FORESTRY COMMISSION

HISTORY

OF

NEWCASTLETON

FOREST

S(S) CONSERVANCY

F O R E S T R Y C O M M I S S I O N

H I S T O R Y

of

NEWCASTLETON FOREST

1920 - 1951

SOUTH (SCOTLAND) CONSERVANCY

History of Newcastleton Forest

CONTENTS

	Page
CHAIRMAN'S COMMENTS	1
GENERAL DESCRIPTION OF THE FOREST	
Situation	3
Area and Utilization	3
Physiography	4
Geology and Soil	4
Vegetation	4
Meteorology	5
Risks	5
Roads	7
Labour and Housing	8
SILVICULTURAL HISTORY	
The Early Years (1921-1927)	9
Preparation of Ground and Planting ...	9
Selection of Species	11
Later Planting(1928-1948)	11
Preparation of Ground and Planting ...	11
Selection of Species	12
Other forest operations	13
Draining	13
Brashing	15
Thinning	16
Windblow	18
Rates of Growth	19
Acquired Plantations	22
District officer's note	23
Research	26
APPENDICES: I. Notes from Inspection Reports	29
II Record of Supervisory Staff	34
III Some notes on Moorburnhead Plantations and Research Branch work on the area.	36
IV Map of the Forest	

HISTORY of NEWCASTLETON FOREST

CHAIRMAN'S COMMENTS

I find by reference to Headquarters file 349/29 that I made some 16 inspections of Newcastleton over the period June 1922 to August 1951.

The first two or three years' plantings were poorly done. The choice of species was indifferent, the methods of planting and of preparation (particularly drainage) poor, and there was damage from sheep and blackgame. Gradually technique was improved, taking advantage of experience elsewhere. In 1931 I noted "This area, after a depressing start, is now coming on very nicely and in this way is a tribute to the careful work of the supervisory officers."

At the beginning we did not know much about the value and requirements of Sitka spruce but fortunately the late Duke of Buccleuch had young plantations nearby at Moorburnhead and older ones in Morton Woods, Drumlanrig. These we visited frequently and got valuable information both on early growth and also as to probable production on similar types of ground. These observations enabled us to proceed with greater confidence.

Similarly in 1927 as a preliminary to an inspection of Kershope for acquisition we (Messrs. Taylor, Hopkinson, J.M. Murray, Guillebaud, Macintyre and I) made a close examination of Newcastleton. Further, the decision to make the large expansions at Kielder (1931/2) were not made until we had looked at the evidence furnished by Newcastleton, Ae and Smales (Kielder).

By about 1927, then, the main establishment problems at Newcastleton were solved.

In 1931 we were discussing (belatedly) the construction of cheap cycle paths to get workers out quickly. There was no doubt in my mind that the cost of walking time over the immediately preceding years would have more than repaid the cost

of a good path and also have given us quicker access in case of fire. My idea was to follow the trace of a future main road which would be gradually developed from the path. A good path could have been made at that time at under £100 per mile.

Fire hazard was much in our minds about that time and a private telephone line was erected to connect up Newcastleton and Kershope, The arrangements for its use were inadequate. A fire involving some 156 acres occurred in 1936 at Newcastleton but no help came from Kershope Forest or the Ministry of Labour Camp at Kershopefoot for the simple reason that no message was put through.

By 1938 the question of extracting produce began to receive attention. Again an inspection of Moorburnhead was made with the object of forecasting probable developments. I noted (7/10/38): -

> "Making allowances for the different methods of planting, planting distances, and so on, I came to the tentative conclusion (which needs confirmation) that there will not be much out-turn from thinnings before the 25th year. Thereafter thinnings will have (with Sitka spruce at least) to be at frequent intervals and there will be a large out-turn of pitwood. In this way some indication may be obtained as to how long we have to instal an extraction system at Tweedenhead."

That estimate took us to 1947 which in the light of events was about right.

I have always relied on roads for the main extraction routes and did not favour an alternative suggestion to construct a flume down the Tweeden Burn.

One point brought out in the Conservancy history of Newcastleton is the effect of order of planting on initial costs of roading. Considered in that way Newcastleton is an example of a poor lay-out.

(initialled) R.

25.10.51.

HISTORY OF NEWCASTLETON FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation

The Forest of Newcastleton lies in Liddesdale within the parish of Castleton and in the county of Roxburgh. On the south-east the forest marches with the Border on the English side of which lies Kershope Forest and at the eastern tip it touches Kielder. The village of Newcastleton is two miles to the west and from this village the forest takes its name.

