



902 (410.46)

FORESTRY COMMISSION

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HISTORY

of

DELAMERE FOREST

<u> 1924 - 1951</u>

.

NORTH WEST (ENGLAND) CONSERVANCY

HISTORY OF DELAMERE FOREST

	Co	ntents				Page			
CHAIRMAN'S COMMENTS	•••	•••	•••	•••	•••	1			
GENERAL DESCRIPTION OF THE F	FOREST	•••	•••	•••	•••	2			
Situation	•••	•••	•••	•••	•••	2			
Area and Utilisation	•••	•••	•••	•••	•••	2			
Physiography	• • •	• • •	•••	•••	•••	6			
Geology and Soils	•••		• • •	•••	•••	7			
Vegetation	•••	•••	•••	•••	•••	7			
Meteorology	•••	•••	•••	•••	•••	7			
Risks - Fire, animals,	insects	, fungi	•	• • •	• • •	7			
Roads	•••	•••	•••	•••	•••	10			
Labour	• • •	•••		•••	•••	10			
STLATCHLATIRE	_					77			
Preparation of ground	•••	•••	•••	•••	• • •	11			
Choice of species									
Planting						12			
Planting									
Spacing. type	e of pla	nts use	ed. meth	ods of	plantin	I 2 .			
Spacing, type Annual rate of success of es	e of pla of plant utablish	nts use ing, ma	ed, meth	nods of and deg	plantin gree of	ug, 12 - 14			
Spacing, type Annual rate of success of es	e of pla of plant stablish	ints use ing, ma ment	ed, meth unuring	nods of and deg	plantin gree of 	12 - 14			
Spacing, type Annual rate of success of es Ploughing	e of pla of plant tablish	nts use ing, ma ment	ed, meth unuring 	nods of and deg 	plantin gree of 	ug, 12 - 14 14 14			
Spacing, type Annual rate of success of es Ploughing Beating up	e of pla of plant tablish 	ints use ing, ma ment 	ed, meth inuring	nods of and deg 	plantin gree of 	ug, 12 - 14 14 14			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding	e of pla of plant tablish 	ints use ing, me ment 	ed, meth anuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species	e of pla of plant tablish	ints use ing, ma ment 	ed, meth unuring 	ods of and deg	plantin gree of 	ng, 12 - 14 14 14 15 15			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth	e of pla of plant tablish	nts use ing, me ment 	ed, meth unuring	ods of and deg	plantin gree of	ng, 12 - 14 14 14 15 15 15 17			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab	of plant of plant tablish 	nts use ing, ma ment plantat	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 15 17 19			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese	e of pla of plant tablish olished earch Br	ints use ing, ma ment plantat	ed, meth anuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 15 17 19 21			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions	of plant of plant tablish olished arch Br	nts use ing, ma ment plantat	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions Note by State Forest Of	e of pla of plant tablish olished earch Br ficer	nts use ing, me ment plantat anch 	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23 25			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions Note by State Forest Of Note by Conservator	of pla of plant tablish olished arch Br ficer	nts use ing, ma ment plantat ranch 	ed, meth unuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23 25 26			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions Note by State Forest Of Note by Conservator	e of pla of plant tablish olished earch Br ficer Inspect	ints use ing, ma ment plantat ranch ion Rep	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23 25 26 27			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions Note by State Forest Of Note by State Forest Of Note by Conservator APPENDICES: I Notes from II Record of s	of plant of plant tablish olished arch Br ficer Inspect	ints use ing, ma ment plantat ranch ion Rep	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23 25 26 27 29			
Spacing, type Annual rate of success of es Ploughing Beating up Weeding Mixtures of species Rates of growth Past treatment of estab Research - Note by Rese Conclusions Note by State Forest Of Note by State Forest Of Note by Conservator APPENDICES: I Notes from II Record of s III Sample plot	e of pla of plant tablish olished earch Br ficer Inspect uperior data	ints use ing, ma ment plantat ranch ion Rep	ed, meth nuring 	uods of and deg 	plantin gree of 	ng, 12 - 14 14 14 15 15 17 19 21 23 25 26 27 29			

HISTORY OF DELAMERE FOREST

CHAIRMAN'S COMMENTS

On my instructions Mr. Innes has added on pages 2 and 3 some fuller information extracted from the Joint Report of the Forestry Branches for 1912-13 (Cd. 7488). I think Mr. Popert's Plan was printed and if so there may be a copy on an Office of Woods file.

No doubt I inspected the forest before 1912, and there may be records on the old Office of Woods files of reports by Crosfield, L.S. Osmaston and D.W. Young. I am not now sure who was responsible for the local management.

My next inspection, as recorded on Commission file 56/29, was in June 1922 when I noted that Corsican pine was the most suitable species for the bulk of the land. Recently formed plantations of that tree had not been successful, due probably to insufficient care in planting. It might be possible to sow Corsican pine <u>in situ</u>. The thinning of the older coniferous plantations was urgent.

The next recorded inspection in April 1930 was concerned also with thinning and marketing of produce. As noted in the history, a very good market for small thinnings was developed by Forester Jones, who did excellent pioneer work in utilization.

My subsequent inspections are noted in the text.

The only other point of interest which I can add was the great pressure on the Commission to continue heavy fellings of pine after the late war had ended. Fortunately, I was able to avert that danger.

R.

July 25th, 1952.

HISTORY OF DELAMERE FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation

Delamere Forest is situated in the County of Cheshire between Chester (10 miles) and Northwich (7 miles). The Parish of Delamere (with Eddisbury) contains a large part of the present woods and is central to the area of former ancient forest land known as the Forest of Mara and Mondren.

The names "Mara" and "Delamere" no doubt derive from the small lakes in the locality which were formerly more numerous and extensive.

Area and Utilisation

The present area managed by the Forestry Commission is 1936.7 acres of which 1895.4 are planted. This is the bulk of what remains of the ancient forest which was a hunting preserve of the Earls of Chester and hence came to be administered by the Crown. Early enclosures for the purposes of agriculture bear to this day such names as "Old Pale" and "New Pale". Old Pale Farm is situated close to the site of an ancient hill settlement and by the side of the Roman Watling Street linking Chester and Northwich.

There was little development in the area, however, until an Act of Enclosure was passed in June 1812. At that time the forest consisted of about 8,000 acres of sandy waste, denuded of trees by right holders, and covered with bracken, heather, and gorse. The Act provided for one half of the area to be allotted to the Crown free of all rights and to be used solely for the growth of timber. The remaining land was to be divided between the Crown and other holders of rights.

