FORESTRY COMMISSION

HISTORY

OF

CLIPSTONE

FOREST

NW(E) CONSERVANCY

I.F. 902(410.48) History of Clipstone Forest

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FORESTRY COMMISSION

HISTORY

of

CLIPSTONE FOREST

1928 - 1951

NORTH WEST (ENGLAND) CONSERVANCY

History of Clipstone Forest

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HISTORY OF CLIPSTONE FOREST

CHAIRMAN'S COMMENTS

Mr. Jackson has written a detailed and interesting account.

I have known the forest from the beginning and watched developments with interest. It was clear from the time of the first acquisitions that Corsican pine was the most promising species but our earliest plantings left a great deal to be desired. Gradually the main problem of establishment was solved by realizing the necessity of aerating the soil and the application of methods of cultivation. The unsuitability of species other than Corsican pine (Japanese larch and Douglas fir, for example) soon became apparent and their use was dropped. The early plantings of hardwoods were also very unsatisfactory but there again soil cultivation has helped and a true appreciation of their silvicultural requirements will help still further.

As Mr. Ross remarks, a lot has been learned from Whitwell Wood on the Magnesian Limestone, a wood which in the light of experience was clearly mis-handled in the first planting operations.

The suggested ultimate conversion of the pine forests to mixed hardwood/pine presents a problem which may not be easy of solution and requires the institution of timely experiments.

R.

July 19th, 1952.

HISTORY OF CLIPSTONE FOREST

GENERAL DESCRIPTION OF THE AREA

Situation

(a) Name

The name "Clipstone" is derived from that of a small village which lies on the Mansfield-Ollerton road (A611), half a mile north of the north-west corner of the main block. The area of the original acquisition has properly borne the name Clipstone Forest since the time when it formed part of the Old Sherwood Forest of North Nottinghamshire. In recent years, however, for administrative reasons, the name has been extended to cover various outlying units.

(b) Location

Clipstone I (Main Block) lies four miles east-north-east of Mansfield.

Clipstone II consists of the Carburton, Scotland Farm, Whitwell Lound and Bevercotes sections: Carburton lies 5 miles north-west of Ollerton, Scotland Farm 7 miles north-north-west of Ollerton, Whitwell 4 miles west of Worksop and Lound and Bevercotes between Tuxford and Markham Moor.

Clipstone III consists of Thieves and Harlow Woods, Warsop, Pleasley and Winkburn sections. Thieves and Harlow Woods lie 2 miles south of Mansfield, Warsop $4\frac{1}{2}$ miles north-east of Mansfield, Pleasley 2 miles north-east of Pleasley and Winkburn lies north of the Rainworth-Newark road.

Area and Utilisation

General

The first area acquired, as shown in Table I, was the main block of Clipstone which was leased from the Rufford and Welbeck Estates in 1928. Since then there have been several other acquisitions, the latest to date being part of Clumber Park from the National Trust.

TABLE I

As at 30.9.51

From	By	Date	Plantations Acquired	Plantable Excl. Col.4.	Nurseries.	Agricultural	F.W.H.	Unplantable Excl. Col.4.	Other Land				Total
									Land Permanently Transferred		Land Temporarily Transferred		
									Description	Acreage	Description	Acreage	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
Welbeck Estates Co.	Lease	23. 3.28							Resumptions	187.0			2988.0
Savile Lord	Lease	4. 5.28											2192.0
Verney Lieut. Colonel	Conveyance	31. 3.31											184.0
Fitzherbert Meynell H.	Lease	16.10.33											397.0
Welbeck Estates	Lease	2. 5.39											64.0
Bradford Property Trust	Conveyance	18. 4.41									Rufford Bombing Range Bloomsgorse Farm	17 263	315.0
Fitzherbart Meynell H.	Lease	10. 6.42											241.0
Peake H.	Lease	16. 8.46											460.0
Notts. County Council	Lease	9. 5.47											122.0
Bradley Losco T.	Conveyance	17. 5.47											145.0.
Godley Williams T.	Conveyance	12. 8.48											51.0
Kirklington Farms Ltd.	Lease	24. 6.49		417									417.0
Welbeck Estates Ltd.	Lease	22. 7.49	7	177							W.D. requisition Felled Woodland	667	851.0
Oates Messrs. Ltd.	Conveyance	27. 9.49	15	209									224.0
National Trust	Lease	27. 7.50									Requisition by W.D.	1149	1149.0
Fletcher J.H.	Conveyance	26. 9.50						2*					2.0
Margrave Estates	Lease	27. 8.51		122									122.0
			22	925				2		187.0		2196	9924.0

* Housing Site

Gross Total 9924.0
Resumptions 187.0
Nett Total 9737.0

TABLE II

As at 30.9.51

		Area	
(a)	Plantations		
	Acquired	113	
	Formed by the Commission	6448	
(b)	In hand awaiting planting		
	For Afforestation	336	
	For Re-afforestation	1202	
(c)	Tenanted, pending planting		
	For Afforestation	578	
	For Re-afforestation	784	
(d)	Nurseries	12	
(e)	Agricultural Land No. of tenancies 3	54	
(f)	F.W.H. Number - 33	168	
(g)	Unplantable Land	35	
(h)	Other Land	7	
		9737	acres

The acquired land can be divided into the following categories:-

1. Heathland. These areas carry dense heather, (Calluna vulgaris and Erica cinerea) with occasional bracken on the steeper slopes and Aira flexuosa in the valley bottoms. There are also local patches of gorse, broom and birch and scattered clumps of Scots pine. It would appear that at some time the whole area had been cultivated, and as far as the main block is concerned, the cultivation seems to be of a more recent date in the east side than in the west.

2. Old Woodland (Conifers). These areas originally carried plantations containing Scots pine, Japanese larch, Norway spruce, oak, beech and sweet chestnut. In Harlow Wood there are signs of arable ridge and furrow cultivation dating from before the establishment of the plantations, but in the Birklands and Clumber Park areas conditions under birch and oak resemble more clearly those of the original dry oakwood that once covered the area.

3. Old Woodland (Hardwood). On the heavier soils, i.e. Whitwell, Pleasley and Swinston Hill crops were of the dry ashwood type containing sycamore

ash, beech with some oak and elm, whilst at Winkburn they are of the moist oakwood type containing little but oak and ash.

4. Derelict Agricultural Land. Having been more recently cultivated, these areas had not reverted to heathland at the time of acquisition. For the most part derelict pasture carried a thin carpet of Aira flexuosa, with thorn, gorse, broom and scattered birch seedlings, but the arable land carried couch grass, Aira flexuosa and locally cocksfoo with occasional broom and gorse. In both cases the amount of larger weed species depended on the period for which the land was idle.

Sporting Rights

The greater part of the acquired area at Clipstone is held on lease with the sporting rights either reserved or leased back to the owners. These arrangements do not appear to have caused any particular difficulty.

Sheep Stocks

There are none owned by the Commission.

Methods of Farming

In this particular district of Nottinghamshire the land is very sandy and marginal from the point of view of food production. The type of farming is mostly arable, the land needing intense cultivation and heavy manuring. In hot summers crops can suffer badly from drought.

The only farm is at Bloomsgorse, Deerdale, which at present consists of 263 acres of land with farmhouse, buildings and two cottages. In 1942 41½ acres were resumed for planting but since that time further planting here has been held up due to a portion of the farm being requisitioned by the R.A.F. as a bombing range. It is hoped that operations may be able to start again in F.Y.53 and a plan for allocating the land between agriculture and forestry is under consideration.

Other agricultural units are 45 acres of land at Lound which the Ministry of Agriculture would not release for planting and a smallholding at Thieves Wood which has been developed for milk production.

Tenancies

There are 33 cottages with land and outbuildings which were originally established as forest workers' holdings. A number of these are still

flourishing as smallholdings, others have been found uneconomic and as much as possible of the land has been taken for planting purposes.

There are five newly built houses in occupation with another five approaching completion; there are also a few older type cottages taken over with land acquired.

One of the features of Clipstone Forest is the number of electricity wayleaves for power lines crossing the Commission's land and serving coal mines and industrial properties generally.

Physiography

(a) Bunter Areas

In general the Bunter areas viz.

Clipstone I - Main Block
Clipstone II - Carburton, Scotland Farm and Clumber
Clipstone III - Thieves and Harlow Wood, Warsop, Birklands and Coxmoor

lie between 100 ft. - 350 ft. with maxima at Thieves and Harlow Woods (500 ft.) and Clipstone I (Strawberry Hill 450 ft.). The whole area is gently undulating with gradual slopes and few outstanding features of relief. The predominant trend of contours runs east to west giving rise to shallow basin-like valleys separated by relatively flat topped ridges. Aspect is thus variable, but mainly either north or south. Owing to the prevailing uniformity of topography, exposure on the top of the ridges tends to be relatively pronounced, whilst owing to cold air drainage frost pockets occur in most of the valley bottoms.

(b) Magnesian Limestone Areas

Clipstone II - Whitwell and Swinston Hill
Clipstone III - Pleasley Park

These areas lying between 400 ft. - 450 ft. are again of fairly low relief and appear to be part of a slightly incised plateau overlying the limestone at no great depth. Slopes are generally more protracted than on the Bunter areas except for small outcrop scarps which occur in each area. Each area lies on the crest of a slope and is therefore subject to fairly strong exposure along its windward edge, since none is shielded by adjacent higher ground. Aspect is locally variable but in all cases the land slopes towards the rock outcrop, giving the following general trends:- Pleasley Park south to south-east, Swinston

Hill south-west and Whitwell north-east; in this latter case a slight depression in the centre of the wood tends to produce a definite frost pocket.

(c) Keuper Areas

Clipstone II - Bevercotes
Clipstone III - Winkburn

The bulk of these areas lies between 200 ft. - 250 ft. Slopes are again slight, but at Bevercotes a fairly steep convex slope runs along the north-west edge of the area, where the Keuper Marls and Rhaetic outcrop over the Keuper sandstone. Apart from this outcrop, however, relief is generally low, and aspect predominately north-west and south-east at Bevercotes and Winkburn respectively.

Along the outcrop at Bevercotes exposure is well marked, but elsewhere it is only slight.

Geology and Soils

The outcrop of three distinct geological formations gives rise to three strongly contrasted sets of conditions:-

(a) Bunter Sands and Gravel cover the bulk of the area, occupying the central position, with the other types round their perimeter. These sandy deposits give rise to extremely light and often pebbly soils of indefinite depth. Drainage is free and pH fairly low. Texture ranges from highly porous on pure sand to compact, especially in valley bottoms where the soil consists mainly of closely packed gravel. These soils are strongly podsolised as shown by heavily stained brown and orange layers at from 14 in. - 24 in. below the surface.

(b) Magnesian Limestone covers some 650 acres in the north-west and north of the district, i.e. Pleasley, Whitwell and Swinston Hill woods. Soils are brown loams or clay loams, increasing in compaction with depth which is often limited by rock outcrops. Drainage is relatively good, and base status fairly high as can be inferred from the presence of a well formed mull humus layer. In general these soils show the characteristics of the brown earth type.

(c) Keuper Marl covers some 700 acres in the north-east and east of the forest, i.e. Bevercotes and Winkburn Woods. Soils are red clay

loams to strong stiff clays of apparently unlimited depth. Drainage is adequate except on plateau and only very gradually sloping sites, base status is again fairly high and humus incorporation relatively rapid.

Vegetation

(a) On the Bunter sands and gravel vegetation is typically heathy and can be divided into three main types, but there appears to be little correlation between ground cover and tree growth. This difference could easily be caused by early cultivation, the better types having been under agriculture more recently.

1. Dense bracken, often with heath bedstraw (Gallium saxatile) and occasional bramble.
2. Dense Aira flexuosa, typically occurring alone in dense tussocks towards valley bottoms, although often mixed with poor bracken, bedstraw, bramble, sheep's sorrel and a number of other herbs.
3. Dense heather, (Calluna, Erica tetralix and cinerea) often occurring pure, with an underlayer of moss (Polytrichum) and lichen, or in mixture with types 1 and 2 above.

(b) On the Magnesian Limestone vegetation is of the dry ashwood type, with ash, sycamore, oak and locally beech, associated with thorn, Lonicera, privet and dogwood. Ground cover locally consists of vigorous bracken with bluebell, but mainly of mixed grasses with dogs mercury and other predominantly calciphilous herbs.

(c) On the Keuper Marl vegetation is of the moist oakwood type with naturally occurring oak and ash, typically associated with hazel, thorn, bramble and Lonicera. Little oak remained at the time of acquisition and ash survives principally as coppice. Birch and aspen have acquired dominance on the heavily devastated sites, with occasional elm and field maple. Characteristic but rare minor species are the small leaved lime and the wild service. Ground cover consists mainly of mixed grasses and calciphilous herbs, Herb Robert and anemone except under heavy canopy, where it consists mainly of moss (Thuidium and Catharinea) with occasional orchid.

Meteorology

In general the prevailing climate can be considered exacting for tree growth especially in view of the low fertility of the bulk of the area. Annual rainfall ranges from 23 in. - 25 in. normally equably distributed. On occasions, however, prolonged drought periods occur as for instance in February-August 1929, March-October 1933, March-June 1937, February-June 1941, July-November 1947, when there was no appreciable rainfall from early spring until late summer or autumn.

The prevailing wind is south-west and protracted gales may occur in late autumn. In spring, however, strong cold northerly winds are of frequent occurrence, and often continue for considerable periods.

In general the area is subject to both late and early frosts the severity of which depends largely upon topography. These factors tend to delay the date of spring bud-break from seven to fourteen days when compared with the south of England. A further factor of vital importance in selection of species is atmospheric pollution. Being situated in the centre of the East Midland coalfield and lying to the north-east of the Black Country, and to the south of the West Yorkshire industrial area, the area is subjected to strong pollution in the form of smoke, its constituent gases, and other chemical effluvia of both immediate and distant origin.

Risks

(a) Fire

Being in a densely populated area, heavily dissected by public roads and railways, fire constitutes the main hazard to the establishment and maintenance of the forest area. The risk is most severe in Clipstone I due to the presence of three railway lines in or adjacent to the forest, but over the whole area figures for F.Y.50 shows a total of 52 fires (49 railway and 3 unknown) despite intensive patrolling and other protective measures.

The realisation of the severity of the risk, first prompted in 1930, the laying down of 1½ chain traces (½ chain ploughed, 1 chain hardwood belt) and the recommendation that all available hardwoods be planted along public roads and railways.

From 1931-1935 whole compartments of hardwoods, e.g. 29, 26, 21,

41, 52, 74, 75-79, 27 and 28 were planted, but, after the failure of unsuitable species, belts 3-5 chains wide were replanted along internal railway lines. In 1938 the triangular rack system was first adopted as a means of facilitating access to known danger spots, whilst the latest development has been the institution of 40 ft. internal graded rides first suggested in 1944 and put into execution in 1947.