Area and Utilisation

3,547 acres were purchased in 1920 from His Grace The Duke of Buccleuch. About 50 acres of woods were included carrying a volume estimated at that time to be 90,000 cu.ft. of timber, mainly Norway spruce with some Scots pine, European larch, Silver fir and mixed hardwoods. A further 4 acres were acquired in 1931 from The Buccleuch Estates Ltd., and in 1949 a housing site of 2.4 acres was acquired in the village of Newcastleton from the same estate. The total area of the forest is, therefore, 3553.4 acres. The sums paid for these acquisitions amounted to a little over £12,000.

Former Utilisation

The first and principal acquisition consisted of the farm of Dykecrofts (1261 acres) and parts of the farm of Tweedenhead (2286 acres). The total stock of sheep on these grazing farms was approximately 106 score Cheviots; some cows and young cattle were grazed on Dykecrofts and on this farm there were about 120 acres of arable land most of which was under cultivation. (This ground has been retained as arable land).

Resumptions

Planting began on Tweedenhead and only the area to be planted was enclosed each year, the remainder being used for sheep grazing by the tenant. Tweedenhead was completed in 1936 when planting started on Dykecrofts, the tenant having sold his stock. Until planting was completed in 1944, however, temporary fences were erected yearly to allow seasonal grazing of hoggs. In 1936 the arable fields of Dykecrofts were let to the present tenants but three acres were reserved for a nursery. Shooting

rights have been let all along and have not affected resumptions for planting.

Physiography

The forest lies among the undulating country typical of the Borders and is situated on the high ground between the Liddel Water and its tributary the Kershope Burn. The area consists of two ridges separated by the Tweeden Burn, itself a tributary of Liddel Water. These ridges run from north-east to south-west and their general tilt is towards the south-west. The slopes from these ridges are gentle to moderate and in only one place - Clintheugh Linns on the Tweeden Burn - is there a really steep slope in the forest. The elevation varies from 450 ft. to 1240 ft. above mean sea level and the average elevation is about 800 ft. Only in the valley bottoms and on the lower slopes is the land sheltered; on the ridge crests exposure is severe especially to the north and west. The slopes from the ridges have north-westerly and south-easterly aspects and as the tilt of the ridges is towards the south-west the flattened crests have a south-westerly aspect.

Geology and Soil

The parent rock is part of the Scottish Calciferous Sandstone series of Carboniferous age. Two lines of swallow holes run through the forest from north-east to south-west; these lines probably indicate outcrops of the Kershopefoot Limestone. Two outcrops of extrusive basaltic lavas occur, one, around the top of Swarf Hill which runs out into two narrow necks, the first towards Tweedenhead and the second across the Tweeden Burn to Thwartergill; and two, near the south-eastern march in the Kershope Valley. The whole forest area has been greatly affected by glaciation and in most places the underlying rock is covered with a layer of stiff boulder clay of varying depth. Peat has formed on top of the boulder clay and covers most of the area; the depth varies from 2 in. to more than 4 ft.

Vegetation

Before planting, the feature of the ground flora was the dominance of Molinia caerulea which was found at all elevations. On the lower slopes Juncus species, Aira flexuosa and Holcus species occurred frequently and on the higher ground, and especially on flat areas of deep peat, there were found Calluna vulgaris, Erica tetralix, Scirpus species, Eriophorum species

and Vaccinium species. Polytrichum species occurred over most of the area and Sphagnum species were frequent in wet hollows. Bracken grew on the steeper slopes at middle elevations.

Meteorology

The forest lies within the "west coast" climatic sub-division of Great Britain and has a moderately high rainfall - approximately 50 in. per year - fairly well distributed over the whole year; rainfall appears to be highest in the late autumn and lowest in the late spring. The prevailing wind is from the south-west and gales are frequent both from the south-west and from the north. Frost is common and late spring frosts can be severe; snow rarely lies long.

Risks

(a) Fire Danger. It was early realised that the main danger period would occur in the early spring and that the principal risk lay in a fire spreading from adjoining land during muirburning. It is only during a period of exceptionally dry weather in the summer that danger exists in that season. Other dangers were considered to come from persons using the drove road and the hill tracks through the forest, and the forest staff. The fact that relations have always been friendly with neighbouring proprietors has greatly reduced the risk from muirburning.

