled the original purpose of the Commission.

## HISTORY OF HALWILL FOREST

### APPENDIX IV

#### HALWILL FOREST - Division 3, E.& W. - Devonshire.

##### Visit by O.J. Sangar - June, 1933

Planting commenced in 1921 and there are now about 1500 acres of plantations. The areas are broadly of three types, viz. moorland carrying heather, ling and dwarf gorse with varying amounts of fine grasses and some wet flats; felled conifer plantations which stood on this type of land; felled woodland, in blocks of various size, of a better type, with much hardwoods.

Until 1927 inclusive a lot of Douglas fir and some European and Japanese larch were used on the better areas of both felled ground and rough pasture and until 1929 Scots pine was used on the "harder" sites. Despite rapid growth on selected sites, these species have proved unsatisfactory on the whole and a great deal of beating up and/or replanting with other species has been or is being done. In the Census of Plantations only 250 of the 500 or more acres originally planted with these species is classed as established; the balance is either mixed crops, still in weeding and/or areas recently beaten up or listed for beating up or replanting with spruces.

The 1000 acres of spruces are rather more Norway than Sitka, especially in earlier years, much of this Norway spruce is on the difficult moorland type; the Sitka spruce until about 1929 is on insufficiently drained wet areas and not turfed. There has been much check and a great deal of draining and beating up has been recently done or is in prospect on possibly 300 acres, mainly prior to 1928; such areas vary from very lightly stocked and more or less undrained wet areas, or patchy blanks in good growth following short check, to completely checked and insufficiently stocked heath types.

The plantations from 1928 onwards are markedly more promising than the earlier ones. The growth of Scots pine is disappointing throughout as this species gets badly defoliated; European larch is also poor; Douglas fir is vigorous on intermediate sites but poor on the hard ones and inclined to wind-throw on the softer and more fertile ground. The growth of the small area of Japanese larch is promising. Both Norway spruce and Sitka spruce are satisfactory when they have got out of check.

The management of this forest is rendered difficult by the presence of many small blocks together with much trespass and the large numbers of rabbits in the district. Rabbits are in places responsible for much damage to the groups of checked and beat-up plants amongst the more vigorous trees, and greatly hamper the necessary repair work in the older plantations.

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P's. 21 to 23, 383 acres. The original area of these plantations was greater, but about 100 acres (Halwill Moor, etc.) were burnt and are dealt with as P.25 (the date of replanting); there have also been minor fires.

There are 235 acres of Norway spruce and Sitka spruce and 50 of Scots pine; the remaining 100 acres is principally Douglas fir but with small areas of Japanese larch, also various mixtures resulting from beating up with different species.

About half the acreage is felled woodlands; the better types thereof occur as 20 or 30 acre detached blocks or in small patches throughout; growth on such areas is illustrated by the following; at Westlake's (P.22) growth is good with both Douglas fir and Japanese larch up to 20 ft. high; Sitka spruce used in beating up the Douglas fir on soft ground are now growing vigorously and will complete the crop; stocking is generally sufficient but there are thin patches, especially in the Japanese larch which (including beech) probably does not exceed

an average of 80% stocking. At Winsford (P's 22 and 23) small areas of Sitka spruce, Douglas fir and Japanese larch are 15 ft. high and Norway spruce 12 ft. but still in coppice with 10% or more definitely dominated or damaged, and there is bad honeysuckle; the greater part is Sitka spruce or Norway spruce in Molinia/Calluna/Ulex with willow and birch, stocked and (at least) out of check but with groups of 5 to 10 trees still making only 2 inch leaders.

In the Higher Moor plantations (P.22) the Douglas fir are 8 ft. high and 85% stocked except on the poorer Calluna type where they have been replanted with Scots pine now 5 ft. high but of poor appearance. Norway spruce are 6 ft. and 90% stocked, with rabbit-eaten patches especially where the plants checked. The 30 acres or so of Japanese larch is very irregular; in clumps of an acre or more it is 25 ft. high with beech 15 ft.; much of it is 12 to 20 ft. but areas of up to an acre are poorly stocked (down to 20%) with Scots pine beat-ups of (?) 1927 8 ft. high and of poor appearance, beech (originals) 10 to 12 ft. in places and surviving scattered Japanese larch of up to 20 ft. Rabbits hamper any work in this block.