(b) Trespass

A fairly high degree of trespass is to be expected though resulting damage is relatively slight.

(c) Vermin

1. Rabbits

Constant warrening is essential to keep the population within reasonable limits, and rabbits are undoubtedly the worst pest. Approximately 2,500 were killed during F.Y.50 these coming mainly from newly acquired derelict woodlands. It may be of interest to note that probably owing to the proximity to Rainworth village Compartments 224-228 (P.51 open heath with dense heather) required no fencing and no damage has occurred since planting.

2. Deer and Hares

In both cases the population is mainly floating and though local damage may occur (Clipstone II) it is too scattered to constitute a serious danger. The fallow deer is the main species but occasional red deer are also present.

(d) Insects and Fungi

In an area consisting largely of pure pine the risk of insect damage is relatively high. The constant presence of Myelophilus, Hylobius and Hylastes makes peeling of produce essential whilst the appropriate time lag in replanting felled areas must be rigidly maintained, as shown by Compartment 1B (Appendix III) (felled 1940 and replanted in P.41) where insect attack increased the necessity of beating up and has resulted in only 80% stocking at the present day. An isolated outbreak of Strophosomus, the Heather Weevil, occurred in F.Y.27 in Compartment 36 and caused widespread damage, covering

all P.26 and part of P.27 (Appendix III), but there has been no recurrence. Evetria (Pine Shoot Moth) is undoubtedly present in the district, but no serious outbreak has occurred in Clipstone. Larch Sawfly was reported in 1933 (Compartment 6 P.26), but cannot be considered responsible for failure of this species. Considerable localised damage has been caused by Fomes, but this is largely restricted to less favourable localities, notably Thieves Wood Compartments 22, 27, 28, 25 and 26 and Scotland Farm Compartments 31 and 32, where other adverse factors no doubt predispose young plantations to this disease. Traces of Brunchorstia are present on Corsican pine but the prevalence of this parasite is insufficient to cause concern.

(e) Atmospheric Pollution has been referred to in the section on Meteorology, page 9.

Roads

A system of forest roads is at present under construction. This was designed to provide improved access for extraction purposes and for fire protection. Starting in the summer of 1950, a limited scheme of construction was put in hand in the area to the north of Inkersall Grange (Clipstone I). This was later extended into the main northern portion of the same block, with further development during 1951 in the Strawberry Hill area (Clipstone I) and also in the outlying plantations of Thieves and Harlow Woods (Clipstone III), Warsop Lings (Clipstone III) and at Dilliner Wood in the Winkburn Group (Clipstone III) near Eakring. By the end of 1951 the total length of roads under construction comprising usable main and feeder roading and tracks, amounted to 19.86 miles.

Construction so far has been kept relatively simple with emphasis placed on the use of equipment rather than upon hand methods. Conditions have proved to be very suitable for rapid initial road work with a motor grader and this technique has been widely developed both in providing new routes in the light sandy soils, and in re-shaping some of the existing tracks and fire rides to give better running surfaces, which are then compacted by rubber and steel tyred rollers. This equipment is supplemented by dozers for heavier earthworks and clearance of vegetation.

The small roadworks team are housed at the site in mobile living accommodation thus forming a self-contained construction group. Road maintenance has been mainly carried out by motor grader but in some places where heavier construction has been required, materials including ashes and brick rubble have had to be imported and stabilization and improved drainage undertaken. A small proportion of this latter type of work has been carried out by contract labour at Dilliner Wood (Clipstone III).

Labour

In general the availability of labour has been inversely related to the demands of the mines and other industries situated in close proximity to the forest.

During the initial formative period 1926-1937, labour was abundant but poor in quality, coupled with periodic drifts to and from industrial employment, and the seasonal nature of forest work gave rise to the extreme transience of the labour force. The establishment of holdings around 1934 somewhat reduced this tendency, but the completion of large planting programmes still demanded the importation of outside workers for the winter months. Under these conditions selection was difficult and quality hard to obtain even though some of the seasonal workers returned to the forest for a considerable number of years.

By 1937 the increase of maintenance work coupled with sustained planting programmes demanded an increase in the labour force, which was difficult to meet in face of the developing re-armament programme. Recruitment was low and quality was equally poor.

As elsewhere, the outbreak of war initiated a period of extreme scarcity which the employment of women and conscientious objectors did little to alleviate. Though employed by local agricultural executives, prisoners of war were not given work in the forest.

By 1947, with the establishment of the Rufford Abbey Hostel the position had begun to stabilise, at a fairly low level, but men returning from the Timber Production Department permitted a wider selection among younger men of better quality and numbers as well as quality had increased considerably since the war years. But the difficulties of suitable local accommodation, already becoming acute, were accentuated by the closing of the Rufford Hostel

in 1950, whilst the increasingly favourable conditions offered in the mines gave rise to slight but persistent shortage. At the same time the incidence of increased Union legislation reduced facilities for disciplinary action with a consequent reduction in the quality of work.

In 1951, the total labour force of 80 men, 10 women and 11 boys, including garage hands and drivers gave an average of one worker per 67 acres of productive woodland, but even at this level, new planting has of necessity been slightly curtailed to meet the increasing demands of early maintenance and a large annual programme of first thinnings.

SILVICULTURE

Preparation of Ground

(a) Conifer (Bunter) Areas

Since P.34 preparation of ground has been synonymous with cultivation, except on old woodland sites. Before mechanical ploughing was introduced it was suggested that trainee labour be employed to loosen the soil in areas heavily damaged by frost, (P.33), but little came of this idea. On the heaviest heather areas some measure of preparation was obtained by hand screefing and heather pulling prior to planting. Bracken burning prior to planting was also carried out P.27-36. This practice was discontinued after a serious fire in F.Y.38.

The eradication of ground vegetation by cultivation has largely superseded preparation of ground as such on open heathland areas, but on old woodland sites a considerable amount of cutting and burning are necessary, though wherever possible young natural coppice hardwoods are retained. Brash and bracken were crushed in F.Y.51 by the use of a tree drag and tractor, but as yet no satisfactory method of dealing with dense gorse has been developed.

It is generally the practice to clear fell before replanting as little benefit is derived from shelter to pine, and coppice proves troublesome in later years.

(b) Hardwood Areas

Preparation of ground has largely been determined by the method of planting in coppice areas. In P.31, 32, 33, 34 and part of P.35 Whitwell, (Appendix III), little was needed as the area had been sold standing and cleared after acquisition.

The group and strip method of planting employed in P.34-37 necessitated either the enlargement of gaps or the clearing of alternate strips 12 ft. 15 ft. and 18 ft. wide, retaining a mixture of coppice so as to introduce a sycamore/ash/Japanese larch mixture. In P.32 Compartment 15 Whitwell under elm, hazel and oak coppice, clearing of the undergrowth and light thinning of the overwood were executed on an experimental scale.

In later years, however, it has been found that larger groups and complete underplanting under light coppice shade give better results. Therefore, commencing in P.39, ground cover has been completely cleared, and overhead cover reduced to, at the most, some 200 stems per acre, which are being removed either by ringing (Compartment 8) or clear felling (Compartment 12 Whitwell) as soon as the understorey is completely established.

Choice of Species

(a) Bunter Areas

1. Scots pine

On average sites throughout the area this species produces Quality Class II timber (F.C. Yield Tables). As compared with Corsican pine it gets away to an early start, experiencing little initial check on all sites; being less susceptible to frost damage, it was considered as a substitute for Corsican after the heavy frosts of 1932. But, although height growth is only slightly inferior on comparable sites, at least in earlier years, the timber produced is generally heavily branched and of poor quality.

Since the earliest days, therefore, it has been preferred to Corsican pine only on sites considered unsuitable for this latter species, i.e. frost hollows, and uncultivated Aira flexuosa and heather areas. Even after P.32 there was some reluctance to use it pure over extensive areas, and it was regarded as a nurse species for Corsican pine in mixture (alternate rows) or as a useful beating up species, where its relatively rapid establishment enabled it to keep up with the earlier planted Corsican pine, provided that intelligently executed beating up was not delayed for more than two or three years.

2. Corsican pine

The performance of this species lies well within Quality Class II and on cultivated ground may equal Quality Class I. Growth is not quite so rapid as in certain parts of East Anglia and South England, but timber of good form and relatively good quality is produced. In F.Y.32 this species was seriously damaged by early

frost, which occurred during a mild spell before annual growth had hardened off. Such frosts have not recurred and damage is negligible during normal seasons. Even on cultivated ground an initial check of some two to three years is experienced though this compares favourably with that of up to ten years in the earlier plantations, (P.25-30) on uncultivated ground. Heavy weed growth and the use of small plants in deep screef holes (Compartment 26 Carburton) resulted in considerable losses, probably due to faulty technique rather than any debility of the species. The use of Corsican pine was first recommended in 1926 and again in 1930 when with the exception of fire belts it was to be employed throughout Clipstone I.

Its use was slightly restricted by the frosts of 1932, but since then it has been planted on cultivated land of all types. On uncultivated land, however, it has been the practice owing to plant shortages and on economic grounds to use a mixture of Scots pine and Corsican pine (Corsican pine forming the intended final crop), where heavy weed damage was anticipated, but in frost pockets it has been replaced by Scots pine.

In P.30 the first "Ursuline" were planted, but despite vigorous early growth, development of crops of this strain (often by individual stems) is very uneven. Height increment is inferior to pure Corsican pine and form and timber quality poor on account of its bush-like habit and its exceptionally heavy and persistent branching. The strain was again used in P.39 and P.40 with the same unsatisfactory results. It has, therefore, been the policy to eliminate this variety wherever possible either in beating up wherever supply has permitted, or in the thinning stage.

3. Other Pines

On a restricted scale Pinus ponderosa (Compartment 55 and P.27) and Pinus contorta (Compartment 56, P.27) have been used. The latter was used in Compartment 31 Thieves Wood for beating up Japanese larch, but severe Tortrix damage precluded its use as a substitute for Corsican pine and for Scots pine in delayed beating up, where its vigorous growth might otherwise have been advantageous.

4. Larch

The larches (European and Japanese) reach at best Quality Class II but more often Quality Class III. Growth is thus relatively slow and tree form characterised by rapid taper. These species are highly susceptible to even light frost during the growing season, and poor soil, low rainfall and strong atmospheric pollution make both species generally unsuited to the locality. Hybrid larch was also tried (Compartment 13, P.27 Thieves and Harlow Woods) (Appendix III) with similarly disappointing results.

From P.26 to P.30 Japanese larch was used fairly extensively at Scotland Farm and Thieves and Harlow Woods, but as early as P.32 it was realised that this species was unsuitable and likely to produce only a moderate crop even on the best sites (usually north aspects). By F.Y.35 there had been extensive failures at Clipstone II and it was decided to fill in failed patches with pine, in some cases this almost amounted to complete replanting.

Even where fairly satisfactory stands have been established (Thieves and Harlow Woods Compartments 13 and 9), (Appendix III) and Carburton Compartment 5 (Appendix III) it has been found necessary to thin heavily so as to encourage bulk production and to maintain crown development which is impeded by repeated frosting.

5. Other Conifers - Douglas fir

P.25 Compartment 3 Clipstone I (Appendix III). Although considered a doubtful choice in P.26 this species was an almost complete failure, and by P.33 the death rate was such that it was decided to replant with Corsican pine. Some of the original Douglas still remain, but have only reached a height of 12 ft. to 15 ft.

Sitka Spruce

In P.26 a good strike was reported for this species, but later it proved a complete failure.

Lawson Cypress

A pilot plot has in F.Y.51 been underplanted with this species after a seeding felling in P.13 Corsican pine Compartment 1 Clipstone I, to determine its potentialities as an understorey species and soil improver on Bunter area.

6. Sweet Chestnut

Sweet chestnut was first considered as a possible species in P.26 and was planted fairly extensively in hardwood belts until P.31. It was soon seen that the species was unsuitable for open heathland (P.32) and by F.Y.33 the belt (Compartments 21-74 Appendix III) was in check and had largely failed on account of frost damage, exposure and unsuitable sites. Success was only slightly better on ploughing (Compartment 27) and even on screefing, but at the present day this compartment can scarcely be called satisfactory. In F.Y.34 it was finally decided to abandon this species in favour of birch and Corsican pine after ploughing.

The failure of sweet chestnut in Clipstone presents an interesting problem, since older woodlands contain fairly sound and large sized stems in mixture with oak (Birklands) or as part of a hardwood-softwood crop, (Compartment 1B, P.13 Clipstone Appendix III).

7. Birch (Betula verrucosa)

Birch is one of the naturally occurring species of the area, but although local stock is of relatively poor form, planted birch produces good results especially on cultivated land (Compartment 102, P.34 height 23 ft. Compartment 79, P.33 height 27 ft.),(Appendix III), but one unaccountable failure of both natural and planted must be noted (Compartment 42 Clipstone I).

Until P.33 little use was made of this species, but from then onwards it has proved of great value in the rapid establishment of hardwood belts. At first it appears to have been regarded as a weed, but following the frost of F.Y.32 natural birch was allowed to seed into failed areas in hardwood belts and conifer plantations. It has also been retained as a gorse 'suppressor' in P.28 and 29, Japanese larch/Corsican pine mixture (Scotland Farm).

8. Beech

Beech was first suggested as a suitable species in 1926, but it was not until earlier failures necessitated underplanting or group planting, that beech was employed to any extent. Like birch, beech becomes established rapidly and grows up to 15 in. in height the second year after planting (Compartment 34, P.47 Thieves Wood (Appendix III)) it continues to grow vigorously at least for the first 40 years, (Compartment 1B, P.08 Clipstone (Appendix III)) even in a somewhat undermanaged plantation. Form is relatively good and once established this species soon suppresses weed growth. Though generally considered frost tender, beech shows few ill effects when planted in frosty localities, nor does it appear to be adversely affected by the lack of overhead shade even when planted on clear felled south facing slopes (Compartment 8, P.47 Harlow Wood). Widespread underplanting with beech was carried out in Compartment 8 Clipstone I P.33-38 in F.Y.44 at what has since proved to be too heavy a degree and too late a date (Thieves Wood Compartment 23, P.39 underplanted F.Y.33 (Appendix III)) and in Compartment 5 Carburton P.27 underplanted F.Y.31 and 35 and again in F.Y.41, 45 and 48 (Appendix III), for the original crop having an earlier start has closed up leaving the beech as a suppressed understorey, except for occasional stems. Similarly even when underplanted early (Clipstone I, P.38 underplanted F.Y.44) the overhead cover will close over and suppress the beech. It seems likely that the best results can be expected from underplanting after thinning the overwood when this has reached at least 20 ft. in height. This procedure is being used to introduce beech as a more permanent species in established hardwood belts.