It was also provided that after allotment no rabbits were to be kept on any part of the forest so allotted under any pretext whatsoever.

Planting in the Crown Allotments began in 1815 and finished in 1823. Returns from the woods were beginning in 1831 and by 1848 a nett income was obtained. It is presumed that thinnings were heavy and the sale of small poles lucrative. However, in a report on Crown forests made by/Mr. Brown in 1852 the closeness of the trees was condemned and heavy thinnings recommended.

By 1849, 4,022 acres were under timber. In 1854 on the instructions of the Treasury three surveyors drew up a report on Delamere. The planting of oak in the past was condemned and so were some of Brown's recommendations.

The obligation to grow timber was repealed in 1856. A large part of the forest was cleared and the ground prepared for farms.

In 1893 it was decided to replant the area of about 2,100 acres still under timber. During the next 15 years 540 acres were cleared and replanted with pines.

In 1908 a Working Plan was drawn up by Mr. Popert, Consulting Forester to the Office of Woods, whereby the whole area, apart from the plantations formed in 1893, was to be replanted by 1930. This scheme provided for the replanting of the best soil with cak and other broadleaved species while the rest of the area would carry a coniferous crop.

Hitherto the conifer area had been dealt with annually but it was not found possible owing to scarcity of mast and to other causes to plant more than some half a dozen acres with oak.

By 1912 the young plantations extended to 770 acres and varied in age from 1 to 19 years. The growing stock was mostly Scots pine, with a considerable mixture of Corsican and some Weymouth pine, Sitka spruce had been planted in damp spots. Beech had been introduced as fire breaks and was mixed with the conifers in the new plantings.

By the Forestry (Transfer of Woods) Order 1924 the majority of the woods remaining on the Crown's Delamere Estate were transferred to the Forestry Commissioners. Certain woods were retained by the Crown as prospective building sites or on account of other values. All mineral rights were retained by the Crown, and this has resulted in the resumption of the greater part of one compartment where the sand was found to be suitable for tile manufacture.

Other compartments contain gravel beds, but attempts by local firms to obtain permission to exploit these have as yet been unsuccessful. The Ministry of Local Government and Planning is favourably disposed towards the preservation of the forest from the amenity point of view, so that there is every prospect of the present area of productive woodland being⁴ increased rather than diminished. A small area is held on lease from a private estate and there are prospects of a further small acquisition in the locality, together with the transfer to the Forestry Commission of the woods reserved by the Crown in 1924.

The present acreage of 1936.7 could be increased to about 2300 acres by these acquisitions.

Details are given in following tables (Tables I and II).

TABLE
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As at 30th September 1951

	TOTALS	Major Wilbraham	Major Wilbraham	Commissioners of Crown Lan	Commissioners of Crown Lan	Commissioners of Crown Lan	(1)	From		
		Lease	Lease	ds Tenancy)	is Annual)	ls Transfer	(2)	By		
	1	15. 3.40	22.9. 27	24. 1.27	31.12.26	1. 4.24	(3)	Date		
							(4)	Acq. Plant	•	
							(5)	Col.4	Plant- able	
							(6)	ies i	Nur-	
`							(7)	ural	Agri-	
							(8)	F. W. H.		
							(9)	Col.4.	plant- able	Un-
						To Commiss- ioners of Crown Lands 6.5.1949.	(10)	Description	Land Perman Transferre	
	35					35	(11)	Acreage	ently d	Othe
Less Res							(12)	Description	Land Tempor Transferre	r Land
wmption Net Area							(13)	Acreage	arily d	
<u>35.0</u> 1937.0	1972.0	14.0	96.0	2.0	21.0	1839.0	(14)		TOTAT.	

TABLE II

As at 30th September 1951

		Area	
a)	Plantations		
	Acquired Formed by the Commission	950 ac 949	res "
ъ)	In hand awaiting planting		
	For Afforestation For Re-afforestation	-	
c)	Tenanted pending planting		
	For Afforestation For Re-afforestation	:	
a)	Nurseries	24	fi
e)	Agricultural Land		
	No. of tenancies 1	6	*1
f)	F. W. H.		
	Number - 1	1	11
g)	Unplantable Land	-	
h)	Other Land	7	Ħ
		1937 a	lcres

The sporting rights belong to the Forestry Commission but there is practically no game. As far as the records go there has never been more than one sporting tenant at a time, the whole forest area being included in the leases. Since 1948 the tenant has been the Master of the Cheshire Forest Hounds. His agreement specifically gives permission to kill foxes.

Physiography

Most of the forest lies between 200 ft. and 400 ft. above sea level although agricultural ground in the centre of the forest area (on which the fire observation tower is situated) rises to 575 ft. (Pale Heights).

Apart from the beds of former meres, the ground undulates irregularly and gives a variety of aspects. Long steep slopes are not encountered and exposure is moderate.

Geology and Soils

The parent rock is Keuper sandstone. This comes near to the surface in a few places, but is mainly covered by glacial sands and gravels. The manner in which these were deposited resulted in the formation of numerous small meres and wet hollows known as mosses, some of which are virtually undrainable and contain a great depth of peat.

In Compartments 3 and 4 the sandstone is overlain by a bed of Keuper Marl which gives a sandy clay subsoil.

Vegetation

Bracken is dominant over most of the area. Heather, bilberry and bent grass (<u>Molinia</u>) occur on the poorer soils particularly on the peat of the mosses. The flora as a whole is remarkably deficient in true woodland species, which presumably did not survive the earlier clearances.

Meteorology

Records of rainfall, maximum and minimum temperatures, wind direction, and incidence of snow or any exceptional weather have been kept daily by the forester since January 1930. (Meteorological Station 2774)

From these records the average annual rainfall is 33.3 in. It is fairly evenly distributed throughout the year but the period February to June has the least rain, and drought, when it occurs, is usually during that time of year. Heavy falls of snow are unusual.

The only months recorded as being completely free from frost are July and August. From October until April frost may always be expected, and in May, June and September there are occasional recordings of temperatures below 32° F.

The prevailing wind is south-south-west but there is a fair incidence from other directions particularly from the east during the spring.

Risks

<u>Trespass</u>. Situated in a relatively highly populated county and within easy distance of Manchester, Liverpool and Warrington, the forest is visited by thousands of people. On fine Bank Holiday week-ends the two principal roads through the forest are lined with cars often nose to tail. The general public is perhaps becoming more conscious of the value of growing timber,

but damage continues on all too large a scale. Trees are blazed, tops cut off, and new plants uprooted. Fences are damaged, and drains blocked. Most of this damage is perhaps caused by thoughtless actions, but deliberate thefts of firewood and Christmas trees also occur.