The main planting areas were at or near Witherdon, Halwill and Cookworthy Moors and include the poorer felled conifer land as well as open moor. Though mainly spruces, some Douglas fir and Scots pine were used on drier sites with bracken over Calluna/ Erica cinerea and some gorse, these are generally of poor appearance and growth down to 2 or 3 ft., with occasional better blocks such as fully stocked 10 ft. Scots pine or 12 ft. Douglas fir. The Japanese larch were used partly on soft ground with Molinia/gorse/Calluna/bramble and willow, thorn and hazel coppice, etc.; the better trees are 15 ft. high, with beech 5 to 8 ft.; parts have been beaten up with Sitka spruce on the main (moorland) type the Norway spruce and Sitka spruce are generally stocked and are in places 6 ft. high; Scots pine on the harder ground are 5 to 8 ft. and in canopy, but badly defoliated. The



greater part of the spruces can best be described as out of check and growing 3 to 6 inches a year except (a) some 50 acres of the tighter shallow peat with Calluna, dwarf gorse, Molinia and Juncus squarrosus where both Norway spruce and Sitka spruce are definitely still in check and (b) on the drained flushes, where both Norway spruce and Sitka spruce are 12 ft. or more high and forming canopy. Beat-up Sitka spruce inserted (? flat planted) in Sitka spruce spaced at 5 x 5 ft. when the originals were 5 ft. high are now 8 ft. high; the originals are 15 ft. and threatening to suppress the beat ups. Definite failed patches are now being dealt with by the "dumping" of turfed Sitka spruce and some drainage has been or is being done in places.

An interesting slagging experiment in Compartment 10 (P.23) when control plots are still in check shows slagged Sitka spruce up to 3 ft. high and Norway spruce up to 2 ft. 6 ins.; the slag was apparently applied 1930/31 and the effect upon the vegetation has been a great increase in the vigour of the Ulex at the expense of the Calluna, whilst appreciable quantities of Molinia, Juncus and Festuca ovina have come in.

P.'s 24, 25 and 26 - 494 acres. Mainly Witherdon (including part Higher Moor) also Upcott and parts of Morcombe Wood, Quoditch and Cookworthy. The main species were Norway spruce and Sitka spruce with about 60 acres of Douglas fir, 20 acres of Scots pine and Corsican pine and a little European larch.

The European larch was not seen; it is believed to have been unsuccessful and mostly replanted or heavily beaten up with Douglas fir, Norway spruce or Sitka spruce. Not more than half the Douglas fir is satisfactory, 6 to 8 ft. high in Upcott and 12 ft. in Morcombe but not yet out of cleaning; the balance has been or is to be replanted with Scots pine or Sitka spruce or heavily beaten up with the latter species and where stocked is now generally an uneven and more or less mixed crop, but with

one block of nearby pure Norway spruce 4 ft. or more high and 90% stocked with balance alive though rabbited. The Scots pine is sufficiently stocked and 6 ft. high but of rather poor appearance, the Corsican pine very uneven after much beating up but of better growth and vigour. Some two-thirds of the spruce area (including most of the 1925 replanting of fire area) is stocked and in growth; on the better sites Sitka spruce are up to 12 ft. high and Norway spruce to 8 ft. but the crop is very uneven except at Upcott and grass coppice, etc. includes small failed areas, due in part to rabbits, like the 2 acres at Upcott, and also extensive wet Molinia flats (e.g. Witherdon) or still checked and/or insufficiently stocked and where preparations for repair work have already been partly made by commencing drainage work and preparing turf nurseries.