9. Oak

Only small areas of oak have been planted. The species grows only moderately well, and except on ploughed land suffers severely from weed competition in early years. It was planted in mixture with sweet chestnut (P.26-27) and showed little promise until the area was cultivated prior to its replanting with Corsican pine in 1935, after which the survivors have developed rapidly.

More recently in P.40 and P.43 it has been planted in mixture, (3:1 oak/Corsican pine in lines, or alternate rows with Scots pine and Corsican pine). In the first case the pine nurse has had to be severely pruned in order to give the oak sufficient room to develop. Growth has been fairly satisfactory, but in view of the large number of forked leaders, it is doubted whether this method is entirely acceptable.

Red Oak

This species has been untried until P.50 and 51, when small plots were laid down to determine its potentialities in clear planting and as an understorey.

10. Sycamore

Sycamore was considered a possible species for Clipstone I in 1926. It was introduced to fill up gaps in Compartment 5, P.27 Carburton (Appendix III) and in Compartments 33-36 Scotland Farm (Appendix III). Results have been disappointing and sycamore is now confined to the magnesian limestone areas.

11. Poplar

Lombardy and Black Italian were planted to form hardwood fire breaks in Compartments 21-76, P.28 (i.e. 4 rows Lombardy at 4 ft. x 4 ft. on the outer edges, and the remainder Black Italian at 8 ft. x 8 ft.). Planting stock was admittedly poor, but the main causes of complete failure were lack of moisture, and exposure. The compartments were ploughed and replanted with Corsican pine in F.Y.35, but a few poor Lombardy poplars 10 ft. - 15 ft. still remain in compartment 75, the Black Italian presumably having disappeared before replanting.

(b) Magnesian Limestone Areas

1. Sycamore

A naturally occurring species on these areas, it grows well, averaging nearly one foot per year height growth over the first 40 years (Compartment 15, P.14 Whitwell) whilst in more intensively managed plantations 17 in. - 18 in. per year may easily be reached (Compartment 16,P.32 Whitwell). Less satisfactory growth (P.30-33)

may be accounted for by the extreme shallowness of soil, and to some extent by the lack of weeding in the early years.

The species was used extensively in groups or strips for the enrichment of coppice areas, either pure or more often in mixture with ash and Japanese larch where it has now become the dominant species. As an understorey species it shows promise, provided that it is given sufficient light, otherwise growth is slow and leading shoots become forked. When planted on reasonable sites sycamore shows little signs of being damaged by exposure, and it is doubted whether overhead shade is really necessary, though planting under broken shelter was considered satisfactory in F.Y.44. It appears to tolerate light overhead cover up to 15 years and side shelter for at least this period.

2. Ash

This species was used extensively and somewhat indiscriminately as part of the Japanese larch/sycamore/ash mixture. It is fairly susceptible to frost damage and many of the earlier sites have since proved too dry and/or with too shallow a soil for real success. On deeper moister sites (Compartment 8 Whitwell) and north aspects growth has proved fairly satisfactory, but elsewhere (Compartment 12, P.35 Whitwell) widespread failure has occurred despite side shade from adjacent coppice strips. Moderate bud-moth damage is apparent, and excessive light produces low forking and poor form.

On these grounds it was decided (1941) to limit its future use to small groups on more favourable sites in a matrix of sycamore or beech, and to replant failed areas (Compartment 12, P.35 Whitwell) (Compartment 7, Pleasley) (Appendix III) with beech or Scots pine.

3. Japanese larch

As on the Bunter sites growth is rarely really satisfactory, Quality Class III being the best that has been attained (Compartment 16, P.32 Whitwell - Appendix III). Climate rather than soil therefore would appear to be the dominant adverse factor.

In 1933 it was decided to retain Japanese larch (P.30) in mixture only to help cover the ground, and its general unsuitability

as a nurse for a mixture of ash and sycamore was finally realised in F.Y.41, especially as abundant natural coppice was already present to fulfil this function.

4. Beech

Beech was first used to plant up the remaining area previously left under coppice as shelter for the P.35 ash/sycamore mixture. It was then used for beating up and for filling gaps in failed ash areas (Compartment 12, P.35 Whitwell (Appendix III)) in F.Y.38. It shows good growth averaging 10 in. - 12 in. per year from planting provided that it is kept free, but in 1940 overhead shelter was considered necessary in order to reduce forking. As a species used for beating up it is liable to be wasted if the work is not intelligently carried out.

As a pure crop beech shows even more promising results (Compartment 10, P.40 Whitwell - Appendix III) especially where introduced under a light canopy of birch 20 ft. - 25 ft. high but here it has been thought necessary to remove the overhead cover as soon as the understorey is satisfactorily established. This operation commenced in F.Y.50 in P.40 beech.

5. Other species

Natural birch has proved useful as an overwood species, and to fill in gaps in failed plantings, but in the early years natural and coppice birch is liable to cause considerable damage to other hardwoods unless severely dealt with or segregated in pure groups.

Scots pine has proved a useful 'establishment' species in failed and heavily weed infested areas. It grows well, though it may be damaged by birch coppice, and is likely to be very useful as a weed suppressor when grown on short rotation.

Oak has received little attention and although satisfactory seedling stems are found, and reasonable coppice was once grown on the area, soils are likely to be too shallow to produce oak on a timber rotation.

(c) Keuper Areas

As these areas of derelict woodland have been only recently

acquired, choice of species is a matter of future work rather than history. However, Scots pine is likely to prove a useful weed suppressor. Beech will probably grow well and is being introduced as an understorey under heavily thinned selected ash coppice (Compartment 161, P.51 Winkburn) or clear planted (Compartment 154, P.51 Bevercotes). Ash may be useful on the fresher sites, some reasonable coppice is found on the area, and existing clumps of natural regeneration (Compartment 179 Winkburn) indicate satisfactory seeding despite abundant rabbits. Oak appears to have done fairly well, and may be useful on the heavier sites, whilst natural birch grows rapidly and produces poles of excellent form although it is doubted if this species will reach timber size.

Planting

Rate

The average annual rate of planting was as follows:-

Forest Year	Acres
25	600
26-28	560
29-33	400
34-40	200
41-46	40
47-51	270

Although this programme was related primarily to the rate of acquisition, it can be divided into three fairly distinct periods -

(a) From F.Y.25 to F.Y.33, a period of maximum expansion without experience.

(b) From F.Y.34 to 40, more cautious development during which the lessons learnt in the first period were assimilated and shortcomings made good, and continued into the war years F.Y.41-46 on what was essentially a care and maintenance basis.

(c) From F.Y.47 to date, a period of post war expansion now proceeding on a fairly firm basis of experience.

It is as well to emphasise these distinctions by considering the methods etc., used in the first period separately from those developed and adopted in the two later periods.

1925-1933

Nursery Methods

Seed was sown at a high density, generally broadcast and covered with sand which was excavated on the site.

Lining Out - The grip method was used which resulted in bent and generally malformed root systems. Piece work was as now the usual method employed, and rates were cut to the stage when good work could not be expected - in other words conscientious men who lined out properly would earn much less than a day's pay.

Weeding - Again funds then available were insufficient to carry out necessary weeding of these closely spaced transplants (10 in. x $1\frac{1}{2}$ in.) which needed far more light than they got.

Planting Methods

Originally pines used were invariably 1 + 1 and these varied in quality from poor to moderate. Efficient culling was not possible and weeding was not intensive enough. Planting was 'cheap' generally the straight notch using Schlich spades, the accent then being on acres planted rather than acres established. Supervision was inadequate and labour unskilled so naturally losses were high as also were costs of establishment.

Towards the end of this period 1 + 2 transplants were used, but the plants were badly balanced and the somewhat larger root development was incapable of supporting the longer shoot, so that losses were not reduced to any appreciable extent. In 1930 2 yr. seedlings were used but as these were of Ursuline type no useful conclusion can be drawn, except that in this particular case establishment was achieved without beating up.

Other plants used towards the end of this period were 2 + 1 transplants which were the result of stand-over seedbeds, these plants were superior to others named above but definitely inferior to similar aged plants now produced.

In F.Y.28 Black Italian Poplar was imported. 2 year cuttings were used to form a hardwood belt (Compartments 21, 41, 52, 74-76) 8 ft. apart. Semi-pit planted in shallow furrows, these plants were very poorly rooted with shoots up to 6 ft. in height and were virtually a complete failure, less than 200 plants survived. At the same time 4 rows of Lombardy 2 year cuttings equally badly balanced were planted at 4 ft. x 4 ft. and of these less than a dozen survived.

A small area in Compartment 38 was shallow screefed in F.Y.27 and Corsican pine seed sown direct, six or so seeds in each screef hole. Germination was fairly good, but few survived the first year, necessitating

heavy beating up with transplants. It is doubtful if any of these seedlings survived at all. In 1928 small plots of Pinus ponderosa and Pinus contorta were planted 'age unknown'. Little is known about these plots, but it is believed that heavy losses in Pinus ponderosa and Tortrix attacks in the Pinus contorta led to both plots being gryotilled in 1936 and replanted with Corsican pine in F.Y.37.

At Pleasley Compartment 6 and Whitwell Compartment 6, 12 ft. wide strips were screefed and ash seed broadcast therein at 10 ft. spacing in P.32. Single rows of Japanese larch were planted in F.Y.33 also at 10 ft. spacing between rows and 5 ft. spacing in the rows. Although germination was good the ash completely failed due to the heavy growth of weeds, mainly Aira caespitosa.

During the whole of this period shallow ploughing was carried out wherever possible, failing which small screef holes were made and plants inserted generally by means of a Schlich spade. The only exception I know of is that of the poplars planted in F.Y.27 already referred to. Results were on the whole rather unsatisfactory on both heath and old woodland sites, but successful on old arable ground. Trees planted on old arable ground are now our most promising plantations, i.e. Compartments 9, 10 and 3 Clipstone I (Appendix III) and Compartments 14-17 and 19-24 W.S. II (Appendix III), 10, 11, 23, 24, 29 Thieves Wood (Appendix III).

1934-51

Nursery Methods

Some progress has been made in improving stock for planting during this period.

For pines the sowing density was lowered, i.e. more ground allowed per lb. or 1.0 seedlings. Plants were normally lined-out as 2 year seedlings, by the straight back method, producing better quality planting stock. Latterly the technique of composting etc. has resulted in heathland nurseries producing satisfactory 1 yr. seedlings of Scots pine fit for lining out but not so with Corsican pine.

With beech through the greater part of this period 2 + 2 plants were used, which are eminently suitable for planting in heavy vegetation, or for deferred beating up. 2 year seedlings were successfully used in F.Y.37 and

home produced 1 + 1 and imported 1 year used equally successfully in F.Y.51.

Planting Methods

From 1934 several improvements took place and planting methods were improved:-

1. The use of the Schlich spade was discontinued, and all planting from then on was done with a garden spade.

2. Planting was more closely supervised and the position of the roots more closely watched.

3. Hardwoods with the exception of oak, birch and beech seedlings were semi-pit planted with their roots spread out to conform as nearly as possible to their natural position.

Spacing

Pines - Unchanged at $4\frac{1}{2}$ ft. x $4\frac{1}{2}$ ft. (increased to 5 ft. in P.48 owing to shortages).

Birch - Increased to 6 ft. x 6 ft. this was reduced again in F.Y.40 to $4\frac{1}{2}$ ft. x $4\frac{1}{2}$ ft.

Beech - $4\frac{1}{2}$ ft. x 3 ft. on open ground, $4\frac{1}{2}$ ft. x $4\frac{1}{2}$ ft. under any form of shelter.

Ash - In P.34, 35 and 36 closely planted in groups with 16 plants in a 10 ft. x 10 ft. group or at $3\frac{1}{4}$ ft. x $3\frac{1}{4}$ ft. and in strips 4 ft. x 3 ft. Wider spacing was adopted from F.Y.37 onwards to 4 ft. x 4 ft. and $4\frac{1}{2}$ ft. x 4 ft.

Sycamore - As for ash.

Species

The use of poplar, larches and spruces was discontinued, more use being made of birch, especially where it appears naturally, and beech. Both ash and sycamore were used less extensively after F.Y.39 and beech generally used in lieu, more care being taken in selecting sites for ash and sycamore. In F.Y.34-45 pines were used pure, i.e. Scots pine pure in frosty hollows and Corsican pine pure on higher ground or a mixture of Scots pine and Corsican pine was used in lieu of pure Corsican pine owing to a shortage of the latter. This mixture was first tried in F.Y.41 and appears quite successful and has the advantage of lowering weeding costs by reason of the more early and rapid development of the Scots pine.

In F.Y. 43 beech 2 + 2 of good quality were planted between 21.10.42 and 4.11.42 - the plants scarcely grew at all the first year, and there were 20% losses; by the second year 50% had recovered and about 30% were doubtful, the maximum shoot length during the second year being 5 in. Generally this early planting of beech was quite unsuccessful, failures were much heavier than normal. A year's growth was almost completely lost and establishment costs were proportionately higher. Beech is now planted later, wherever possible in November and December.

Ploughing and Cultivation

(a) Soil Conditions

Throughout the Bunter area soils consist of fine sand with a variable proportion of gravel. They are naturally compact especially in valley bottoms, where finer material fills the interstices in the accumulated gravel, and provides a strongly consolidated soil mass, which probably helps to retard establishment to a less obvious, but equally important, degree than frost. Although the soils are strongly podsolised, as shown by their well developed, leached and depositional zones, there is little sign of cementation and actual 'panning' in the 'B' horizons. But the heavily matted humus layers (often up to 6 in. semi-decayed Aira flexuosa and heather roots) together with the densely rooted surface layers offer considerable physical resistance to the rooting of young trees.

In addition the "puddling" effect of rain falling directly on the exposed surface of the light soils, and the growth of a thin layer of lichen and moss below the heather, must also act as a surface seal and prevent the free passage of air into the soil mass.

It is interesting to note that on some estates (Newstead, Welbeck and Clumber) there are abundant signs of cultivation in old woodland probably dating from the establishment of the rotation felled prior to acquisition, and it is believed that during the later half of the 19th century it was customary to continue surface cultivation until plantations had almost reached the thicket stage.

(b) Cultivation 1925-33

Apart from screef and later semi-pit planting little cultivation appears to have been done in the early years, but in 1930 earlier failures led the Assistant Commissioner to recommend two furrow strip ploughing with

planting in the furrows for F.Y.31 and 32. Again in 1932, poor results in P.26 led the Chairman to suggest deep and thorough cultivation as a means of improving aeration, to this end also he suggested that a few of the checked plants be slightly lifted to determine the effects of improved aeration, further evidence of which was obtained from the better growth of Corsican pine, P.28, Compartment 50 on the old arable as opposed to the old woodland part of the compartment.