Camping is not allowed on Forestry Commission ground as there are no safe sites, but a number of neighbouring landowners provide camping grounds. The collection of firewood by campers has often led to damage, and in 1950 a system of permits was introduced. The permits, issued for a nominal fee of 2/6d for limited periods, set forth conditions to be observed. A copy of each permit, signed by the holder is retained by the Forestry Commission.

Fire. The main sources of fire risk are the Chester - Northwich Railway which runs for three miles through the forest, the visiting public and burning on adjoining land.

All the fire control units contain young conifer plantations with a ground vegetation of bracken. The most hazardous time of the year is between February and May when dry easterly winds may be expected and there is no green ground vegetation. The most hazardous time of day is the afternoon.

The combination of risks and hazard is likely to be greatest at Easter and Whitsun week-ends in the plantations which have not yet reached the thinning stage. At these times and places fire danger may be expected to be extreme.

For many years small fire fighting teams have been provided from the forest staff, and dating from the 1939-45 War, there have been arrangements for calling on the National Fire Service and now the County Fire Services for immediate help. In addition by arrangements dating from 1948 and 1949 respectively assistance can be summoned from Army and Naval establishments situated within a few miles. Pale Heights has ever since the transfer of the forest to the Commission been used as a look out post during periods of• fire danger, the alarm being given by bugle call. In 1951 a 60 ft. steel fire tower was erected on the Heights and the telephone is being installed.

<u>Rabbits</u>. Owing to the sandy nature of most of the ground, rabbits can construct extensive warrens. Control is difficult without the co-operation of neighbouring landowners. In May 1951 a gassing campaign by the Cheshire

Agricultural Executive Committee covering all surrounding parishes had immediate results.

<u>Squirrels</u>. Red squirrels are present in moderate numbers. Grey squirrels have been seen on a few occasions since 1950 but are not yet resident.

<u>Insects.</u> Delamere Forest is noted for its insect life and has been visited regularly by the entomological societies for many years. Members complain that the insects are not what they were before the Forestry Commission took over management. The main forest pests are the Pine Weevil (<u>Hylobius</u> <u>abietis</u>), the Black Pine Beetle (<u>Hylastes ater</u>), the Pine Sawfly (<u>Diprion</u> <u>pini</u>), Pine Shoot Moth (<u>Evetria buoliana</u>) and the Large Pine Shoot Beetle (<u>Myelophilous piniperda</u>).

The Green Spruce Aphis (<u>Neomyzaphis</u> <u>abietina</u>) attacks both Norway and Sitka spruces, the latter often being completely defoliated except for the current year's needles.

One of the Scale Insects (<u>Coccidiae</u>) is noticeable on the bark of Weymouth pine during wet summers but does not appear to effect the vigour of the trees to any extent.

The population of the insects injurious to pine must have been very high between 1900 and 1930 by which time some measure of control was achieved owing to arrears of thinning being overtaken and to systematic trapping. There was a rise, particularly of Pine Shoot Beetle and Pine Weevil, during the years 1940-46 owing to the necessary stacking of unpeeled props and to clear fellings. Thinning and trapping since the war have practically reduced the population to normal.

<u>Fungi</u>. Honey fungus (<u>Armillaria mellea</u>) is the most serious, which is not surprising in view of the earlier hardwood crop. It attacks all the main conifers planted at all ages. Fructifications have been observed at a height of 5 ft. to 6 ft. on Corsican pine. Gaps have been caused in the plantations but not to the extent that stocking per acre has been reduced to sub-normal.

Conifer Heart Rot (Fomes annosus) attacks Sitka spruce and it is doubtful whether Norway spruce will be free from it.

If Rust fungus (Cronartium ribicola) is present on Weymouth pine it

does not affect the trees. There are extensive fruit farms growing <u>Ribes</u> species in the locality.

<u>Hunts</u>. The Cheshire Forest hunt north of the Cheshire - Northwich road and the Cheshire south of this road. Some damage has been caused to fences in the past but arrangements for unlocking certain gates when Meets are held now reduce this risk.

Roads

An adequate system of rides and paths was laid out at some time during the 19th Century(probably 1815-49). The focal point of this system is, however, Eddisbury Lodge (still Crown property) and not the present forester's house at Linmere.

During the period September 1947/July 1948, 3.93 miles of main access and extraction roads were built by direct labour. Owing to the generally easy gradients and dry sandy or gravelly soils, much of this road construction was built to a fairly low and cheap specification using gravel. In 1951 a limited amount of new road construction was carried out by contract labour adopting a more robust standard in view of poorer ground conditions. At the end of 1951 a total new roads mileage of 5.18 has been completed.

All compartments of the forest with the exception of parts of Harthill (Compartments 25, 26 and 27) are now accessible to motor transport after reasonably dry weather. Within many compartments, however, numerous open drains hinder extraction.

Labour

It has been fairly easy to maintain an adequate labour strength, but quality has always been rather poor. Even the woodmen formerly employed by the Crown, some of whom still continue with the Forestry Commission, had not the skill and capacity for work that is found for example in the New or Dean Forests. The present position is that surrounding industries offering houses or higher wages attract the best labour and the Forestry Commission has to choose from those left. Consequently costs of operations tend to be high. The men are in general opposed to piece-work, because few have the skill to enable them to increase their earnings if economic rates are fixed.

The best workers are young men who come to the forest to get practical experience before taking courses in Forestry.

SILVICULTURE

Preparation of Ground

There is no evidence of any special technique when re-afforestation began in 1815 except that a very thorough and intricate drainage system was established. This was skilfully done, and the cost even in those days must have been considerable. In some cases drains were piped through sand at a depth of 15 ft. and more. Several drains have stoned sides and there are many culverts. The amount of fall in many of the main drains is very slight and a blockage can quickly cause the flooding of large areas.

The upkeep of these drains is expensive - sometimes involving the use of shuttering - but it is essential to tree growth over a substantial proportion of the forest, and to road and ride maintenance nearly everywhere.

During the period 1890 to 1910 when a start was made in replacing the hardwoods (oak and chestnut, also some birch) with pines, a few scattered trees were left standing over the re-planting areas for the purpose of providing shelter. These old hardwoods proved to be nothing but an embarrassment, however, and preparation of ground from 1924 onwards at any rate, has been by complete clear felling. Hardwood belts one chain or more wide were left along roadsides for amenity and fire protection.