(b) Traces. From the first years of the forest a fire trace was maintained along the marches considered most dangerous. This consisted of a half chain strip burned under control each year. As planting progressed a number of internal rides also were burned yearly but this very dangerous practice was abandoned, after 1936, in favour of mowing. An attempt is now being made to convert one broad ride into a grazing belt.

(c) Methods of Detection. A fire tower was erected in 1950 at the highest point on the forest and practically the whole area can be seen either from this tower or from two towers situated on Kershope Forest which marches with Newcastleton on the south. A field telephone system connecting various points on the two forests was installed in 1931 and a joint Standing Fire Plan adopted.

(d) Access. In the early years lack of access routes heightened the fire risks greatly; until the late twenties the only road was a cart track from Dykecrofts to Tweedenhead. In 1928 a cycle track was constructed to Tweedenhead which gave speedier access to the middle of the forest but it was not until 1947 that this track was replaced by a metalled road. Since then the construction of roads has been carried on continuously. During 1951 a beginning was made with the construction of a network of tracks suitable for a Land Rover.

(e) Fires. Only one fire damaging plantations has occurred. On 11th February, 1936, during a period of keen frost, a fire started in the middle of the forest and 156 acres were destroyed. Almost half of this acreage, however, had been planted only the previous year but the remainder consisted of thicket stage crops including some of P.21, the earliest plantation. The fire was probably started by a match or cigarette end thrown away by an Indian pedlar who had crossed the forest by a hill track. The forester and his men were engaged in burning a fire trace along a nearby march at the time and were able to get to the fire quickly. An east wind eventually carried the fire out of the forest and on to Sorbietrees where it was extinguished.

Other Protection

(a) Animals. Both blackface and Cheviot sheep stocks border the forest and cattle are grazed on some of the adjoining farms. Stock fences were thus necessary and have been maintained since the beginning of the forest.

Luckily there have been few rabbits and no netting has been necessary. Hares, though numerous, have not done any appreciable damage. There are not many foxes in the forest.

It was recorded as late as 1933 that there were no deer in the neighbourhood but a few years later roe deer began to be seen in the area and at the present time it is estimated that there are at least fifty within the forest. As the plantations consist of over 95% spruce little damage has been caused but it is anticipated that fencing against deer will be necessary in felled or windblown areas where it is desired to introduce any species other than spruce. A close season for hinds and does is observed from April to July each year.

In the early years black game were abundant and caused considerable damage to Scots pine; in 1927-28 damage was done even to Sitka spruce. Growth was thus often held back for two or three years but recovery was always complete in five years. After the middle thirties black game disappeared and only in the last three years have there been signs of their return.

(b) Insects and Fungi. No special dangers have become apparent although one group of Sitka spruce die-back has been under observation during 1950 and 1951.

(c) Climatic Conditions. Two severe late spring frosts, one in 1935 and the other ten years later killed back many trees in the low lying Tweedenhead Valley. Recovery has been very good.

Snow has caused practically no damage.

Erosion has taken place wherever drains carrying much water have been cut at too steep an angle, and also in places where a large volume of water from drains has been run into a small stream. Stakes have been driven into some drains to slow down the rate of flow and this has been successful in many places.

Windblow has occurred in some of the wettest parts of the forest; in all almost 41,000 cu.ft. of blown timber has been cut up to the end of F.Y.51. The problems of windblow are discussed more fully in Section 3 (d).

(d) Trespass. As Newcastleton Forest is in a fairly isolated position and only one public road (and that little used) approaches the forest, trespassers do not constitute a danger.

Roads

Construction of the first metalled road from the county road, near Dykecrofts, to Tweedenhead began in 1946 and was finished in the summer of the following year. From then onwards the construction of roads has gone on almost continuously and at the end of 1951 $5\frac{1}{2}$ miles of metalled roads had been made.

All roads except one have been constructed through existing plantations and have necessitated the felling of a forty feet wide strip. So far no serious windblow has resulted but the danger is always present.

Up to 1936 all rides were laid out on a grid system which paid no attention to the natural configuration of the ground. Consequently most of these rides have made poor extraction routes except where it has been possible to use an overhead cable. From 1936 onwards, for the plantations formed on Dykecrofts, rides have been laid out to follow the contours and the easiest gradients, and these rides should prove of great value during extraction from this block of forest.