In Compartment 56, P.27, Corsican pine had done better on the earth works of a disused rifle range than elsewhere in the forest. The same was true of oak in Compartment 74 though its growth was greatly accelerated by strip ploughing prior to replanting with Corsican pine in 1935. In Compartment 27, P.31 sweet chestnut had done better on hand screefing than when notched, but better still on later shallow ploughing. As a means of obtaining some cultivation at least on areas severely damaged by the frosts of 1932, the establishment of a trainee camp was considered in 1933.

(c) Cultivation 1933 to present.

In 1933 thorough cultivation was considered to be one of the essential preliminaries to planting. The method first employed (F.Y.27) was to plough shallow ($2\frac{1}{2}$ in. deep) double furrow strips at 4 ft. spacing, the plant being notched into the furrow slice. A considerable amount of complete shallow ploughing was also done. Results were encouraging, but did not compare with those obtained from complete deep ploughing (10 in. deep), which was first done in F.Y.33. This method was later modified to strip ploughing at $4\frac{1}{2}$ ft. spacing. Gyrotilling (10 in.- 12 in. deep) was first used in F.Y.35, and shallow ploughing with subsoiler was used sporadically from 1935 onwards.

With complete ploughing the common method of planting appears to have been by notching in to the furrow slices, little additional advantage being derived from more elaborate mounding. With deep strip ploughing plants are notched into the side of the furrow slice.

(d) Results

The following can be quoted as typical examples of the effects of cultivation, though results are summarised on Graph I.

Compartment 103 P.32 Corsican pine, Shallow ploughed, Stocking 80%
Height Mean 11 ft. Max. 17 ft. Min. 8 ft.

" " RP.34 " " Deep strip ploughed, Stocking 100%
Height Mean 13 ft. Max. 17 ft. Min. 11 ft.

The results are even more striking in birch belts.

Compartment 106 RP 48 Corsican pine, Not cultivated, Heights Mean 10 in. Max. 12 in. Min. 4 in.

" " " " " Gyrotilled Heights Mean 16 in. Max. 24 in. Min. 6 in.

The graph is based on height data obtained from a wide range of samples on Bunter areas. Complete curves cannot be drawn since the methods of cultivation were not contemporaneous, and those for deep ploughing and gyrotilling must be taken as provisional especially in their upper limits.

However, the beneficial effects of any form of cultivation are strikingly illustrated. The good results in early years from skim-ploughing with subsoiling and gyrotilling would appear to be due to the strong 'shattering' effect of both treatments and to the complete disruption and partial incorporation of the vegetational mat. Both these treatments seem to promote more rapid early rooting than deep ploughing where the cut turf offers more resistance. But at 15 years, i.e. when the slice has completely disintegrated there appears to be little to choose between all three methods. After this, as would be expected, the deeper treatments appear to produce more lasting results.

(e) General

In the earlier days there seems to have been some controversy as to the relative merits of 100% and strip ploughing. Until 1938 the latter was favoured, it then fell into disfavour until the present day when it is again preferred, since it produces comparable results with a considerable reduction in cost.

Apart from its success in promoting aeration, cultivation was claimed to reduce liability to frost damage, after the severe frosts of 1932. Moreover, cross contour ploughing was held to be an active agent in reducing soil toxicity in that, excess precipitation, after percolating through the soil and leaching soluble toxins ran down the furrows to waste, instead of being ponded back, as would have occurred had the furrows run contour-wise.

The effect of cultivation on surface vegetation, though local, is similarly striking. The original heather, often with an underlayer of moss and lichen, is often completely eradicated and replaced, in early

years at any rate, by a thin cover of open Aira flexuosa with occasional bramble and a few herbs. This is also true of places where the original cover consisted of a dense mat of Aira flexuosa often overlying partially decomposed stems to a depth of up to 5 in. Such changes are naturally more obvious on 100% ploughed or gyrotilled areas, but they also occur on the upturned furrow of strip ploughing. Only one instance of stimulation of ground vegetation by cultivation can be quoted. In Compartment 12 (III 7) Warsop, gyrotilled and planted in 1938, the original cover was Aira flexuosa, Calluna and bracken burnt over in 1933.

Since gyrotilling Aira flexuosa has grown into dense vigorous tussocks, and gorse previously unknown has seeded quite abundantly into the area. This unaccountable case is quite contrary to the normal reduction in surface cover that follows cultivation elsewhere in the Forest. On several occasions 1932-37 the application of slag at the time of planting was advised, this was naturally to be coupled with cultivation, if only that afforded by pulling heather and digging, before replanting failed areas (Compartments 16 and 17). Though this operation undoubtedly produced satisfactory results (Inspection of September 1938 (Appendix I)) data from other sources seem to indicate that cultivation rather than manurial treatment is the predominant factor in promoting satisfactory establishment.

Beating Up

(a) Bunter Areas

During the early years a high annual rate was necessary largely owing to the difficulties of establishment on uncultivated ground. Poor stock and attempts at cheap establishment left as a legacy a large programme, which was accentuated by adverse weather conditions in F.Y.32/33 and sporadic failures in unsuited species notably Japanese larch. Beating up in P.27-35 was continued until F.Y.46, and has resulted in an irregular stocking. Though much of this beating up was undoubtedly considered necessary at the time, events have since proved it to be wasted except where gaps were large. Until F.Y.36, Scots pine and Pinus contorta were both commonly used (2 + 2 and 2 + 0) in frosty localities, Corsican pine (2 + 1) being restricted to more favourable areas.

In order to eliminate competition by weed species and to improve aeration heather pulling and semi-pit or deep screef planting were commonly employed.

From F.Y.36 onwards, however, the Pinus contorta was abandoned and increased cultivation reduced the necessity of heather pulling. In this year also beech was first used for beating up in Compartment 5 Carburton and Scotland Farm (Appendix III), and soon afterwards in Compartment 23, P.29 Thieves Wood (Appendix III). In both cases the results of excessively delayed beating up have been disappointing since now only a small portion of the beech have reached the canopy, the remainder forming a suppressed understorey. Scots pine has been used with better results even in delayed beating up where Corsican pine is unsuitable since its initial check of 2-3 years delays establishment often until the older planted pine have almost completed canopy formation leaving the plants used for beating up as suppressed whips to be removed at the first thinning, e.g. Compartment 36, P.27 Clipstone I (Appendix III). In larger gaps a similar situation occurs in the peripheral zone, but attempts to eradicate the '100% complex' have done much to reduce the wastage of plants.

In recent years, improved technique has reduced the period of establishment to 3-4 years and the overall beating up programme by some 60%, although this is to be expected as the older plantations become established.

(b) Magnesian Limestone Areas

In Whitwell and Pleasley the proper siting of species has been the main factor in reducing the need for beating up. Until 1933 the original species were used in beating up the sycamore/ash/Japanese larch mixture (P.30, P.33). The use of Japanese larch was then abandoned and in F.Y.36 beating up with ash was also discontinued. Some sycamore was used but the principal and most suitable species has been beech first employed in F.Y.36. A later development has been the use of Scots pine in areas susceptible to frost or covered with heavy bracken. Here more rapid establishment reduces liability to damage and it is hoped that complete ground cover will serve to suppress weed growth prior to the re-establishment of a hardwood crop.

The period of beating up in clear planted Japanese larch/ash/sycamore mixtures appears to depend on suitability of the site. In Compartment 16 P.32 (Appendix III) Japanese larch used for beating up in F.Y.34 has since developed into a full crop. Compartment 14 (Appendix III), however, where the soil is particularly shallow, was beaten up with Japanese larch in 1934, with Scots pine in 1939 and 1946, and with beech in 1949 and 1951, the

present crop being open and very irregular owing to the successive sporadic failures of Japanese larch. In the strip and group methods protracted beating up, finally followed by underplanting with beech, has been necessitated by the sustained failures of ash, e.g. Compartment 12 Whitwell (Appendix III), but underplanted beech has been successfully established without any beating up, e.g. Compartments 10 and 9 - P.40 and 49 (Appendix III).

Weeding

(a) Bunter areas

Intensity and duration naturally vary with the state of ground prior to planting. Until F.Y.31 when widespread cultivation was first adopted the customary period appears to have been up to 10-11 years. Heavy gorse and coppice growth often prolonged the period as a result of crowding out the original planting and the successive beating up (Compartment 32, P.28 Scotland Farm - (Appendix III)). Less frequently on cleaner sites the period was 4-5 years. On cultivated land, however, it has generally been reduced to 2-3 years, on account of the weakening effect upon ground vegetation and the enhancement of an early growth rate as a result of increased aeration (Compartments 106 and 107 P.48 Clipstone I Corsican pine/Scots pine - (Appendix III)). But the local seeding of the gorse and the apparent stimulation of Aira flexuosa may necessitate weeding for up to 11 years as in Compartment 12 P.38 Warsop (Appendix III).

Intensity of weeding also varies according to the ground cover, and heavier weeding has been proved more necessary on dense Calluna and bracken areas than on gorse or grass bracken sites.

In addition Scots pine, birch and to some extent beech need less attention than Corsican pine on account of their more rapid rate of establishment. On cultivated sites no weeding may be necessary for the first year, and after that it may be restricted to cutting back local patches of gorse and birch coppice.

Dominant weed species may be grouped as follows according to the original state of the ground:-

(a) Heathland - Calluna, bracken, Aira flexuosa, occasional birch and gorse.

(b) Old woodland - birch, sweet chestnut, sycamore, oak coppice, Epilobium, bracken and occasional bramble.

(c) Old Agricultural - birch and thorn, gorse, bramble, Aira flexuosa, couch and cocksfoot.

In all cases birch causes the most damage, followed by gorse, bracken and Calluna, where these occur in vigorous clumps.

(b) Magnesian Limestone Areas

Dense vegetation of the following types:-

(a) Heavy bracken 4 ft. to 6 ft. tall.

(b) Coarse grasses, bramble, briar, Lonicera and other shrubs.

(c) Hardwood coppice regrowth, oak, ash, elm, aspen, lime, sweet chestnut and birch

coupled with relatively slow establishment, make heavy weeding essential on open sites. This was stressed in 1944 by the Assistant Commissioner who stated that, hard weeding of hardwoods was essential until the regeneration crop had become established, and that cheap establishment could not be expected.

Failures of ash and Japanese larch, in P.32-35 Whitwell, have increased the problem, since the open canopy has encouraged weed growth, and the necessity of repeated beating up has prolonged the weeding period up to 10 years - Compartment 14 (Appendix III) whilst where establishment was more rapid, e.g. Compartment 16 weeding was necessary for up to 7 years.

The foregoing applies to clear felled or strip and group areas, but on completely underplanted areas, particularly beech Compartment 10, P.40; Compartment 12, P.38 (Appendix III) and even sycamore Compartment 9, P.37 weed growth appears to be considerably reduced by the overhead cover, 4 years moderate weeding being the maximum required. Under these conditions also the understorey appears to strike and become established more quickly, thus further reducing the weeding period.

Ash appears to be particularly susceptible to weed competition and low shade, and sycamore is affected to a lesser degree, but excessive overhead cover results in bad form. Beech is fairly tolerant of overhead cover, but if the best results are to be obtained requires only relatively light and high shade.

Mixtures

Reference has been made above to the chief mixtures planted at Clipstone, i.e. mixtures of Scots pine and Corsican pine on the Bunter areas, and mixtures of sycamore/ash/Japanese larch on the Magnesian Limestone areas, and to the various irregular mixtures resulting from a change of species during beating up.

The only mixture which so far shows any definite merit is the Scots pine/Corsican pine mixture. The advantages gained are cheaper establishment due to the lower cost of Scots pine planting stock, its better take and quicker

initial growth, and its nursing effect on Corsican pine in the early stages. This mixture has been produced fortuitously in enough of the older plantations to show that the Scots will persist well into the thinning stage, and so yield saleable produce, while here and there a few trees of outstanding vigour and quality may continue into the final crop.

Rates of Growth

(a) Bunter Areas

1. The Pines

As shown on Graph 2 based on 23 samples of Scots pine and 49 of Corsican pine covering a fair choice of sites and plantations throughout the forest, the growth rates of these two species are roughly parallel. The extent of the divergence in higher age classes may be slightly over emphasised since the upper limits of the curves are based on scanty data, i.e. Corsican pine 2 stands P.13 (Clipstone I, Compartment 1B and Warsop Compartment 8), and 1 stand P.00 Clipstone II Compartment 14 (Appendix III), and Scots pine 2 stands P.13 Clipstone I Compartment 1B (Appendix III) and Compartment 8 Warsop (Appendix III), but the general trends of behaviour are well exemplified.

Mean height data were collected from stands on all types of sites, lying between 100 ft. - 450 ft. elevation, and of varying aspect. Soils were typically sandy podsols varying only in compaction and type of cultivation. On these grounds it is felt that the graphed values may be a little low, particularly the higher age groups, since these plantations were established before cultivation was introduced. The 'cross-over' of the curves at about 11 years is typical of the behaviour of the two species in early years, and it is felt that from 0-25 years the graphs are fairly representative of the mean development of these species on Bunter soils.