Bracken has usually been burnt under control in October on ground to be planted that season. Most planting has had to be enclosed by rabbit fencing topped with barbed-wire to discourage trespassers. One area (Compartment 23) centrally situated and fairly remote from agricultural ground has been planted (P.50) without fencing, however.

The deciding factor in this case was the presence of a few natural seedlings and therefore the possibility of natural "beating-up".

Choice of Species

In 1815 to 1849 the main species chosen was pedunculate oak although it is more than likely that the ancient forest contained sessile oak. Sweet chestnut was also planted and Scots pine and European larch were used in mixture with the hardwoods to provide shelter. Of these species Scots pine grew best, and in 1890 a start was made to replace the hardwoods, which were stunted and full of shakes, with pines.

Corsican pine was favoured for the higher ground, and was often

planted pure, but failures were replaced with Scots, or Weymouth pines so that mixed stands resulted. On the lower land pure Scots pine was planted.

The Scots pine was not a success on the peat of the mosses, but the reason may well have been largely silvicultural neglect (lack of drainage upkeep, brashing and thinning until 1924) which predisposed the trees to insect attack.

From 1931 to 1939 Norway spruce and Sitka spruce were planted on the mosses as an understorey to the pines which were reduced to 100 to '200 trees per acre. Neither of the spruces show promising growth. Norway spruce is perhaps the less backward of the two, as Sitka spruce gets badly frosted and defoliated. The solution to the problem has perhaps been given by the planting in 1936 in Blakemere Moss Compartment 22 of a small area of western hemlock (<u>Tsuga heterophylla</u>). This has been unaffected by frost or insects, appears to have enjoyed the shade of the pines, and is growing rapidly. 8 acres were planted with this species in F.Y.51 (Compartments 9 and 10).

Japanese larch was chosen for well drained slopes in F.Y.28, 29, 30 and 31. The area planted with this species is not great. It does not appear ideally suited although growth has been reasonable. Since F.Y.31 Japanese larch has been used for ride rows and along the boundaries of plantings to give early suppression of bracken to lessen fire hazard.

Rows of beech have also been planted along the edges of rides on the better drained sites at various times during the past 40 years. Height growth is good although form is bad. Old beeches on neighbouring Crown Land indicate that the species is capable of producing a large volume of timber in this locality. Provided that plants of good origin are used and complete protection from rabbits given there seems no reason why this species should not produce good timber and a high volume per acre. It may also have the additional merit of improving soil conditions if used as an understorey to the pines or if planted in belts.

Three acres of pure beech were planted in F.Y.50 (a species which might also be useful for soil improvement is red oak. This has not yet been planted anywhere in the forest).

Planting

(a) <u>Spacing</u>. The earlier plantings of pine were closely spaced, 3 ft. x 3 ft. to $4\frac{1}{2}$ ft. x $4\frac{1}{2}$ ft. (e.g. P.20 Corsican pine in Compartment 46A

at 3 ft. x 3 ft.). Since 1924 wider spacings have been adopted, 5 ft. x 5 ft. now being used for the pines, and also for Japanese larch until F.Y.48 when this species was planted at 6 ft. x 6 ft. The spacing of underplanting has been governed by the density of the overwood.

Parts of Compartments 18 and 24 were naturally regenerated with Scots pine between 1900 and 1910 and the stocking was very high.

(b) <u>Type of Plants Used</u>. Ex Crown woodmen say that large plants were used for the plantations made between 1890 and 1924. Probably 2 + 1 or 2 + 2 transplants of Scots pine measuring 12 in. - 24 in. were used. The treatment of Corsican pine in the nursery to produce large plants suitable for planting is not recorded, but the practice of wrenching both seedlings and transplants is said to have been usual.

Since 1924 the tendency has been towards using younger plants, and this was given impetus from 1946 onwards by the nursery technique developed by the Commission. Thus the 1939-45 war fellings were replanted using 1 + 1 Corsican pine and some 1 + 1 Scots pine. Ride rows of Japanese larch were also 1 + 1 plants. 1 yr. seedlings of beech were used in F.Y.50. Practically all the plants used have been raised in the Delamere nurseries from imported seed (or since 1948 from imported seedlings).

- (c) <u>Methods of Planting</u>. Notch planting (especially T notch) with ordinary planting spades, has been the method used. The exception has been planting on the mosses since 1931 when the inverted turf method was introduced.
- (d) <u>Annual Rate of Flanting</u>. The hardwood plantations formed between 1815 and 1849 were planted at the average rate of 110 to 120 acres a year. The replacement with softwoods between 1890 and 1950 (when all land at the disposal of the Forestry Commission had been dealt with) was at the average rate of 30 acres a year. This figure makes no allowance for felling and planting which did not affect the net acreage of softwood, e.g. underplanting in Blakemere Moss and elsewhere, the felling and replanting of about 300 acres due to the 1939-45 War, and replanting burnt areas.

- (e) <u>Manuring</u>. No manuring has been done at this forest.
- (f) <u>Degree of Success of Establishment</u>. The existing plantations have been established without undue difficulty. The heaviest losses have occurred when small plants have been used, and wet summers have induced excessive bracken growth. Well rooted, sturdy plants have succeeded best, e.g. 2 + 1 Scots pine 9 in. to 15 in. high. The modern practice of raising 1 + 1 Corsican pine for planting has not produced particularly good results at Delamere. Such plants have been easily smothered by bracken. Japanese larch on the other hand can now be grown sufficiently large as 1 + 1.

Norway spruce and Sitka spruce used have been 2 + 1 or 2 + 2 and have taken satisfactorily, but subsequent growth has been poor. The small quantities of hemlock used have been relatively old plants e.g. 2 + 1 + 1. They have taken well.

The P.50 beech in Compartment 13 were planted as 1 yr. seedlings. These were heathland nursery stock with plenty of fibrous root and about 9 in. shoots. Losses were 30%, but it is possible that transplants would have fared the same as there was a drought with high temperatures in May after the leaves had appeared.

Ploughing

There is no record of ploughing prior to planting when reafforestation commenced in 1815, and none was necessary when the hardwoods were replaced by conifers.

Beating Up

Little is known of beating up prior to 1924 except that Corsican pine planted between 1890 and 1902 was often beaten up with Scots pine and Weymouth pine.