Labour and Housing

Work began in 1920 with about eight local men. The number increased to about twelve by the middle twenties and this figure was maintained until the early forties when the employment of women and boys increased the number to about twenty. In 1948 about fifty men were employed, the increase being due mainly to road work. During 1951 about ten men left for other employment and at the end of the year less than forty persons were employed.

Throughout the years the quality of the forest labour has been good. Practically all the men employed have been local and have stayed in the village of Newcastleton or nearby. From time to time men have used the Kershopefoot Hostel, established by the Ministry of Labour in the early thirties and later taken over by the Commission and administered from Kershope Forest. About six men were employed under the Forest Workers Training Scheme shortly after the war and these men stayed at this Hostel.

The main acquisition in 1920 included on Dykecrofts, the farmhouse and two cottages, and on Tweedenhead, two shepherds cottages each with about ten acres of inbye land. In the small acquisition of 1931 another cottage - Hillhouse - with a small area of inbye land was obtained. Entry into the two cottages on Tweedenhead was gained in 1925 and1927 and these cottages and their inbye land were scheduled as Forest Workers' Holdings. One of these - Tweedenhead - is still occupied, but the other - Scotch Kershope - was abandoned in 1941. Hillhouse was occupied in 1931 and scheduled as a Forest Workers' Holding in 1939. Entry into Dykecrofts farmhouse and the two cottages was obtained in 1936 when the farmhouse became the forester's house; the two cottages were condemned and abandoned in 1947. Two houses were built near Dykecrofts in 1927 and scheduled as Forest Workers' Holdings and in 1951 ten houses were completed at Holmfoot in Newcastleton Village on a small area of land acquired for the purpose. At the end of 1951,

therefore, Newcastleton Forest had a forester's house, four Forest Workers' Holdings (two without land) and ten houses.

II. SILVICULTURAL HISTORY

1. The Early Years (1921 - 1927)

(a) Preparation of Ground and Planting. The story of the first seven years is mainly the story of the development of turf planting at Newcastleton. In 1921 direct notching was used; the plants were small, the vegetation - Molinia, bracken, Holcus in places - was heavy and the result was that there were high losses owing to smothering with weeds. The following year, in an attempt to combat this heavy growth of vegetation and also to get the roots through the peat into the mineral soil, a form of screefing was tried. The top three inches of the peat layer were removed in a square approximately 12 in. x 12 in. and the plant notched into the bared ground. The thin paring of turf removed was placed on the south-western side of the plant to give shelter from the prevailing wind. In this year, 1922, the first trial at Newcastleton of turf planting was made. Some of the plants were notched through the shallow turf instead of into the hole made by the removal of the turf. In this method the roots were, of course, still in the original surface of the ground.

In these, the first two years of planting, little drainage had been carried out. No new drains were cut and only about four chains per acre of existing drains were cleaned out. These sheep drains had been made in the first place only on the poorest ground and practically always ran straight up and down the slope and thus had almost no effect on the waterlogged ground.

In 1923 the cutting of new drains in two compartments was carried out. Only ten chains per acre were cut but the spoil from these drains was spread between the drains into mounds about six inches high and the plants were notched into these loose turfs. It was seen that these plants retained a good colour for longer than those planted in the screefed areas.

1924 was an unsuccessful year and there were many deaths. It was seen then that the hollows made by the screefing acted merely as small reservoirs for water and the plants had thus to contend with even wetter conditions than they would have had if notched direct into the original

surface. Another small area of planting on mounds was tried, again with success, and in the following year a larger area was attempted.

By 1926 it was realised that drainage was essential and the cutting of new drains and the spreading of the turfs cut from these drains was combined in a definite operation designed to give general drainage and at the same time provide local drainage by raising the plants off the ground.

All the 1927 planting was done on turfs and this proved a successful year's planting despite a heavy attack by black game. By this time it was realised that more drains per acre were required and the number of new drains cut was raised to thirty chains per acre. The turfs cut from the drains were from six to twelve inches high and eighteen inches square at the bottom. Plants were placed in the middle of the turf and the roots were between the turf and the surface of the ground. At the same time the necessity for cutting all drains as contour or cut-off drains was seen and from 1927 onwards the up-and-down-the-hill draining ceased. (It is interesting to note that the piecework rate at this time for cutting new drains and spreading three rows of turfs was 1/- per chain).

In this way the technique of turf planting at Newcastleton was evolved and the much more even growth and the much higher density of stocking from 1927 onwards can be clearly seen and is, in the main, the result of the planting method developed.