2. Details of the growth rates of other species are shown in Table III. Differentiation of soil types has not been made since these are very similar throughout the area. Samples were chosen as being representative of P. years and site types, and the effects of cultivation are apparent in the case of all species. Frost rather than

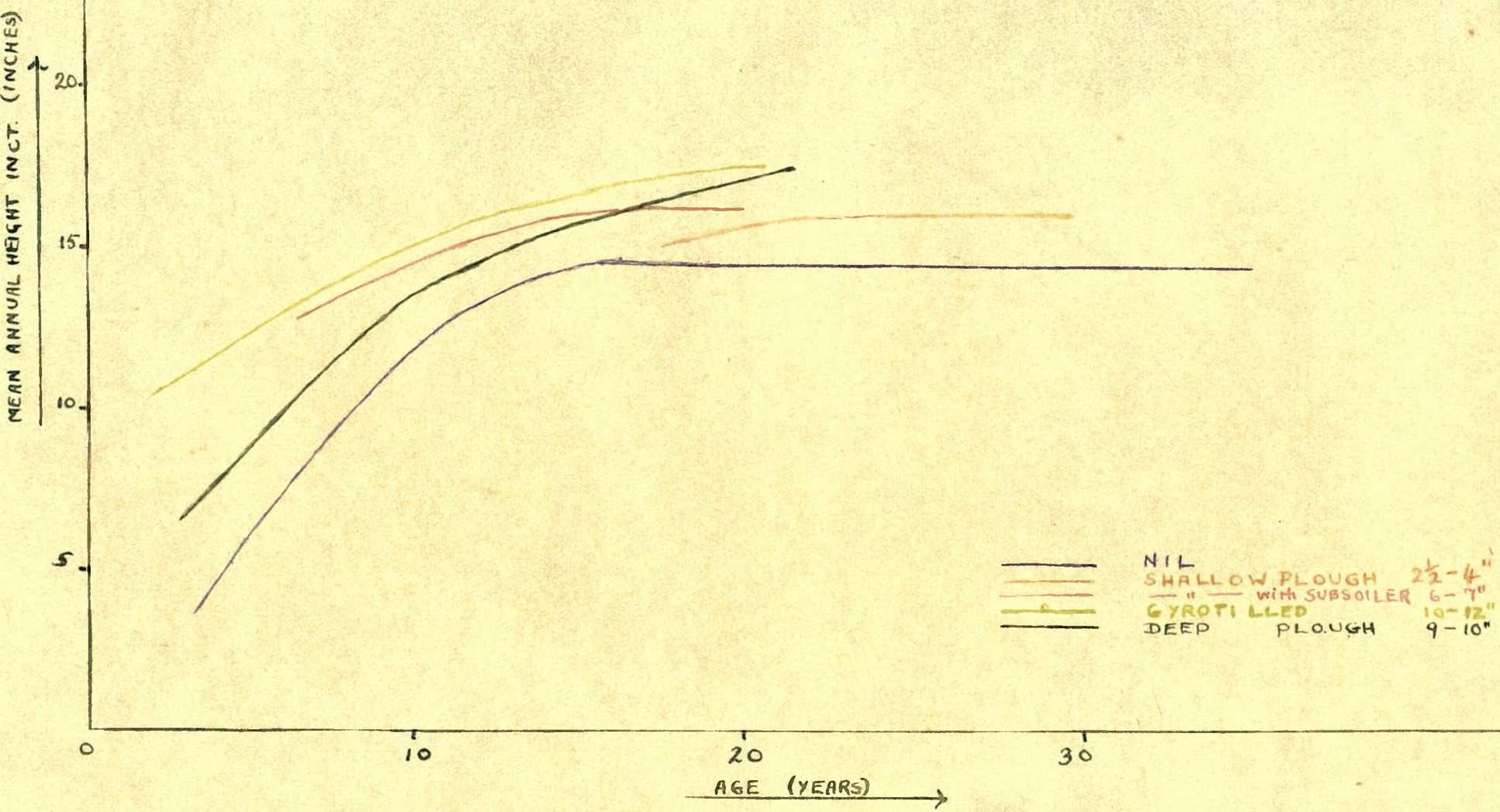
elevation would appear to retard the growth of Japanese larch but even with this species the effects of cultivation are to some extent compensatory (Clipstone I, Compartment 81). In the case of birch soil compaction in valley bottoms (Clipstone I Compartment 102 (Appendix III)) would appear to impede growth which is otherwise satisfactory, and it is possible that this factor may account for the general deterioration in crops of all species towards the bases of slopes. Oak appears to grow steadily throughout, though not so rapidly as beech, which, however, where underplanted may be seriously checked by excessive retention of too heavy a canopy.

GRAPH I

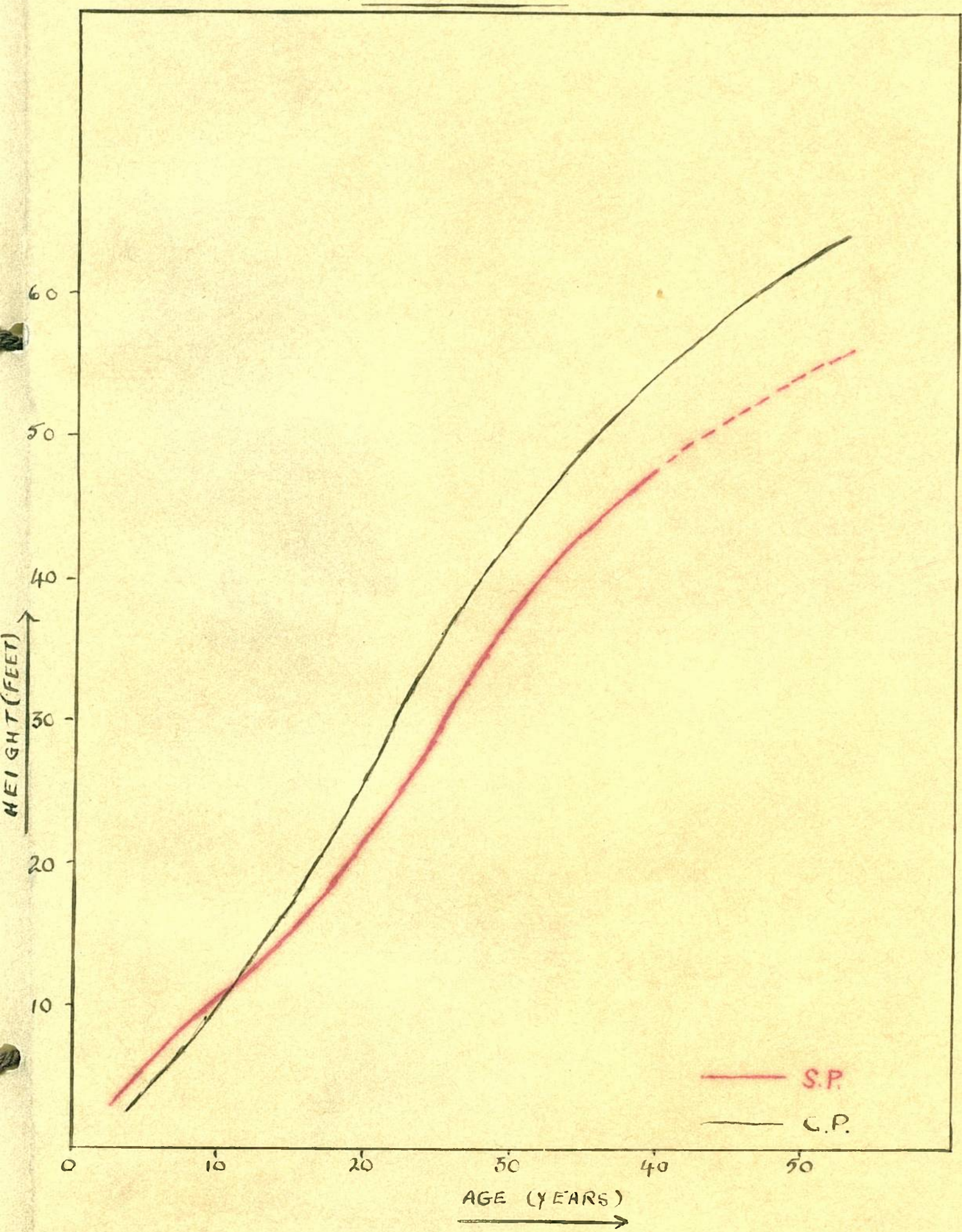
CLIPSTONE FOREST

HEIGHT GROWTH - CULTIVATION RELATIONSHIP

C.P. BUNTER AREAS



GRAPH II



CLIPSTONE FOREST

HEIGHT - AGE CURVES S.P. & C.P.

(BUNTER AREAS)

S.P. 23 SAMPLES
C.P. 49 — " —

TABLE III

BUNTER SANDS

Block	Cpt	Age	Original Ground Cover	Aspect	Slope	Altitude & Exposure	Cultivation	Remarks	Mean Height of Dominants (a)	Mean Annual Height Increment (b)	Current Annual Ht. Increment during last 5 years (c)
					1. J.L. including E.L. and H.L.						
Clipstone I	1B	38	Acquired Plantation	S.E.	Slight	225' Slight			38'	12"	12½"
Thieves	22	33	Woodland (oak)	S.	"	450' Nil	Old ridge	(Frost hollow)	36'	13"	16"
Clipstone I	6	25	S.P., Calluna, Bkn. A/flex	S.E.	"	275' Slight	-	-	31'	15"	21"
Clipstone II	5	24	Woodland (Oak/Ch.)	N.W.	Mod.	250' Mod.	-	-	30'	15"	15"
Harlow	13	24	" "	N.	"	450' Slight	-	H.L.	28'	14"	20"
Clipstone II	35	22	" (Gorse)	S.E.	Flat	250' "	-		29'	16"	13"
Thieves	35	21	" (Bi. Oak)	S.E.	Mod.	475' Mod.	-		24'	14"	12"
Thieves	9	20	" (Bi./Oak/Ch.)		"	500' "	-		30'	18"	21"
Clipstone I	102	19	Heath	S.E.	"	400' Slight		(Frost in S.)	20'	12½"	10"
Clipstone I	102	17	Heath	"	"	" "	Deep	"	21'	14½"	24"
Clipstone I	81	18	Calluna, Gorse, Broom	S.	Slight	350' "	"	"	22'	15"	21"
Clipstone I	80	18	" " "	S.	"	350' "	"	"	22'	15"	18"
Clipstone III	8	33	Acquired Plantation	S.W.	"	300' Mod.	"	-	40'	15"	10"
					2. Birch						
Clipstone I	79	18	Calluna, A/Flex.	W.	Flat	350' Slight			24'	16"	16"
Clipstone I	102	17	" /Bi.	S.E.	Mod.	400' "	Deep		23'	16"	21"
Clipstone I	102	17	" "	"	"	400' "	Nil		4½'	2½"	4"
Clipstone I	50	13	Bkn. Calluna, A/flex.	N.	"	250' "	Shallow		20'	18½"	20"
Clipstone I	42	13	Oak, Bi, Coppice	N.	Steep	250' Strong	-		15'	14"	12"
Clipstone III	33	12	Pasture (A/flex)	S.	Mod.	350' Mod.	SS		17'	17"	20"
Clipstone III	34	12	" "	S.	"	350' "	"		15'	15"	19"
Thieves	17	4	Woodland Bi./S.P.	N.	"	500' "	Ridge		2½'	10"	10"
Clipstone I	28	3	Calluna, Bracken	S.E.	Slight	350' "	-		5'	20"	20"
					3. Oak						
Clipstone III	8	38	Acquired Plantation	S.W.	Slight	300' Mod.			36'	11½"	12"
Thieves	22	33	Woodland	S.E.	Flat	450' Slight	Ridge		33'	12"	12"
Clipstone I	36	24	Calluna, poor bracken	N.W.	Mod.	300' Mod.	Shallow		12'	6"	7"
Clipstone I	50	24	Bkn., Calluna, A/flex.	N.	"	250' Slight	Slight		16'	8"	15"
Clipstone III	26	11	Arable (Couch)	N.	"	350' Mod.	SS		9'	10"	10½"
Clipstone III	30	8	" (Clover)	N.	"	350' Mod.	SS	Heavy Weeding	7½'	5"	12"

Block	Cpt.	Age	Original Ground Cover	Aspect	Slope	Altitude & Exposure	Cultivation	Remarks	Mean Height of Dominants (a)	Mean Annual Height Increment (b)	Current Annual Ht. Increment during last 5 years (c)
					4. Beech						
Clipstone III	8	38	Acquired Plantation	S.W.	Slight	300' Mod.			42'	13"	9"
Clipstone I	80	18	A/flex., Bkn., Calluna	S.	"	350' Slight	Deep		21'	14"	24"
Clipstone I	50	13	" " "	N.	Mod.	250' "	Shallow		9'	8"	6"
Clipstone II	5	6	Woodland Oak/Ch.	N.W.	"	250' Mod.			7'	14"	10"
Thieves	34	4	Woodland	S.	Slight	475' Slight	Ridge		5'	12½"	12½"

(b) Magnesian Limestone Areas

As previously described soils vary markedly in depth and friability throughout this area. This variation exerts a striking effect on the growth of all species (Table IV) e.g. Compartment 14 Whitwell (Appendix III).

1. Sycamore

Where it is not limited by soil depth the growth of sycamore is fairly steady and fast, but to obtain the best results, light overhead or fairly dense side shade seems to be desirable, (Compartment 8 Whitwell (Appendix III)), since it promotes height growth and reduces a marked tendency towards low and heavy branching. The data provided show little difference between the various layout methods of planting, i.e. (a) complete planting under reduced canopy, (b) alternate 12 ft. to 18 ft. strip planting, (c) group planting under reduced canopy, but methods (a) and (b) (with large groups) are preferred on the grounds of easier management.

2. Ash

The picture presented for ash, is not quite complete, as development is highly variable according to individual stems, and occasional satisfactory stems may be found in a stand where as much as 60% of the original planting has failed, e.g. Compartment 12 Whitwell (Appendix III). Despite reasonable height growth this species is not thriving and form is at best moderate except on the fresher sites, Whitwell Compartment 8 (Appendix III).

3. Japanese larch

Growth of Japanese larch also lies mainly at the 'survival' level, although comparing favourably with that on the Bunter Areas.

4. Beech

As on Bunter areas beech becomes established rapidly, but a higher rate is not unnaturally maintained in subsequent growth. Complete planting under reduced canopy is again preferred to strip and group underplanting, but the removal of the overwood as soon as the crop is established is essential. This relatively good growth rate has been maintained even on a short scarp slope with no great depth of soil, Compartment 8 Whitwell (Appendix III).

5. Scots pine

Limited experience of Scots pine indicates that it is likely to grow fairly well, if only on short rotation. If it does this it will have served its purpose as a ground cleaner. Though liable to damage by weed growth (Compartment 6 Pleasley), it is not so seriously affected as sycamore/Japanese larch/ash which have been completely smothered on comparable sites, but the Scots pine has suffered considerably from attack by Fomes.