Between 1926 and 1929 a good deal of beating up took place in plantations made in the years immediately preceding the transfer to the Forestry Commission. Good examples are the P.20 and P.24 Scots pine and Corsican pine in Compartment 46A and B. In some cases where whole areas had failed this beating up amounted to replanting. In other cases it is now evident that the beat up plants served no useful purpose. By the time they had become established the original plants were beginning to suppress them, and few reached rustic pole size.

Recent practice has been to replace failures where these are in excess of 20% or in patches in the two seasons following planting.

Usually the same species have been used as in the original planting, but Corsican pine has sometimes been beaten up with Scots pine owing to the latter's faster rate of growth in the first two years following planting.

Fencing and drainage upkeep have been given special attention on all newly planted areas.

Weeding.

There seems never to have been any doubt about the need for thorough weeding. In some compartments bracken reaches 6 ft. to 7 ft. in height in a wet season. Plants are soon killed by smothering if the bracken falls in a heap on top of them. Also if throughout the summer plants are shaded by dense bracken the growth made is small and weak.

For the first two summers following planting two weedings have to be given. The first in June is to whip the heads from the new bracken so that its growth is delayed and the plants are relatively free when their leading shoots are making height growth. The second weeding is a complete freeing of the plants in the latter half of August or in September.

One weeding, in late summer, usually suffices for plantations three years old although Corsican pine may need two. It is five or six growing seasons after planting before weeding is no longer essential in patches of heavy bracken.

Mixture of Species

Scots pine and Weymouth pine occur in mixture in plantations about 50 years old in the main block of forest, e.g. P.Ol in Compartments 18 and 19. In the P.Ol in Compartment 35 Corsican pine also occurs with Scots pine and Weymouth pine. Mixtures of Corsican pine and Scots pine occur in all age classes. In F.Y.49 shortage of Corsican pine resulted in the policy of planting alternate rows of Corsican pine and Scots pine. Apart from this it is likely that most of the pine mixtures resulted from beating up.

Corsican pine is always dominant in these mixtures and suppresses Scots pine near it. Weymouth pine is also dominated by Corsican pine but holds its own with Scots pine. In F.Ys 28, 29 and 30 Corsican pine was planted in 50% mixture with Japanese larch, e.g. Compartments 6, 38 and 43.

The Japanese larch outgrew the Corsican pine from the start and after the first thinning the Corsican pine forms little more than a tenth of the crop. Underplanting of P.94 - P.10 Scots pine on the mosses took place between 1931 and 1939, e.g. Compartments 21, 22 and 23 (Blakemere Moss). The species used, Norway spruce and Sitka spruce have not been successful. Despite the protection afforded by the overwood, frosting of both species is still severe. At the same time the spruce appears to need more light if it is to grow.

Another adverse factor is severe defoliation, particularly of Sitka spruce by the Green Spruce Aphis.

It is probable that the spruce would benefit most by more light (and where this has been given in Compartments 16 and 19 growth is better) but many of the pines have in recent years developed healthy crowns and have resumed height growth. This is attributed to the low stocking to which they were reduced (100 to 200 trees per acre) and the systematic trapping of injurious insects. Also regeneration of Scots pine, some Weymouth pine and occasional oak has come in. In fact all the evidence now points towards pine being more suited to the site than spruce. The poor condition of the pine in 1930 may in fact have been largely due to lack of thinning leading to mass breeding of bark beetles.

In the circumstances it is considered that the removal of the pine overwood to favour the spruce would be of doubtful value.

In F.Y. 36 about an acre of P.32 Sitka spruce was beaten up with seven hundred western hemlock under P.94 Scots pine in Compartment 22 (Blakemere Moss). The good growth of the hemlock suggested the further use of this species, and in F.Y.51 8 acres of P.11 and P.15 Scots pine were underplanted with it on mosses in Compartments 9 and 10.

In the same year 1 acre of P.25 European larch in Compartment 42 was underplanted with beech.

Rates of Growth

Rates of growth for the main species are given below:-

Compt.	Species	P. Yr.	Age	Geology and Soil	a. Altitude b. Aspect c. Slope d. Exposure	Mean Height of Dominants (ft.)	Mean Annual Height Increment (in.)	Current Annual Height Increment during last 5 years. (in.)
6	S. P.	31	20	Moist glacial sand with good humus layer.	a. 250 ft. b. South c. Moderate d. Sheltered	31	18	18
15	S. P.	13	38	Glacial sand with some gravel.	a. 250 ft. b. North c. Very slight d. Sheltered	49	15 <u>1</u>	14
52	S. P.	08	43	Fine glacial sand. Rather wet.	a. 260 ft. b. South East c. Slight d. Slight	57	16	14
15	S. P.	04	47	Glacial sand with some gravel.	a. 250 ft. b. North c. V.Slight d. Sheltered	55	14	12
22	S. P.	98	53	Moss Peåt	a. 250 ft. b. Flat c. Flat d. Sheltered	25	6	10
46B	C. P.	24	27	Fine glacial sand with high carbon content.	a. 266 ft. b. Flat c. Flat d. Fairly sheltered	45	20	20
25	C. P.	23	28	Glacial sand.	a. 260 ft. b. North c. Fairly steep d. Moderate	43 ·	18 <u>1</u>	18
27	C. P.	18	33	Glacial sand	a. 230 ft. b. South c. Moderate d. Slight	50	18	16
43	C. P.	14	37	Sand overlying Keuper sandstone.	a. 450 ft. b. South East c. Moderate d. Sheltered	61	20	· 15
26	C. P.	03	48	Glacial sand	a. 260 ft. b. South East c. Moderate d. Slight	69	15	13
17	W.P. (in Mixture with S.P.)	Ol	50	Glacial sand with gravel	a. 260 ft. b. South West c. Fairly steep d. Moderate	53	12 1 2	10
19	W. P.	01	50	Glacial sand with gravel	a. 270 ft. b. South c. Slight d. Sheltered	55	13	10
42	E. L.	25	26	Sand Overlying Keuper sandstone fairly near surface.	a. 400 ft. b. North c. Fairly steep d. Moderate	41	19	14