The intention throughout was to plant the best ground first and in general this was carried out. The resumption of land for planting in the early days was greatly influenced by the requirements of the grazing tenants and this accounts for the fact that the most distant part of the forest from the main road was planted first. This has occasioned a considerable amount of inconvenience with regard to the extraction and road making projects of the forest generally. The area covered by the first six years planting now carries an unevenaged crop owing to the many small portions of poorer ground which were left in the early years for future treatment and which were planted up five to twenty-five years later. Inevitably as draining and turfing technique improved, less and less ground came to be regarded as "unplantable" with the consequence that the areas covered by the later plantings are much more regular in age.

The rate of planting during these early years was about 130 acres per year.

(b) Selection of Species

At the time of acquisition it was realised that Norway and Sitka spruces would probably form the main species but besides planting these various others were tried in the first few years including white spruce , Japanese larch, Douglas fir, mountain pine and grey alder. Japanese larch was planted mainly on the bracken ground but has developed very coarsely. The sites originally chosen may have been unsuitable but it seems probable that the seed used did not come from trees of a good type. White spruce, Douglas fir and grey alder were failures. Generally Sitka spruce was planted where the peat was deeper than six inches and Norway spruce where there was less than this depth of peat. Little consideration was given to altitude but in four or five years it was seen that Sitka spruce in the hollows was always affected by spring frosts and generally it became usual to plant Sitka spruce only above an elevation of about 700 ft.

In 1926 strips of three rows of mountain pine were planted at forty yard intervals up and down the slope to provide shelter for a crop to be planted some years later. This system was abandoned the following year, however, when the remainder of the ground was planted up, mainly with Sitka spruce. The pine are now all suppressed and mostly dead.

As has been already stated poor areas of deep peat were left out in the early years for later planting; most of these areas were dealt with from 1930 onwards. Some of these poorer parts in which Calluna was dominant were planted as trials. Scots pine, Norway spruce and Sitka spruce were used either pure or in mixture. In most cases the Scots pine and the Norway spruce died and the Sitka spruce checked and remained in check. Phosphate was tried - about 2 oz. after planting and gave promising results. Most of these Calluna areas which were planted in the early years were replanted later when the poor areas omitted at first were being planted.

2. Later Planting (1928 - 1948)

(a) Preparation of ground and planting. From 1927 onwards planting proceeded at about 150 acres per year up to 1944; from then up to the present, only small areas previously omitted as unplantable have been planted.

Hand draining at about 30 chains per acre remained the normal practice and little change in the technique evolved by 1927 was found necessary. Turf nurseries holding about 250 plants each were tried, the first being started in 1932. Parts of the 150 acres burnt in 1936 were replanted from turf nurseries.

More Japanese larch was planted in the later years on the bracken slopes. The method of planting was to cut a triangular turf on two sides and turn it over by the hinge of the third side. The plants were notched into the ground at the point of the hinge. The fairly large area free from vegetation enabled the plants to be found easily during the weeding season, a most important point in the heavy bracken areas.

Up to 1935 rides had been laid out by marking rectangular compartments on the map and then fixing these on the ground, without regard to the configuration of the land and the suitability of the rides for future extraction roads. From 1936 onwards rides were laid out following contours and cutting down slopes obliquely, taking into account easy slopes for extraction routes.

(b) Selection of Species

The spruces continued to be the main species used, Norway spruce in the hollows and Sitka spruce above about 700 ft. In the replanting of the failed deep peat and heather areas and in the planting of those areas omitted previously, Sitka spruce was used pure or in mixture with Pinus contorta and mountain pine, sometimes with the addition of phosphate, more often without. In some parts mountain pine was planted and the area then beat up some years later with Sitka spruce or with Sitka spruce and Pinus contorta in mixture. The pines have grown moderately well but the Sitka spruce is very poor. Drain deepening in most of the checked areas has been carried out usually more than once.

In 1935 and 1945 late spring forests were especially severe. In 1945 at the end of April and the beginning of May there were nine consecutive days on which the minimum temperatures recorded at Eskdalemuir varied from 23 degrees fahrenheit to 30 degrees fahrenheit. Before this frost there had been a severe drought and strong northerly winds accompanied the frost. Practically all the damage was done to a belt of Sitka spruce eight to ten years old, which occupied a gentle slope with a south-easterly aspect.