P.27 - 139 acres. About 75 acres of Norway spruce, 45 of Douglas fir and the balance of Scots pine. The pine (Witherdon) is stocked, 4 ft. high, and of fairly good appearance to date; the Douglas fir adjacent is probably sufficiently stocked including small (rabbited) plants. The balance of the Douglas fir is mainly at Croftmoor, 5 ft. high and 95% stocked; some (at Quoditch) has been replanted with Sitka spruce. The main Norway spruce area (Quoditch) is stocked and 3 to 6 ft. high except recently lightly drained wet flats beaten up in 1933 with Sitka spruce on individual turfs, the Norway spruce are still in cleaning. The small areas of Sitka spruce attributed to this year are mostly checked on Calluna, and are probably more recent replants of other species.

P's 28 and 29 - 208 acres. Ball's Moor, part Croft Moor and part Brock's Moor (or Northcombe). About 40 acres of Scots pine is stocked and 3 ft. to 4 ft. high except on wet Molinia/Calluna sites and some 12 to 15 acres of European larch is rather better; on a further 12 or 15 acres, the European larch (beaten up with beech) is of poor growth and form and plants are still

dying and the European larch planted on Ball's moor (P.28) have mostly been recently replanted with Sitka spruce. In P.29 most of the Sitka spruce was drained and turf planted and is now quite satisfactory except for frost damage at Croftmoor, and is in places (Brock's Moor P.29) 3 ft. high along drain-sides in Molinia. Ball's Moor (mainly P.28) was chiefly Norway spruce planted on ploughed furrows on hard ground with Molinia/Calluna/Ulex vegetation; the Norway spruce are mainly checked, but are improving except on small undrained areas with Calluna dominant; they were beaten up in 1933 with Sitka spruce.

P's 30, 31 and 32 - 156 acres. Only Norway spruce and Sitka spruce were used in these areas; P's 30 and 31 were mainly and P.32 entirely turf-planted Sitka spruce. So far as seen, these plantations are stocked and promising. Turfed Sitka spruce of P.30 by Cookworthy Holdings are already up to 5 ft. high and near Witherdon both Norway spruce and Sitka spruce are out of check and stocked, having required no heating up. The P.31 Sitka spruce north of Halwill Moor are partly turfed on old arable or pasture and partly flat planted on woodland; stocking is normal and vigorous growth has commenced in places but brambles are dense in part of the woodland; turfed Norway spruce and Sitka spruce seedlings on dwarf gorse with fine grasses, Erica etc. promise well.

P.33 - 100 acres. Not visited.

O.J.S.  
24/7/33.