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Compt.	Species	P . Yr.	Age	Geology and Soil	a. Altitude b. Aspect c. Slope d. Exposure	Mean Height of Dominants (ft.)	Mean Annual Height Increment (in.)	Current Annual Height Increment during last 5 years. (in.)
6	J.L.	29	22	Moist glacial sand with good humus layer.	a. 250 ft. b. North c. Moderate d. Sheltered	36	20	18
6	J. L.	28	23	Moist glacial sand with good humus layer.	a. 250 ft. b. South c. Moderate d. Sheltered	41	21	18
4	J.L.	26	25	Keuper Marl. Soil is sandy clay.	a. 350 ft. b. South c. Slight d. Fairly exposed	40	19	15
21	N. S.	37	ц	Moss Peat	a. 250 ft. b. Flat c. Flat d. Sheltered	6	5	6
21	N. S.	38	13	Moss Peat	a. 250 ft. b. Flat c. Flat d. Sheltered	6	5 <u>1</u>	6
45	N. S.	23	28	Glacial Sand	a. 265 ft. b. Flat c. Flat d. Sheltered	30	13	12
22	S. S.	35	16	Moss Peat	a. 250 fft b. Flat c. Flat d. Sheltered	8	6	6
19	S. S.	34	17	Moss Peat	a. 250 ft. b. Flat c. Flat d. Sheltered	9	6 1	9
22	S. S.	34	17	Moss Peat	a. 250 ft. b. Flat c. Flat d. Sheltered	8	5 <u>3</u>	6
22	Ts. het.	36	15	Moss Peat	a. 250 ft. b. Flat c. Flat d. Sheltered	18	142	15
3	Oak	10	41	Keuper Marl. Soil is sandy clay.	a. 380 ft. b. South c. Slight d. Fairly exposed.	34	10	11
16	Beech	13	38	Glacial sandy gravel.	a. 250 ft. b. South c. Very slight d. Slight	50	14	16
39	Beech	13	38	Sand over Keuper sandstone.	a. 470 ft. b. South West c. Slight d. Fairly exposed.	48	13	15

Past Treatment of Established Plantations

The pine plantations established from 1890 onwards received no treatment until 1924. By that time there was a substantial acreage in which brashing and thinning were seriously overdue. In the older plantations the trees were whips with very small crowns. Owing to the close spacing there were many dead trees with the result that the beetle population was exceedingly high.

Besides the gaps caused by the retention of scattered hardwoods, birch had grown up unchecked and overtopped the pines in many places.

From 1924 brashing and cleaning proceeded as quickly as funds would allow. Old hardwoods were cut out where this could be done without causing excessively large breaks in the canopy.

Frequent light thinnings were the policy and this certainly resulted in a more normal stocking being achieved without loss through wind damage. The response to more light was very slow, however, and crown development was hindered to some extent by bark beetles and Pine Shoot Moths. It is only in recent years that full vigour has begun to return to the older plantations, and even so some of them still convey the impression of former neglect.

During the years 1934-38 selected trees in the better stands were pruned to a height of 30 ft. The oldest trees pruned were thus thirty to forty years old which was perhaps rather late for this operation. It must be remembered, however, that owing to lack of thinning, girths were still relatively small. Moreover, it was possible to get the work done at the piece work rates of 3d and $3\frac{1}{2}d$ per tree.

The annual thinning programme is now about 300 acres which means that one fifth of the area of plantations over 20 years of age is dealt with every year. The thinning plan provides for blocks of adjacent compartments to be thinned in the same year. This concentrated method of working has been found more economical than thinning by P years.

A great deal of pioneer work was done from 1926 to 1939 in obtaining markets for the thinnings. The main trade developed was for rustic poles, stakes of all sizes down to $\frac{1}{2}$ in. diameter, birch brushwood (for jumps), firewood and Christmas trees. The rustic poles from the first thinnings of 30 yr. old plantations were of excellent quality being very long and with very little taper. Two to three inches butt diameter and 20 ft. to 25 ft. in length was a common size whereas today it is not listed. The market for pine

rustic poles had to be created, however, it was not there waiting for supplies.

From 1935 onwards pitprops and timber for wood wool formed an increasing proportion of the production from thinnings.

The annual yield from thinnings is now about 60,000 Hoppus ft. During the 1939-45 War and the year immediately following (F.Y.46) the timber supplies contributed by Delamere Forest were as follows:-

Forest	Thinning	(Acres)		Total Yield from Thinnings and Fellings. (Hoppus ft.)		
iear	lst Thinning	2nd & Sub. Thinning	Clear Felling (Acres)			
40	46	59	87	195,000		
41	52	92	36	101, 000		
42	36	304	8	44,000		
43	-	388	-	77,000		
44	83	-	67	151,000		
45	49	102	47	124,000		
46	100	147	97	243,000		
Totals	366	1092	342	935,000		

The majority of this timber went to the mines as pitprops. The felling and conversion was mainly carried out by the Timber Production Department, except in F.Y.46 when 97 acres were sold to various timber merchants for clear felling.

Research. Note by Research Branch

Only two permanent sample plots (details of which are given in Appendix III) have been established in Delamere Forest, both in Compartment 26, Hart Hill (Nat. Grid Ref. 33/560711). The site is practically level, though with slight irregularities, and is situated on a general plateau, 250 ft. above sea level. Although almost surrounded by other plantations, the stand is moderately exposed. The underlying geological formation is Keuper Red Marl, but this is covered by an indefinite depth of glacial sand of the Ice Sheet Moraine. The soil is a moderately deep light sand, with a thin layer of mor humus.

The crop was planted in 1902, at a spacing of 4 ft. x 3 ft. as a mixture of Corsican pine and Scots pine, the Scots pine being planted in groups, and the plantation was awarded a prize by the English Arboricultural Society in 1909. The sample plots were established when the mean height of the crop was 30 ft. The canopy was then fairly uniform but the stems distributed rather irregularly. The Scots pine were exceedingly poor and were cut out in the early thinnings. Two sample plots were established, one thinned to a B grade (light low thinning) and the other to a C grade (moderate low thinning). The vegetation was scanty, mainly <u>Pteris aquilina</u>, with some <u>Sorbus aucuparia</u> and <u>Betula</u> spp. Summaries of the measurements are given on the attached forms.

The very light thinning grade, B grade, has kept the canopy complete, but the crowns have been much restricted by competition and are generally thin. The effects of competition have been magnified by the whipping of small crowns, and the presence of <u>Lophodermium pini</u> was recorded in 1932. The stocking has been kept dense, though rather irregular, and there has been little possibility for selection of good stems, with the result that many are curved or show forking in the upper crown. Branching is heavy and persistent. Slight gale damage occurred in 1943.

The more heavily thinned plot has shown good response to the thinning, and enabled better selection of stems. The crowns are symmetrical and full, the stocking more uniform, and the stem form much better, though some forks still exist in the upper crowns, and some of the stems have curved butts. Gale damage was recorded in 1943.