TABLE IV

Magnesian Limestone

Block	Cpt.	Age	Original Ground Cover	Aspect	Slope	Altitude & Exposure	Remarks	Height		
								Mean Height of Dominants ft. (a)	Mean Annual Height Increment in. (b)	Current Annual Ht. Increment during last 5 years in. (c)
					1. Sycamore					
Whitwell	15	37	Acquired Plantations	N.E.	Slight	375' Slight		34	11	-
"	14	19	Woodland oak/birch nat. coppice	E	"	350' "	Alternate rows	14	9	7
"	16	19	Woodland oak/ash coppice birch and elm.	N.E.	"	400' Mod.	Clear pl under cop.	27	17	12
"	14	17	As for Compartment 16	E.	"	350' "	Grp. in cop.	18	12½	12
"	12	16	Hardwood coppice	N.E.	"	325' "	12-12' strips	16	13½	12
"	7	14	" "	N.E.	"	400' "	Grp. in cop.	15	13	12
"	9	14	Woodland	N.W.	"	350' "	" " "	14	12	15
"	8	12	Hardwood coppice	N.E.	"	375' "	" " "	18	18	17
Pleasley	7	19	" "	N.W.	"	400' "	" " "	20	12½	8
					2. Ash					
Whitwell	14	19)						(18	11½	14
"	16	19)						(28	17½	10
"	14	17)						(18	12½	9
"	12	16)	as above				as above	(12	9¼	11
"	7	14)						(15	12¾	13
"	9	14)						(15	12¾	12
Pleasley	7	19)						(18	11½	7
					3. J.L.					
Whitwell	14	19)	as above	S.E.	Slight	)	as above	18	11½	9
"	16	19)				)		25	13	9
Pleasley	1	19	Felled woodland	S.E.	"	400' Mod.	Alt. rows	21	13¼	9½
"	7	19	" "	N.W.	"	400' "	" "	18	11¼	7
					4. Beech					
Whitwell	12	13	ash/syc./cop. strips				Coppice & failed ash strips.	16	14¾	14
"	8	12	Hardwood coppice	N.	Steep	350' Slight	Up after thinning	14	14	14
"	10	11	" "	N.	Slight	325' Mod.	" "	12	13	17
Pleasley	4	8	ash/syc./coppice	S.	"	400' "	Cop. strips	11	16½	11
"	4	7	" "	S.	"	400' "	" "	9½	16¼	9½
Whitwell	9	2	ash/bi./coppice				Up after thinning	3	18	11
					5. S.P.					
Pleasley	4	11	ash/syc. P.32	S.E.	Slight	400' Mod.	Failed gaps	13	14¼	19
"	7	11	"	S.	"	400' Slight	" "	13	14¼	21
"	6	11	"	S.W.	"	400' Mod.	Heavy Bkn.	10	11	14

Past treatment of Established Plantations

(a) Cleaning

Normally cleaning of pine is carried out 10-13 years after planting but on heavy birch gorse and coppice areas repeated cleanings may be necessary (Compartment 35, P.29 Scotland Farm (Appendix III)) if severe damage to the crop is to be avoided. As with weeding, cleaning on hardwood, especially old coppice areas, is essential particularly where establishment of the crop is slow, in order to reduce overhead cover and soil competition - (Compartment 14 Whitwell (Appendix III)). In the strip and group planted areas some reduction of the gross area cleaned was effected, since cleaning was confined to enlarging existing gaps and widening strips, a certain amount of overhead cover being removed at the same time. But the operation is easier and requires less supervision in complete underplanting.

(b) Brashing and Pruning

Information obtained from pilot plots (Compartment 18 Clipstone I) laid down in 1944 indicated that live pruning had little effect on growth provided that more than three whorls of branches were retained. Thus it has been the custom to prune and/or brash up to about 6 ft. leaving 5 clear whorls. Fire protection largely determines where pruning will start, and racks are brashed 2-3 years before pruning. During the war years complete pruning was adopted to provide a measure of protection against incendiary attack and despite the controversy that was aroused, this practice has been retained, at least in 1 ch. wide strips along the edges of areas of high risk.

In oak/Scots pine P.40, (Compartment 30 Warsop (Appendix III)), it was found necessary to remove nearly half of the Scots pine and to prune the remainder heavily in order to give the oak a chance of reaching the canopy. In many cases the Scots pine has succumbed to this drastic treatment, as would be expected from the pilot plot data. In oak/Corsican pine mixture (Ursuline) (Compartment 26, P.40 and 43 (Appendix III)) the pine was pruned in F.Y.50, but the operation was by no means urgent and was limited to side trimming of the pine.

On hardwood areas (P.32 ash/sycamore/Japanese larch (Appendix III)

Whitwell and Pleasley), sporadic failures have resulted in the heavy branching of the survivors, particularly Japanese larch and sycamore. The former does not deserve particular attention but selected stems of the latter have been live pruned up to 8 ft. in F.Y.50 and F.Y.51. It is felt that suitable conditions of side shade would have considerably reduced the heavy branching of sycamore

(c) Thinning

Prior to F.Y.46, thinning was restricted to (a) that of established plantations, (P.89-18), belonging to Welbeck Estate, but included in the District for management, (b) lightening overhead natural and coppice growth in Whitwell and Pleasley as part of ground preparation, (c) the better stands in P.25 Clipstone I Compartments 9 and 10 and P.26 Compartments 14 and 15 W.S. II.

(1) **Pines**

In 1940, reviewing the general development of the forest, the Assistant Commissioner stated that particularly with Scots pine and on the poorer sites subject to pollution, pine should be so thinned as to favour the rapid development of the more vigorous stems; subsequent thinnings have been directed towards this end. The present cycle is 5 yearly commencing at 20-23 years, i.e. at mean height of 25 ft. but in view of the rapid growth between 1st and 2nd thinnings (i.e. 20-25 years), an initial interval of 3 years may be preferable.

Volume out-turns and areas thinned annually are provided in Tables V and VI.

TABLE V

Average Pine Thinning Yield per Acre at Clipstone F.Y. 49-50

Forest	Thinning	Cpts.	P.Yr.	Stems Removed	Top Ht.	Pit wood	Pulp wood	Total *
						H.ft	H.ft.	
Clipstone I	1st	17,13,14	26	349	23'	127	75	218 H.ft.
"	2nd	8	26	330	25'	170	95	265 "
Clipstone II	1st	32	26	382	19'	56	79	136 "
"	1st	31, 23	28	375	19'	55	75	142 "
"	2nd	14,15,16	26	238	27'	198	75	274 "

* including firewood

TABLE VI

Annual Thinning Areas and Yields

Forest Year	Block	Compartments	P. Yrs.	Area (Acs.) Thinned		Produce	
				1st	2nd	Poles	Ho
50	Clipstone I	((1B, (2,3,9,10)	13, 26	-	42	3,830	
	"	((56) (51, 58, (67)	27, 28				
	"	(59) (64-66)	29	109	-	17,660	
	Clipstone II	(31, 22)	28	16	-	3,200	
	"	(14-16) (33) (37-8)	26, 28, 32	-	94	14,750	1
	Clipstone III	(23)	32	15	-	3,150	
		(15) (29) (25)	15, 29, 10	-	49	5,410	
49	Clipstone I	(7, 12, 13, 14)(57)	26, 28	115		18,440	
		(7, 8)	26		43	3,900	
	Clipstone II	(14) (20) (23, 24)	27, 26, 29)				
		(29, 31)	28)	52	-	20,060	1
		16			30	3,800	
48	Clipstone I	(7) (49, 50, 57)	26, 28	83		22,470	1
	" II	(18) (19) (24) (31)	26, 27, 29)				
		(37, 38)	)	87		18,380	
	III	(10-14) (23)	27, 29	115		31,960	1
47	Clipstone I	(3) (8, 15)	25, 26	75		19,500	
	" I	(9, 10)	25		17	3,400	
	" II	(18) (24) (35)	26, 27, 29	61		5,650	
	" III	(22)	18		28	4,080	
46	Clipstone II	(16, 17)	26	30		6,300	
		10	10		13	2,390	
45	Clipstone I	(1)	09	5		550	
		(1)	13		2	100	
44	Clipstone I	(8, 15) (75)	26, 28	8		1,600	
		(1)	13		6	900	
	" II	(14, 15)		24		12,080	
43	-	-	-	-	-	-	
42	-	-	-	-	-	-	
41	Clipstone I	(1)	13		16	6,780	

(2) Hardwoods.

Except for isolated instances e.g. Compartment 15, P.14 Whitwell (Appendix III) and Pleasley Compartment 2 coppice thinned F.Y.44, thinning has not yet commenced in hardwood areas, although the sycamore/ash/Japanese larch mixture in Compartment 16, P.32 Whitwell (Appendix III) is marked for thinning F.Y.51. In this the object is to favour select stems at 15 ft. spacing by crown thinning, followed by pruning of selected stems.

Earlier thinnings in these areas have been restricted to improvement fellings in the overwood, reducing it to some 200 stems per acre (20 ft. - 25 ft.) prior to underplanting, and in F.Y.50 complete removal of the overwood commenced, (Compartment 10, P.40 Whitwell (Appendix III)

RESEARCH. Note by the Research Branch

Only one experiment was laid down at Clipstone by the Research Branch, and, owing to reduced staff during the war, it could not be properly followed up.

It was started in 1942 and concerned extremely heavy green pruning of pre-dominant Corsican pine in some very irregular crops planted in 1926, with the idea of encouraging the development of a more even plantation. The treatments were as follows:-

A. Removal of all branches except the top whorl
B. " " " " " " " two whorls
C. " " " " " " " three whorls
D. " " " " " " " four whorls
E. " " " " " " " five whorls
F. " " " " " " " six whorls
G. Complete removal by felling of pre-dominant trees.

The only points that can be stated with certainty, are:-

1. All the trees in treatment A., B., and C., died within 2 years.

2. In 'D' some died, but the remainder were not checked sufficiently to affect surrounding trees.

3. 'E' and 'F' were not checked at all.

4. Treatment 'G' certainly produced a more even crop, but it also removed what might well be considered the best volume producers in the stand.

If further work could have been carried out in treatments 'E' and 'F' between 1943 and 1947, some better results might have been obtained.

Conclusions

1. Clipstone Forest, 9614 acres, first established 1925, is situated on the Bunter Sands of north-east Nottinghamshire with outlying units on the Magnesian Limestone to the West and Keuper Marl to the East, each formation giving rise to different ecological conditions i.e. birch-oak heath, dry ashwood, moist oakwood respectively.

2. Climate is relatively exacting, the main adverse factors being low rainfall and atmospheric pollution. A fairly high level of trespass is expected and fire danger the most serious risk.

3. Preparation of ground as such has been largely superseded by cultivation except on old woodland and Magnesian Limestone areas. Prior to widespread cultivation, hand screefing and heather burning were employed and even to-day clear felling and burning of scrub is preferred on the pine areas where coppice re-growth is likely to damage new planting.

4. Commencing 1932 thorough cultivation has been regarded as essential to establishment on heathland sites, aeration is improved and weed growth eradicated. $4\frac{1}{2}$ ft. strip ploughing has proved to be the most economical method. Gyrotilling gives the best results in early years, but the effects of this and of skim ploughing with or without subsoiler are less durable than with deep ploughing.

5. Choice of Species

(a) Bunter Areas - Corsican pine has proved to be the most successful despite severe frost damage in 1932; Scots pine is slightly inferior in subsequent height growth, but considerably deficient in volume production and form. Larch including European and hybrid can be considered unsatisfactory, and Douglas fir and spruce a complete failure. Birch and beech are promising especially on cultivated ground. Oak and sweet chestnut are disappointing and sycamore and poplar have failed. Red oak has still to prove its worth.

(b) Magnesian Limestone Areas - Only sycamore of the original sycamore/Japanese larch/ash mixture has produced reasonable results, particularly when grown with moderate side shade. Larches have proved as unsatisfactory as on Bunter areas and ash is likely to succeed only on the moister sites with deep soil. Beech is promising and

particularly useful as a beating up species, Scots pine is likely to serve as a useful weed suppressor in short rotation.

(c) Keuper Areas - These areas have only just been taken in hand, but it seems that beech will grow well, ash will probably do well on moister sites, and oak on the heavier patches. Scots pine may also prove useful on a short rotation.

6. Planting and Nursery Procedure

Annual rate has fallen from approximately 600 acres in 1925 to 270 in 1951, with 40 acres per annum during the war years. Large initial programmes and inferior stock resulted in 'cheap' planting and large beating up programmes. Originally 1 + 1 pines were used, followed by 2 + 1 or 1 + 2, and occasionally 2 + 2. These larger plants were generally badly balanced and with the abandoning of notching with Schlich spade in 1934, better results were obtained with 1 + 1 and garden spades, the current method being notch or semi-pit with garden spade, semi-pitting being mainly used for hardwoods and on heavier soils.

7. Beating Up

Cultivation and improved planting methods have reduced both quantity and duration. Corsican pine is largely unsuitable for use in beating up owing to initial check of 2-3 years compared to Scots pine. Beech is a useful species providing that its introduction is carefully timed.

8. Weeding

Intensity and duration have been reduced by cultivation, whilst improved siting of species has reduced the necessity of weeding in gaps created by the protracted failure of unsuitable species notably Japanese larch. In Whitwell and Pleasley this rejection of strip and group planting in favour of complete underplanting has also reduced the necessity of weeding.

9. Later Treatment

Coppice re-growth particularly birch may necessitate repeated cleanings prior to brashing, which is normally carried out 2-3 years prior to thinning or when height is such that there are 5 clear whorls above 6 ft. from ground level.

It has been the practice to do advance brashing as much as possible where fire danger is high. Failures in sycamore/Japanese larch/ash mixture have

given rise to heavily branched stems, the best of which are now being pruned and retained at 12 ft.- 25 ft. spacing for retention as final crop stems. Owing to the limiting growth factors (notably pollution) and the uneven cropping resulting from difficulties in establishment on heathland, thinnings of pine are aimed at bulk production in the shortest time. Thinning of established plantations commenced on a small scale in 1944 (40 acres). By 1950 the annual area was 325 acres and it is intended to increase the programme as a 5 yearly cycle to some 600 acres by 1960.

"J. V. Jackson"

District Officer I.

STATE FOREST OFFICER'S COMMENTS

1. Bunter Sandstone Areas

The limitations of infertile, compacted soils, coupled with low rainfall and atmospheric pollution, are now well recognised and the evolution of the technique which is required to overcome them in the establishment stages is fully recorded in Mr. Jackson's report. He has the advantage of knowing Clipstone practically from its inception and this detailed record of his experience is invaluable.

It seems almost equally important as a guide to future development, that some observations should be made on the remnants of older plantations still standing on adjoining estates in the Dukeries. The best of these have gone now, but records will exist in the files of the 1938-39 census.

By all accounts when this land was first enclosed 150 to 250 years ago it was in much the same condition as many (but perhaps not the worst) areas to be planted by the Commission. Speaking in very general terms, the most satisfactory species for volume production on a long rotation have been hardwoods, notably chestnut and beech, and while good mature Scots pine and even European larch has been raised in mixture with hardwoods, the older pure stands of conifers with the single but not invariable exception of Corsican pine are extremely mediocre.

We can probably look for the explanation of this phenomenon in the fact that the deciduous canopy of hardwoods allows the maximum of rainfall to reach the soil in winter, and the development of a mull soil type under shade bearers enables it to be stored for use during the growing season. With the evergreen conifers a proportion of the rainfall is intercepted at all seasons, and as the crop opens out with age the surface litter in which most of the soil moisture is retained will often dry out completely during late spring and summer, and growth is correspondingly stunted. Corsican pine scores over other species mainly by its deeper rooting habit and heavier litter.

These considerations suggest fairly plainly that in the second rotation at least the pioneer crops of pure pine should wherever practicable give way to hardwood mixtures, and thus in the meantime research into the methods of introducing hardwoods should be continued. It can already be seen that once forest conditions are established beech shows considerable promise, and

perhaps attempts with chestnut and other species were abandoned too soon. Successful introduction of hardwood mixtures would automatically go a long way towards solving two other problems - fire protection and amenity.

As regards pollution, it is as well to remember that the Nottinghamshire coalfield was developed long after the establishment of the oldest tree crops in the locality, and on present estimates will be worked out within the life time of the youngest. This problem is, therefore, to some extent a transitory one.