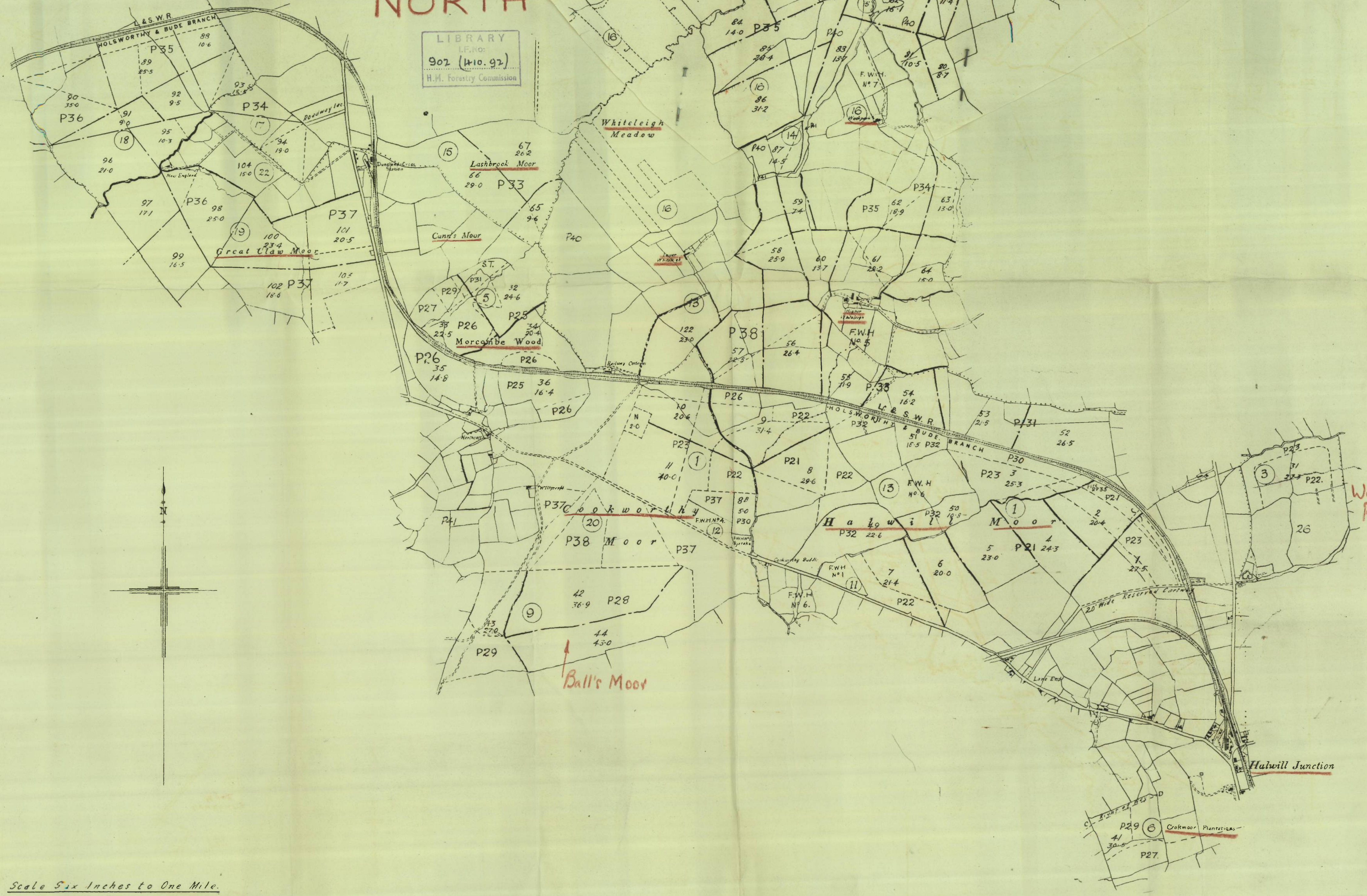
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South  
15  
Holsworthy ↓

Scale Six Inches to One Mile.