Leaching of the upper soil layers was recorded as being pronounced in 1932, but in 1947, though there was evidence of some leaching, it did not appear so pronounced as suggested by the earlier report. Soil vegetation is still scanty, but the variety of species has increased, and now includes <u>Pteris</u> (a), <u>Dryopteris</u> (a), <u>Aira flexuosa</u> (f), <u>Galium</u> (o), <u>Vaccinium</u> (o), <u>Scilla nutans</u> (o).

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(J. N. R. Jeffers) March, 1952.

Conclusions

<u>Forest Protection</u>. Rabbits could be eliminated as a serious pest by gassing, provided that this was carried out simultaneously every year by all land occupiers in the entire district. The results and benefits obtainable justify some measure of compulsion if necessary.

Desirable Choice of Species

(a) <u>Well drained sites</u>. Corsican pine or beech. Scots pine if quality is preferred to maximum volume of softwood. Other species that will grow reasonably well and are useful for amenity purposes are Japanese larch, Lawson cypress and the western red cedar.

(b) <u>Wetter sites but relatively free from peat</u>. Scots pine. Weymouth pine in mixture with Scots is growing well on these sites. It is unaffected by rust fungus, but it is not suggested that this species may be used in future on a large scale, although the matter might be worth future investigation in view of the quality and volume of the timber produced by Weymouth pine.

(c) <u>Peat Mosses</u>. Western hemlock.

<u>Planting</u>. Fairly large plants are preferable for the bracken ground and in the case of Corsican pine it is doubtful whether really suitable 1 + 1transplants can be grown, 1 + 2 Corsican pine wrenched or undercut when 1 + 1would be better. A spacing of 5 ft. x 5 ft. is suitable for the pines and 6 ft. x 6 ft. for Japanese larch. Western hemlock has as yet been used only for underplanting, but if the shortage of this species persists there seems no reason why successful new planting could not be made at a wide spacing, even as much as 8 ft. x 8 ft. rather than leave suitable sites unplanted. Nursery technique for hemlock might well be improved and research on this would be justified.

Beating Up. Failures in excess of 20% must be replaced in the two years following planting, otherwise, unless a complete area has failed, the crop cannot be materially improved by delayed beating up.

<u>Weeding</u>. Thorough weeding is essential to successful establishment at Delamere.

<u>Treatment of Established Plantations</u>. The outstanding conclusion is that Scots pine and Corsican pine must be regarded as light demanding species,

and that a heavy grade of thinning is required from about 20 years of age. Once the crop is allowed to lose vigour by being kept too dense, it is slow to respond to thinnings.

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Note by State Forests Officer

The most important lesson to be learnt from the history of Delamere is undoubtedly the need for timely and moderately heavy thinning of pines, particularly on the poorer sites. The loss of vigour, the build up of damaging insect populations, and the slow and difficult recovery of under thinned stands, forms a sequence which could all too easily be repeated elsewhere. Root competition controls the optimum stocking fully as much as light requirement, and it is clear that if the production of quality timber is to be included in the objects of management it must be attained by artificial and not by natural pruning. Delamere can provide evidence to show that the economics of artificial pruning are perfectly sound.

It is by now fairly clear that the introduction of an understorey or admixture of shade bearing hardwoods is essential if soil fertility is to be maintained up to the end of the rotation. The necessity for wide spacing to retain vigour (or the resulting thinness of canopy if this is not developed) means that bracken and other weeds will otherwise come back strongly, jeopardising any prospects of a natural regeneration and imposing a recurrence of heavy weeding costs on the establishment of the next crop.

The growth of healthy Weymouth pine in mixture with Scots pine suggests a method of raising this valuable species which is to be followed up on an experimental scale. Seed was collected from some of the best and most vigorous trees and sown in F.Y.51. Finally the failure of spruces and the success of hemlock (and ultimately of pine) on the moss peats is instructive and should have application elsewhere.

J.S.R. CHARD.

State Forest Officer

Note by Conservator

This history together with the State Forest Officer's Note gives a very fair picture of the more recent story of Delamere Forest and of its problems.

Research into the ancient records of this forest might be repaying in certain directions but would be unlikely to unearth much of silvicultural value.

As regards choice of species we must pay just tribute to our predecessors who in 1890 chose Corsican pine as a suitable species for the higher ground. There will undoubtedly be room in the future on selected sites for more <u>Tsuga</u>, suitably nursed, and on the drier ground for beech as an aid to the pine as well as in its own right.

It should be worth while trying out red oak in mixture with pine on areas falling due for replanting.

I do not think this is a forest at which Japanese larch should be used on any scale in view of generally dry soils and moderately low rainfall. It may start growing alright, but growth will I believe fall off in early life, though it is true that the Rate of Growth figures for Japanese larch 22 to 25 years old do not indicate any serious decline at that age.

> A.H.H. ROSS. Conservator N.W. (E.) 20.3.52

History of Delamere Forest

APPENDIX I

Notes from Inspection Reports

5.6.34. Inspection by the Chairman

<u>Compartments 31,33,13,15,16,17,35</u>. Various stages of thinning and some pruning were seen and led to the following points:

- (i) Corsican pine should be persevered with as it is unquestionably the most suitable tree. Japanese larch planted prior to P.31 was unsatisfactory and this tree should not be planted here.
- (ii) A thinning plan is to be compiled.
- (iii) Pruning should be extended.

<u>Compartment 29</u>. It was suggested that arrangements should be made with Delamere Golf Club for joint action against rabbits.

5.12.37. Inspection by the Chairman

Thinning and Pruning. It was recorded that the present rate of thinning was about 185 acres per annum and of pruning 80 acres per annum. The Chairman considered that traps for beetle should be laid during the lst thinning, such traps to be prepared in winter from pines with rough bark, and collected and peeled in May before the beetles emerged. Pruning should be started with the lst thinning as regards selected poles or good groups. In the old plantations it was started too late. All produce except pitprops was sold locally, the forester having gradually worked his local sales up to £2000 per annum. The props were supplied peeled and it was estimated that about 250,000 lin.ft. would be prepared that year.

<u>Trespass</u>. The Chairman agreed that it would be impossible and also inadvisable to try and exclude people from the forest altogether and efforts must be confined to preventing damage.

<u>Compartments 19,20, 21</u>. Thinning in P.95 to P.01 was inspected. The Chairman observed that old rough birch should have been cut out at an early stage, though to do so now would lead to very large gaps. These birch were being lopped where they were likely to damage the pine.

23.4.41. Inspection by the Chairman

The Chairman visited Compartments 31,17,18,19,20,21,23, and 26 and remarked that he was much impressed by the greatly improved appearance of the woods following the pruning, thinning, and beetle trapping carried out since his last visit.