2. Magnesian Limestone Areas

Here again Mr. Jackson's intimate knowledge of the crops throughout their history is of great value.

The key to the variable results and difficult establishment period on these sites again appears to be connected with the soil water relations, and particularly so where the rock comes close to the surface. Clearance of existing canopy before the new crop has established its root system, by allowing the soil to dry out in summer, not only stunts its growth directly, but subjects it to intense root competition from established weed and coppice re-growth. The dilemma of weeding is then whether to expose the plants to further drought or leave them to take an unequal chance of becoming smothered. On similar grounds the undue retention of canopy, even though the planted crop is not suffering from shade, may depress its growth simply by monopolising the limited rooting space and soil moisture. The failure of Japanese larch on these relatively fertile soils, even more than on the Bunter areas, clearly demonstrates that rainfall is the limiting factor. It would be folly to persist with it in this part of the country.

"J.S.R. Chard"

State Forest Officer.

CONSERVATOR'S COMMENTS

I have little to add beyond endorsing Mr. Chard's remarks on the value of Mr. Jackson's history.

I am in complete agreement with Mr. Chard's view that whenever and wherever conditions suitable for the growth of hardwoods can be obtained hardwoods should be introduced and should feature largely in future crops.

While giving all due weight to the local demand for conifer pitprops a compromise in favour of good silviculture will be necessary. Furthermore the Nottinghamshire Coalfield is now probably somewhere near the peak of its production, which, failing some as yet unforeseen development, may well begin before long to decline.

Meanwhile there is still a good deal to be learned about the incidence and effects of atmospheric pollution and about the location and extent of those areas which are suffering the greatest progressive lowering of the water-table due to underground workings.

One of the chief lessons provided by experience, particularly on the Magnesian limestone areas, is the unwisdom of rejecting existing growth at the time of acquisition, e.g. sycamore coppice, in favour of clearance and replanting. It can now be seen that many difficulties could have been avoided and much money saved by making the most of all advance growth which we should now consider acceptable.

A further interesting point to note is the apparent success of beech on all the main soil types viz: Bunter sands, Magnesian Limestone and Keuper Marl.

"A. H. H. Ross"

Conservator. N.W. (E)

APPENDIX I

Notes from Inspection Reports

December 1926 (Chairman)

Good strike of Sitka (Carburton) Douglas fir probably unsuited. Area likely to be suitable for Corsican pine. Original beech fair, sweet chestnut likely to be satisfactory and shake free. Sycamore seems to stand pollution well.

August 1930 (Assistant Commissioner)

100% Corsican pine to be planted except for 1 chain fire belts, sweet chestnut/sycamore with beech in frost hollows. More intensive cultivation on poorer sites for P.31 and 32.

April 1932 (Chairman) (Sir Roy Robinson)

Poor results Compartment 16 and 18 Clipstone I due to insufficient stirring up of podsol; deep ploughing likely to overcome this. Experimental lifting *in situ* to determine the effects of enhanced aeration. Compartment 37 - little response to treatment with slag. Compartment 50 - better growth of P.28 Corsican pine on derelict arable than old woodland sites, also on rifle butts Compartment 56 hardwood belts already hardly satisfactory. In Thieves Wood mature and newly planted Japanese larch unsatisfactory. Corsican pine only really suitable species.

July 1933 (Assistant Commissioner)

Scots pine only possible replacement for Corsican pine after serious frosts of 1932, Ministry of Labour trainees considered as means of cultivation, otherwise Scots pine or natural birch to be used as a nurse for Corsican pine. Douglas fir (Compartment 4) dying, to be ignored and replanted with Corsican pine. Compartment 6 Japanese larch to be retained for trial period of 10 years. In general a proportion of Corsican pine break check annually. Sweet chestnut to be ploughed and replanted. Corsican pine - this species also showed benefits of cultivation. Continued good growth on cultivated ground. Japanese larch to be dispensed with in Whitwell.

September 1933 (Chairman and Assistant Commissioner) (Sir R. Robinson and Mr. W. L. Taylor).

Progressive improvement in state of Corsican pine but continued sporadic deaths create gaps - these to be filled in with beech. Compartments 33 and 34 natural birch to be allowed to get up as shade for sweet chestnut. Good results of deep screef beating up Compartment 37. Pinus contorta too heavily damaged by Tortrix to be considered as substitute for Corsican pine. Contour ploughing regarded as ponding back leached soil toxins. Complete and thorough cultivation now regarded as essential. Treatment of frosted areas to be deferred till full extent of damage seen.

May 1935 (Assistant Commissioner) (Mr. W. L. Taylor).

Poor larch to be group planted with Corsican pine and beaten up with sycamore. Japanese larch also thought unsatisfactory (Whitwell). Ploughed and replanted hardwood belts (Clipstone I) making satisfactory progress.

October 1935 (Assistant Commissioner) (Mr. W. L. Taylor).

Clipstone II beech likely to prove best in strip and group mixtures, strips preferred to groups. Clipstone I continued break in check, ploughed hardwood belts now flourishing. Birch already giving good results. (Compartments 77 and 78).

September 1937 (Chairman) (Sir R. Robinson).

Clipstone II satisfactory progress in hardwood mixture, but coppice growth dangerous, weeding of sickly Japanese larch abandoned. Underplanting after clearing undergrowth recommended in coppice strips as standard practice. Carburton Scots pine beat up plants in frost hollows now becoming established. Clipstone I P.26 general break in check even of most recent beating up. Poorer blocks to be deep screefed and beaten up with Corsican pine.

September 1938 (Assistant Commissioner) (Mr. W. L. Taylor).

Clipstone I natural birch to be restricted to frost hollows but liable to be dangerous in pine. Benefits of cultivation in P.33 strikingly demonstrated. Underplanting beech in Compartments 78 and 79. Birch belt precluded by high cost of fencing necessary for establishment. Establishment of checked plants regarded as more important than introduction of others. Sporadic failures and rapid development of survivors preclude attainment of 85% stocking on first rotation. 66% level to be regarded satisfactory establishment on moorland sites leaving quality timber production to second rotation.

July 1940 (Assistant Commissioner) (Mr. A. P. Long).

Clipstone III P.27 hybrid larch considered satisfactory only in view of local conditions. Thinning in Scots pine subject to atmospheric pollution should aim at giving the most vigorous stems ample room to make bulk. Otherwise its limited life under such conditions may result in a pitwood rotation only. Compartment 23 P.29 Corsican pine underplanted with beech in P.36 regarded as satisfactory. 100% brashing recommended as temporary wartime measure against incendiary attack. Clipstone II beech underplant requiring more light even though half of overhead removed since planting. Complete underplanting gives comparable results at lower management cost than strip and group methods. Clipstone I, in view of uneven stocking, intensive pruning and thinning to be adopted as a means of bulk production.

October 1941 (Chairman) (Sir R. L. Robinson).

Wolfing desirable to encourage development of smaller but better formed stems. Advantages of cultivation visible in all stages. Clipstone II hardwood mixtures generally need more light. Beech under light cover of birch considered ideal arrangement; chosen birch being allowed to continue with the beech to veneer size.

July 1944 (Chairman) (Sir R. L. Robinson)

Irregular growth on skim ploughed P.26 likely to disappear by time of thinning. Results of live pruning experiments show no falling off in growth if 3-6 whorls retained. Future pruning to be based on retention of 4 whorls above 6 ft. in height and to commence irrespective of irregularities in development on those stems most needing it. Graded rides proposed along railway lines.

August 1944 (Assistant Commissioner).

Clipstone II Scots pine not ideal, but reasonable as an establishment crop (Whitwell Compartment 13) first used as nurse for ash and later filled in completely (Pleasley).

October 1949 (Commissioners)

Clipstone I Compartment 28 ploughing gives slightly better results than gyrotilling, but the latter leaves surface level for extraction. Compartments 51/56 normal development to east, but protracted check and failures to west, little difference in soil types, but eastern portion of forest had been under cultivation more recently. Clipstone II P.00 heavily thinned

F.Y.41 and underplanted with beech. Some natural regeneration appeared, but it is intended to encourage this by rough cultivation.

History of Clipstone Forest

APPENDIX II

Supervisory Staff

F.Y.	Conservator	Divisional Officer	District Officer	Forester i/c	
				Clip I	Clip II
1926		A.P. Long	D.C.D. Ryder	T.E. Anderson	-
27		"	"	"	-
28		"	"	"	-
29		"	"	"	-
30		H. M. Steven	"	"	-
31		"	"	"	-
32		"	C.A. Connell	"	-
33		E. Wynne-Jones	"	A. A. Parry	W.V. Jackson
34		"	"	"	"
35		"	I. M. Ross	"	"
36		J. Macdonald	"	L. Wyatt	"
37		"	"	"	"
38		"	J.B. Stocks	"	"
39		C.A. Connell	W.V. Jackson	"	Newell
40		"	"	"	"
41		"	"	"	"
42		"	"	"	"
43		"	"	"	"
44		"	"	"	"
45	G.W. Backhouse	J.T.L. Fitzherbert	"	"	"
46	"	"	"	W. Arnott	Waters
47	A.H.H. Rodd	"	"	G. A. Simpson ϕ	
48	"	G.I. Mackenzie	"	"	
49	"	"	"	"	
50	"	J.S.R. Chard	"	"	
51	"	"	"	"	

ϕ G.A. Simpson (Head Forester) exercising control over both beats, including Clipstone III.

APPENDIX III

Notes on Representative Compartments

The following compartments, to which reference is made in the text of Clipstone Forest History, were selected as representative examples of the points requiring illustration and of the development of the forest in all its various aspects up to the present time.

The records of original condition and subsequent treatment are summarised for easy reference in the field.

APPENDIX III

Clipstone I

P. Yr.	Cpt.	Species Orig-inal	Species Pres-ent.	Original Ground Cover	Preparation of Ground	Planting	F.Y.	Beating Up and Weeding	F.Y.	Cleaning, Brashing Thinning	Ht. Mean Dom.	Remarks
13	1B	SP 50 EL 25 CP 15 Be. 1	60 24 15 1	Acquired Plntn.		Probably Pit			28 35 41 51	Cleaned Bi. copp. Pruned 1st. Thinning 2nd Thinning		Hardwoods have suffered from under thinning
25	4	DF 100	DF 20 SP 40 CP 30	Heath with odd pine and birch coppice.		Notch with Schlich	27/35 37 25/40	SP CP Weeding prolonged by B.U.	40 & 49 49	Cleaned Birch coppice Pruned, select stems.		DF virtually complete failure
26	3	CP 100	100	Derelict pasture.	Shallow plough	Notch with Schlich	 26/29	B.U. Nil Light mainly bramble patches	41 46 51	Clean, Bi. and thorn Pruned 1st Thinning		Good growth on N. aspect
	7	CP 100	 95 SP 5	Bracken Gorse	Shallow plough	Notch with Schlich	 26/31	B.U. CP 1+1 SP Light weeding	39 42	Cleaned Pruned		Establishment delayed by drought poor planting and under weeding
	11	CP 100	 CP 65 SP 35	 Clumps S.P & Bi. Bkn., A/flex, Gorse.	 Cleared by less-or Shallow Plough.	 Notch with Schlich	 26/31	 BU C.P. 1+1 " S.P. Light Weeding Bkn. patches only.	 39	 Cleaned, Bi. coppice.		 Frost, Weevil, and drought delayed establishment.
	6	JL 100	JL 45 SP 35	Calluna, weak Bkn, patches of A/flex.		Notch	 26/32	SP Mod. Bracken patches	 49	 Pruned	 32' 26'	 Later failures of JL result in 80% stock.
27	36	Oak 100	0. 10 Ch. 70	Calluna, weak Bkn, patches of A/flex.	Bracken burnt	Oak patches sown. Ch. Notch	28 27/31	B.U. Ch. & Oak Notch Moderate, Bkn. & Cal.				S/Ch. unsuitable Oak poor form
	53	CP 100	 90 SP 5	Calluna, weak Bracken A/flex.	 Shallow plough	Notch with Schlich	29 30/32 27/31	CP SP Notch Light weeding, Bkn, Cal.	40	Cleaned and pruned.		Frost and poor planting cause uneven stocking.
	50	0. 50 Ch. 50 Bi. Be.	5 60 60	Bkn. Cal./A. flex. Gyrotilled 1938	Burnt bare Shallow plough	Sown patches 44 U/P Be. Notch.	28 27/31 38/40 44/46	B.U. Notch S/Ch. Light Bkn. patches B.U. Notch Bi. Light Bracken Light Bkn. & Trim Bi.	 47 51	 Be. cleaned, Bi. pruned.	16' 16' 20' 4'	 F.Y. 51 Bi. representing 60% canopy to be reduced to 30% by ringing.
28	68	CP 100	 60 SP 40	Pasture, clumps of gorse and broom.	Clear gorse Shallow plough	Notch with Schlich	 28/33	 S.P. Heavy gorse/broom	34 & 39 48	 Cleaned Pruned		
30	42	CP 100	 60 SP 30	Woodland scrub, bi., poplar and occasional broom.	Clear scrub	Notch	 30/35	C.P. S.P. Heavy Bkn. Bi. A/flex.	37 46	Cleaned Bi. copp. Pruned.		
31	28	Ch. 70	 Bi. 100	Cal. poor Bkn. patches, A/flex. and gorse. Clear burnt Ch.	Clear Part gyrotilled " not cult.	Notch Semi-pit			42	Burnt	 5' 2½'	R.P. Bi. F.Y. 48
	93	CP 100	 50 SP 50	Cal, sparse Bkn. patches A/flex gorse (a) (b)	Clear Part gyrotilled " not cult.	Notch	31/34 49 50	Heavy Bkn., gorse. BU. CP Gorse cut	42	Burnt (a) (SP 2½ (CP 2 (b) (SP 1½ (CP 1	19	R.P. SP/CP FY. 48 Little weeding needed on cultivated ground.