# HALLWILL FOR NORTH

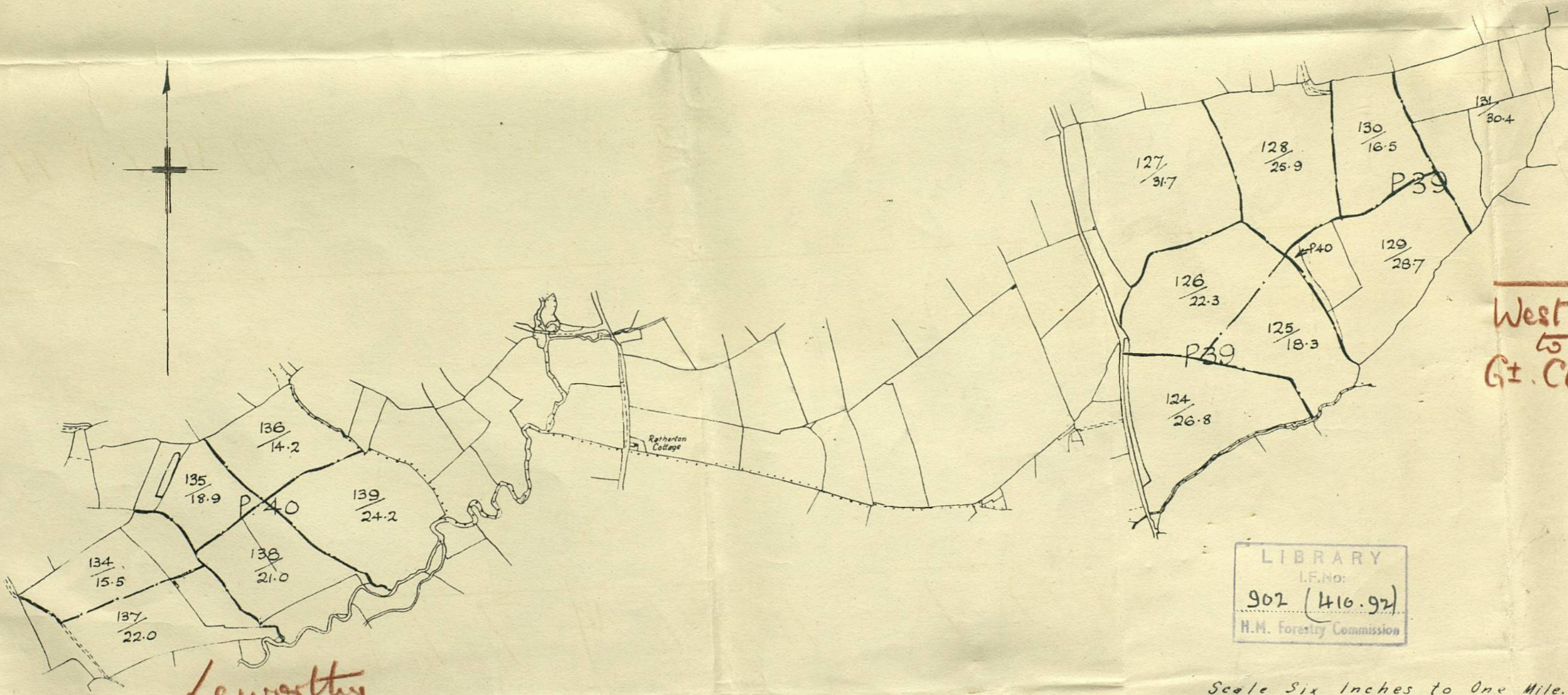
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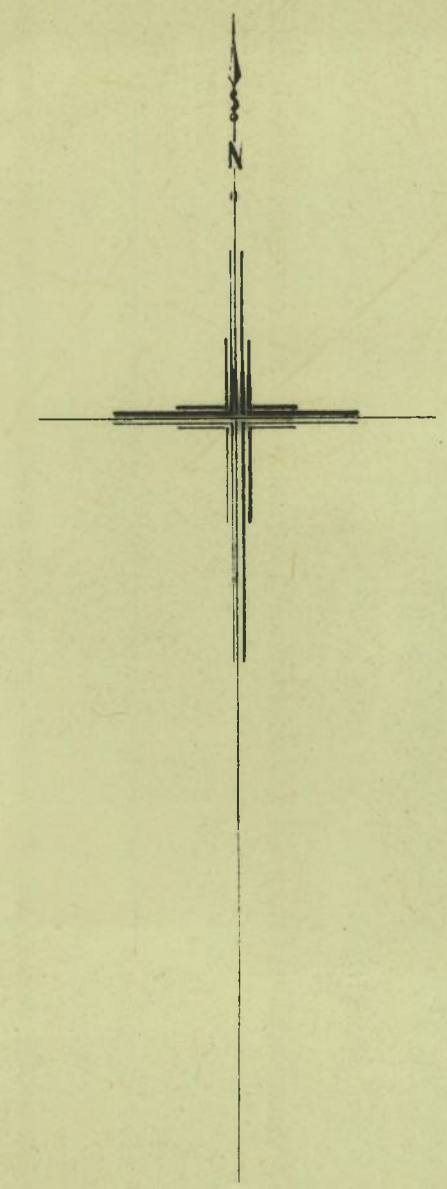
SOUTH

# HALWILL FOREST

# PLAN N° 2

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Devonshire 62 SE, 63 S & 75 N.



Scale Six Inches to One Mile

Witherdon

Brockscombe

Northcombe

HALWILL

PLAN N° 6

Devonshire 64.SW 76.NW.



Scale Six Inches to One Mile.

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