20.8.44. Inspection by the Chairman

<u>Compartment 25, P.23</u>. The Chairman commented on the excellent growth of the Corsican pine and regretted that more had not been planted in earlier years. <u>Compartment 26, P.02 and P.03</u>. The Chairman wished the sample plots to

continue as such indefinitely, even if they were blown over. The Chairman stated that early pruning was necessary to obtain good results. Research showed that green pruning caused a quicker healing and was less likely to lead to resin pockets than when dead branches were pruned. He considered that in really good stands pruning should go ahead where labour was available, but that it was essential to start early, select the most vigorous trees and continue to keep them vigorous by careful thinning. The Chairman considered that 250 to 300 Hoppus ft. per acre could be taken out of these stands in immediate thinnings and do nothing but good.

<u>Compartments 22 and 23</u>. This area of Blakemere was entered and the spruce underplanting inspected. The Sitka spruce were gradually getting through the frost. Not enough coppice cutting had been done in the Norway spruce and the Sitka spruce and the Chairman explained that these species, particularly Sitka spruce could not stand the exclusion of light by two canopies and while the top canopy remained the lower canopy of coppice must be cut down harder. It needed good judgment to keep a proper balance between the admission of light and protection from frost.

History of Delamore Forest

APPENDIX II

<u>Supervision</u>

Year	Gonservator	Divisional Officer	State Forest Officer	District Officer	Forester in Charge
1920		Young, D.W.		, Simpson J.	-
21		н		(Resident)	-
22		n		Ŧ	-
23		H		n	-
24				n	-
25		Sangar 0.J.		Ross A. H. H.	Dyer H.C.
2 6		n		11	Jones G.W.
27		n		-	11
28		H		-	n
29		"		-	19
30		ı		-	"
31		Long A.P.		-	H
32		n		-	11
33		11		Fairchild C.E.L.	11
34		11		**	11
35		"		*	11
36		Long A.P. Popert A.H.		n	17
37		u		π	17
38		H Theorem 4 TT		11	17
3 9		Fairchild C.E.L. (Acting)		n	Ħ
40				-	17
41		Smith R. H.		-	11
42		n		-	17
43		n		-	π
44		n		-	n v
45		n Gwith D. U		-	n
46		Backhouse G. W.		-	18
47	Ross A.H.H.		Fitzherbert J.T.L.	-	11
48	n		Mackenzie G.I.M.	-	n
4 9	n		Mackenzie G. I. M.	Chard R.	n
50	n		(Chard J.S.R.	H	18
51	n		11	11	. tł
52	n		n	17	T

$o_{\rm e} E_{\rm s} \underline{66}$ Area 0.227 acres Species Consistant pine "B" "B" Q. pt. 26, Hart Hill, Delamere. Thinning Grade "B" "B" "B" Q. pt. 26, Hart Hill, Delamere. RECORD OF PERIODICAL MEASUREMENTS PER Acre "B" Thinning Trade "B" "B" Total Grop Per Acre Total Grop Per Acre Per Acre	Lacres Species CONSIGNAL PINe Quality Class II Delamere. Thinning Grade "B" Quality Class II ND OF PERIODICAL MEASUREMENTS PER ACRE Main Crop Basal of thin are and are ast of the area of t	66 Area 0, 297. acres S 6 Hart Hill, Delamere. RECORD OF Main Crop $rac.$ $of 100$ Average $Average$ $Avera$	Plot No. E. 6 Site Cpt. 26 Site Cpt. 26 Numens of Age ber ure- meant of tree free tree 5/1922 20 17: 5/1932 20 17: 5/1937 25 112 5/1937 35 89 5/1941 39 74
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(*42625) WT.P.0533/325 1,000 SHEETS 5/51 A.& E.W.LTD. GP.686

5/1951	8/1947		6/1941	6/1937	6/1932	5/1927	3/1922		ment	Year of meas-			Site	Plot	
49	46		39	35	30	25	20	угв.	 	Age of			Cp t	No.E	
286	311		392	498	555	685	945	Sun	after thin-	Num- ber of trees			.26	•67	
69	66 <u>7</u>		58 <u>1</u>	51	44-2	38	32 1	ft.	largest trees	Heig Average			Hart	Are	
672	64		56	491	43	36	29	ft.	crop	ght.		REC	Hil	a 0, 2{	
•399	ł	Blow	•372	804	-406	•357	- 347		Factor	Form	Main	ORD	L, De	33 ac	
32	30	n t	27	24- <u>2</u>	22	6T	142	ins.	4' 3'	True Girth	Crop	ç	lame	res	
127.7	123.4	ees	122.4	130.2	116.4	106.2	87.2	g. ft.	thin-	Basal area per ac.		PEF	re.	Specie	
3433	1	1943	255 2	2632	2042	1455	876	cu. ft.	(dinger bark) Q.G.	Vol. per ac.		RIODI	: 	es (
27	1		195		191	ध	61	%	,o Bark	Cr'wn		CAL	hinni	Cors	
25	63	18	106	57	131	25 8	785		bor of trees	N	Inter	M M	ng Gr	ican	
61	58	572	52	46	381	30	251	ft.	Ht.	A ⊲	mediat	ASU	ade	pin	
26 <u>1</u>	25	29	23	18 <u>1</u>	16 <u>1</u>	12 <u>1</u>	10 <u>2</u>	ins.	nt 4' 3"	True	e Yield	REM		e	
7.5	17.2	6.5	24.4	8.3	15.1	18.4	38.5	sq. ft.	Q.G.	Basal area	from Th	ENTS	"C"		SAMPL
189	377)	цт Г	484	841	207	171	271	cu. ft.	Q.G.	Vol. per ac.	iinnings	PEF		Qualit	E PLO
263.6	251.8	1	227.1	210.5	188.4	163.1	125.7	sq. ft.	Q.G.	Basal	Tota Yield	ACI		y Class	T FOR
5427	t		3833	3429	2691	1897	1147	eu. ft.	bark) Q.G.	Vol.	l Urop to date	Ĩ		, II	M NO.
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3.9	+-		t 2	+ + +	5. L	7.5	I	q. ft.	Basal Area	rer Mean Main Incre			£)	
159	1		101	148	159	150		Q.G. cu. ft.	(U.B.)	Annual Crop ment			G		

(*42625) WT.P.0533/325 1,000 SHEETS 5/51 A.& E.W.LTD. GP.686