Clipstone I (Contd)

P. Yr.	Cpt.	Species Orig-inal	Species Pres-ent	Original Ground Cover	Preparation of Ground	Planting	F. Y.	Beating Up and Weeding	F. Y.	Cleaning, Brashing Thinning	Ht. Mean Dom.	Remarks
32	100	J.L 50 C.P.50	15 75	Cal. gorse, Bi. coppice	Clear gorse, Shallow/subsoil 4'6" strips	Notch	32/35 32/37	CP Notch Heavy Cal., Bkn.			JL23 CP25	Subsequent failures of J.L. result in 90% stocking.
	102	JL	JL 10	as in 100	Clear		32	CP Notch	47	Cleaned Bi. copp.	JL20	Part burnt in 1932
		100	CP 70		Shallow plough 4½'	Notch	32/36	Light Bkn/A. flex.	50	Part pruned	CP19	R. P. 34
		CP					34/36	CP Notch	47	Cleaned	CP22	Full crop achieved by cultivation.
		100	100	Burnt P. 32	Deep plough 4½'	Notch in furrow slice	34/37	Light Bkn., gorse.	49	Pruned	Bi23	
38	26	Sw. Ch. 100	0 CP100	Pasture, mainly couch Failed P. 28 S. Ch.	Shallow Gyrotilled	Notch	39 37/42	3% BU, S.P. in frost holes. Mod. couch, cocksfoot				
41	13	CP 100	60 SP 40	SP '05 felled '40 Bkn. and A/flex appeared immediately after planting.		Notch	41/42 41/45 -	SP Notch B.U. Moderate Bkn. & HW. coppice.				Beetle and frost damage caused uneven stocking. R.P. followed felling too soo
45	8	CP 100	Be 95	Bare following clearing of CP Bkn. and Cal.		Notch & Pit	45/47	No B.U. Light Bkn. Bi. coppice				Severe frost hinders development.
47	31	CP 80 SP 20	80 20	SP/EL and Ch. cleared by lessors in 1942.		Notch	49/51	BU SP/CP H.W. coppice, bramble raspberry.				No rabbit fence damage only light.
26	15	CP 100	95 SP 5	Woodland SP/EL		Notch 5x5 CP 1 + 1	35 26/30	B.U. Notch SP Moderate bramble, Thorn, Bi. coppice	38 42 44 50	Cleaned HW. copp. Pruned 1st Thinning 2nd Thinning	28' 28'	

APPENDIX III (Contd)

Clipstone II

P. Yr.	Cpt.	Species Original	Species Present	Original Ground Cover	Preparation of Ground	Planting	F.Y.	Beating Up and Weeding	F.Y.	Cleaning, Brashing Thinning	Ht. Mean Dom.	Remarks
27	5	JL75 Ch25	SP 33 37 5 0 5 Bi. 20 Be. UP	Woodland Bi/Oak with Sw/Ch coppice	Fell Copp.	Notch	31 25 41) 45) 48) 27/50	B.U. Be " Be/Syc groups Further B.U. Be. Weeding HW. copp. prolonged by repeated B.U.	43) 47) 47	Cleaned Bi. coppice SP and JL pruned	SP30 JL33 Ch35 0.10 Bi37 Be 7	Repeated B.U. without breaking canopy has resulted in suppressed understorey of Be.
28	21	CP 100 SP 20	80	Old pasture Bi. and thorn	Shallow strip ploughing	Notch	28/32	BU Notch SP Mod. weeding thorn and Bi.	45 50	Cleaned and Pruned 1st Thinning	SP28 CP28	
	32	CP 100 SP 32	58	Woodland, odd Bi., gorse and heather.		Notch	33 34 28/38	BU SP " CP Moderate-heavy weeding in gorse patches	41 46 50	Cleaned Bi. copp. Pruned 1st Thinning	CP24 SP22	Frosty locality also subject to deer damage, causes uneven crop.
29	35	JL 100 CP 35 Be. 5	60	Woodland oak/Bi. S/Ch. gorse clumps.	Clear HW coppice	Notch	29/34 36 29/40	BU. CP BU. CP failed groups Heavy weeding, HW copp. gorse and bramble.	42) 45) 49) 45 44	Cleaned Bi. and hardwood coppice J.L. pruned C.P pruned and cleaned	JL32 CP19	JL moderate but damaged by light frost.
40	3	CP95 SP 5	CP 95 SP 5	Woodland EL/SP Syc./N.S. felled 37/38	Cleared by Merchant	Notch $4\frac{1}{2}$x$4\frac{1}{2}$ 2+1 (Urs)	41 40/44	B.U. C.P. Light, trim coppice	47	Cleaned HW coppice	8	SP clear planted in frost hollow.
32	16	Syc. $37\frac{1}{2}$ Ash $37\frac{1}{2}$ JL 25	60 20 20	Oak/ash coppice occasional elm and Bi.	Clear felled prior to planting.	Notch $4\frac{1}{2}$x$4\frac{1}{2}$	34 32/39	B.U. JL Notch Heavy and continuous weeding HW coppice	41 44 51	Cleaned 1st Thinning	Sy. 27 A. 28 JL 25	Original plants large and needed staking.
	14	Syc. $37\frac{1}{2}$ A $37\frac{1}{2}$ JL 25	50 20 15 Be. 15			Notch alternate rows	37 32/41	Again Bu 44 Be. Heavy and continuous weeding.	43	and 3 yearly cleaned	Sy. 17 A. 18 JL 18 Be. $2\frac{1}{2}$	80% Ash failed, open canopy and slow establishment account for heavy weeding.
34	14	Sy. 50 A 50	60 5 Be. 20	Clear groups 100/ac 21' apart in 1 yr. coppice.	Notch 16 plants per group alternative A/Syc.		34/35 39 49	Complete weeding in groups and trimming hedges. Failed patches enlarged B.U. SP again in 46. BU Be. failed patches again in 1951.	47	Cleaned	Sy. 17 A. 18 Be. $1\frac{1}{2}$	
35	12	S. 25 A. 25 Copp 50	35 10 15 Be. 40	Bi/ash coppice E.L., thorn, Elm, aspen, A/caesp. and Bkn.	Clear alternate strips 12, 15, 18', ring large coppice.	Semi-pit alternate strips. Syc/Ash 18-24" plants 3 rows @ 3' in strips, 4' in rows. Coppice strips planted Be. 1938	35/37 46 48	Moderate weeding Bkn. and Hdwd. coppice BU Be. 60% Ash failed. BU Be.	37 38 51	Ringed coppice felled and sold Coppice strips cleared. Remaining large coppice felled	S. 18' A. 18' Be. 16' Be. $4\frac{1}{2}$'	
39	8	S. 50 Bi. 50	50 50	Bi, ash, elm, oak coppice 20-25' hazel, thorn bramble, briar Bkn.	Gaps enlarged by felling, also where heavy thinning.	Semi-pit groups 10 rows square at 4' in rows. 30' between groups. Clear plant on Bkn.	37/40	Light weeding, heavy on Bracken.	45	Groups enlarged standards ringed	Sy. 18 Bi. 38	

P. Yr.	Opt.	Species		Original Ground Cover	Preparation of Ground	Planting	F. Y.	Beating Up and Weeding	F. Y.	Cleaning, Brashing Thinning	Ht. Mean Dom.	Remarks
		Original	Present									
40	10	Be. 100	100	Oak, Bi, lime Copp. 25-30' with occasional Be. standards Bkn. briar, bramble.	Clear undergrowth. Heavy improvement felling reducing over wood to 200 stems/acre.	Underplant Be. throughout semi-pit.	40/46	Light weeding Bracken	50	Overwood felled Copp. cleaned. Few select Bi. retained.	Bel2 Bi40	Little weed damage as growth suppressed by overhead. Similar technique in C.9 UP 48, 49 and C.161 Winkburn UP 1951.

APPENDIX III (Contd)

Clipstone III

Thieves and Harlow Wood

P.Yr.	Cpt.	Species Original	Species Present	Original Ground Cover	Preparation of Ground	Planting	F.Y.	Beating Up and Weeding	F.Y.	Cleaning, Brashing, Thinning	Ht. Mean Dom.	Remarks
18	25 22	SP40 EL40 O 20	80 15 5	Acquired plantation	Appears to have been ridge and furrow ploughed	Pit 4½ x 4½			41 46	Pruned Thinned		
27	11	CP 100	100	Pasture Cal, Thorn Bkn. & Bi.	Clear Bi.	Notch CP	28 27/32	BU C.P. Light weeding Bi. Thorn.	35 40 45 50	Cleaned Bi. Pruned 1st Thinning 2nd Thinning		Good stand on N. aspect.
	13	HL 100	70	Woodland Oak/Ch. patches Bkn/A. flex.	Clear Coppice	Notch	30/33 33/35 27/33	S.P. Notch B.U. J.L. " " Heavy weeding patches till 1936	41 44	Cleaned Bi. and Hdwd. coppice Pruned	HL25 SP23	Moderate Loh. stand on Northern aspect.
29	23	CP 100	95 Be.5	Arable, couch, A/flex.	Shallow plough 5'	Notch in side of furrow	29/32 36	Moderate weeding Bi. coppice UP Be.	39 46 49	Cleaned Pruned 1st Thinning	CP20 Be 8	CP, now closed over Be., leaving suppressed understorey.
39	9	JL 100	100	Woodland O/S/Ch.		Notch	34 32/36 35	BU C.P. Heavy weeding, Bkn. Bi. BU C.P.	44	Cleaned Bi. copp and Pruned	JL30	Part burnt 33 RP CP 34
34	9	CP 100	100	Burnt P.31			34/40	Heavy weeding Bkn. Bi.	47	Cleaned & Pruned	CP25	
32	2	JL50 CP50	20 40 SP40	Woodland Bi/O/E.L.	Clear. Old ridge and furrow.		33 34 45 32/39	SP notch B.U.) some CP " B.U.) P.C. SP BU failed groups Mod. weeding Bkn. Bi.	47 51	Cleaned. Pruned		Repeated BU gives uneven but full stocking.
39	38	CP 100 Bi. 100	100 100	Pasture A/flex. Failed Nat. Bi.	Shallow plough and subsoil	Notch mound in furrows 1+1 Urs. 60% Notch Schlich and bar in gravel.	39/43 45/48	No B.U. Light weeding A/flex and Juncus. Light weeding A/flex and Bi.			23' 4'	Area retained as Nat. Bi. failed R.P. S.P.45
47	34	Be. 100	100	Woodland Bi./Oak SP/EL Ridge & Furrow	Cleared by Lessor	Semi-pit 4 x 4	50 47/50	B.U. Be. semi-pit Moderate weeding, Ep. and Hdwd. coppice				Growth no better than C.8 P.47 Be. on a moderate S. facing slope.
						Warsop						
13	8	SP)75 CP) (EL (Be.25 (O	32 38 5 20 5	Acquired Plantation					44	Pruned prior to acquisition 1st Thinning	CP42 SP40 EL42 Be) O)36	
35	5	CP 100	100	Old arable, Bi. Gorse A/flex.	Clear Deep plough 4'	Notch in furrow slice CP 2+1	36	B.U. C.P. mound in furrow. Moderate weeding Bi. coppice.	48	Cleaned (Bi. copp) and pruned.	23'	Growth compares well with C.17, uncultivated Dom. Ht. 18'
38	12	CP 100	90	Tufted A/flex, Cal. Bkn, Burnt F.Y.33	Gyrotilled F.Y.36	Notch (Urs)	41 44 &) 46) 38/48	B.U. Syc. B.U. dead Syc. C.P. B.U. S.P. Heavy weeding A/flex Gorse stimulated by cultivation.	49	Cut Gorse	13'	Open crop Urs/SP/CP. Height varies from 6-16' in dense A/flex.
39	34	CP95 Bi.5	95 5	Pasture, gorse A/flex, thorn and cocksfoot	Clear gorse shallow plough and subsoil.	Notch (Urs.)	40 39/43	B.U. CP Moderate weeding Gorse and A/flex	46	Trim Bi.	CP15 Bi.17	Bi. planted in frosty hollows.

APPENDIX III (Contd)

Clipstone III

Warsop

Yr.	Cpt.	Species Original	Species Present	Original Ground Cover	Preparation of Ground	Planting	F.Y.	Beating Up and Weeding	F.Y.	Cleaning, Brashing, Thinning	Ht. Mean Dom.	Remarks
43	34	CP 100	100	Deep plough 4'	Notch		43/46	Moderate weeding, Bi. and Bramble	49	Trim Bi. coppice	10'	
40	30	SP25 0 75	30 70	Arable under clover	Shallow plough and subsoil	Notch SP 4½x9 Oak 4½x9 in rows of 3 plants.	40/45	Heavy weeding clover and cocks-foot.	46 49	Prune SP Half SP removed, rest pruned again.	SP11 0 9	Oak show good take but form poor.
40	26	CP50 0 50	50 50	Arable couch	Shallow plough	Notch CP 2+1 Interplanted Oak 2+0 7'x2' between Pine rows.	40/44	Moderate weeding couch	50	Pine trimmed to favour Oak	SP11 0 7½	Oak better developed than in C.30

CLIPSTONE FOREST

BEAT 2.

N

To Worksop

Calloughton Wood

To Oxcroft

Burnt Oak Pltn

Notts 13 S.E.

Notts 14 S.W.

Notts 14 S.E.

To Worksop

Elkesley

To Scrooton

CLUMBER PARK

Holywell Wood

Lake

Clumber House

Scotland Farm

Notts 18 N.E.

Notts 19 N.W.

To W. Drayton

Lawn Covert

Notts 19 N.E.

Carburton

Blyth Corner

Bathamsall

LOUND

Haughton

Bevercotes

Bucky Corner

To Norton

To Gueckley

To Warsop

To Ollerton

To Kirton

To Tuxford

Walesby

Bevercotes Park

To Woodsetts

Yorks 296 S.E.

SCALE. 1: 25000.

P.J. McK 23.11.50

WHITWELL WOOD

To Blyth

To Worksop

Whitwell

DERBY 19. N.E.

SWINSTON HILL

CLIPSTONE FOREST [BEAT I]

To Edwinstowe

To Ollerton

N

Notts 23 S.W

Notts 23 S.E

Clipstone

Colliery

To Mansfield

Forest Town

Railway

F.W.H.

Nursery

F.W.H.

Mineral Rly.

To Bilsthorpe

Straw berry Hill.

Colliery

Notts 28 N.W

Black Hill

Ialersall Grange.

Notts. 28 N.E.

To Mansfield

Rainworth

Python Hill.

M.R. Mansfield - Southwell.

To Blidworth

To Woodborough

To Farnsfield

SCALE 1/25.000

P.J. M&H. 23-11-59

CLIPSTONE FOREST

BEAT 3

WINKBURN

NOTTS 28 N.E.

Lady Wood

Park Spring Wood

Winkburn

Rae Wood

Dales Wood

Hacketon Wood

Dillner Wood

Nut Wood

To Hacketon

To Eakring

To Bilsthorpe

Kirklington

Harlow Wood

To Blidworth

To Mansfield

F.W.H

Thieves Wood

NOTTS. 27 S.E.

Coxmoor Plm

To Kirkby

SCALE 1/25,000

CLIPSTONE FOREST

BEAT 3.

WARSOP

PLEASLEY PARK

NOTTS 18.S.W.

DERBY 31.N.E.

DERBY 31.A.N.W.

Warsop

Shirebrook

G.C. Rly Chesterfield - Lincoln

M.R. Mansfield - Worksop

To Pleasley

To Edwinstowe

To Clipstone

To Mansfield Workhouse

PLEASLEY PARK

F.W.H.

Burnt 41 RP 43

Burnt 46 RP 47

RP 45

N

SCALE 1/25.000

P.J. McN. 23.11.50