The damaged belt lay along the 800 ft. contour and at 700 ft. little damage took place and on the crest of the ridge at 900 ft. little or no frosting occurred. It was estimated that over 25,000 trees were killed back to ground level and that 250,000 trees lost from one to four whorls. Subsequent recovery from this frosting has been very good.

Up to 1933 no roe deer were present in the area but there has been a steady increase since about 1938, and the present population is from 50 to 100 head. The selection of species in the past was therefore not influenced in any way by the presence of deer but if the numerous small areas of checked Sitka spruce on heather are beat up with Pinus contorta it may prove difficult to establish this or any pine species because of the roe deer. The introduction of a second crop, in windblown areas for example, again may be impossible if a species other than spruce is used unless deer fencing is used for each area.

Black game and voles both caused damage for the first ten years but since about 1937 the populations have decreased greatly. There has been a slight increase in black game since 1947. Rabbits and hares have never been sufficiently numerous to cause appreciable damage and there have been no serious fungal or insect attacks.

Damage by sheep has been sporadic and was at its worst during the war years when labour in the forest was reduced to a minimum. The chief damage was on the slopes of the Kershope Burn where the joint march with Kershope Forest was not always effective for either forest. Damage from sheep in the later planted years has been negligible.

3. Other Forest Operations

(a) Drain Repairs. For the first six years little draining was done and most of the drains which were cut ran straight up and down the slope; these drains were, of course, quite ineffective. After 1927 contour drains became general and the importance was realised not only of having the correct alignment but also of having the drains sufficiently close together. It was seen too that upkeep was necessary and repairs were carried out in the poorer areas three to six years after planting. The vital need for constant upkeep, however, was not appreciated and whilst repairs were carried out in some areas there was no comprehensive plan embracing every planted area throughout its development.

In 1939 a new system of drain maintenance was begun in unbrashed crops. The sides of the rows of trees on both sides of the drain were pruned to eight feet and then the drain was deepened. This method of "racking and draining", modified in that the trees were brashed only to six feet, has been used constantly since its introduction.

In 1948 the first windblow took place. This occurred in P.23 Sitka spruce situated on a gentle slope where the peat was about twelve inches deep. The area was inadequately drained, the few drains in the area being badly aligned. The roots of the blown trees showed that they had been killed back continually to the level of the water table, which was only a few inches below the surface of the ground. This first windblow drew attention to the urgent need for drain deepening to try to lower the water table and thus to enlarge the rooting space available to the tree. It is agreed that deepening suitably aligned drains to just below the usually clearly defined line between the peat and the underlying boulder clay will lower the water table in the peat, but it does not seem to be known yet whether or not digging the drains deeper down into the clay will, in fact, dry the top layer of the clay and thus enable roots not only to penetrate but to live in fissures in this clay. The answer to this problem may prove one of the most important factors in tree growth in the Borders.

Since 1949 some of the areas covered only by drains of the up-and-down-the-slope variety have had new drains out at a correct alignment. This has been an extremely difficult operation and it does not seem too much to say generally that with our present knowledge, once a drainage system has been laid out and a tree crop established on the area the land has been committed to that particular system of drainage however good or however bad it may be, for the foreseeable future.

At the beginning of 1950 a "Plan of Operations" for the period 1950 to 1958 was drawn up, "drain repairs" being one of the operations considered. The Plan prescribes the following drain maintenance scheme:

1. Drains to be deepened about four years after planting (only on the poorest ground).
2. Drains to be deepened immediately prior to formation of thicket.
3. Drains to be deepened at time of brashing (approximately two years before thinning).

(Where pre-thicket stage drain repairs are not done, drains will be deepened after racks have been cut, about eight years after the formation of thicket. This operation combines 2 and 3 above).

4. Drains to be deepened immediately after each thinning.

It has been found in practice that the intensity of draining varies enormously depending on soil conditions and slope and it is difficult to lay down a definite amount of chains per acre for this operation. At Newcastleton it has been found to vary between 7 chains and 20 chains per acre.

(b) Brashing. Brashing was started in 1937 when some complete brashing was done. Little more was attempted until 1943 when brashing was started again. The aim then was 50% selection brashing but 75% of stems always seem to have been brashed. Most of the brashing was done as a piece-work operation and the unit of payment was "100 stems". It seems clear that where payment is by "trees brashed" and not by "area covered" the tendency with selection brashing will be always to have a higher percentage done than is desired.

Selection brashing continued until 1949 when, in an attempt to reduce the large expenditure per acre on brashing, line brashing was introduced, every third line of trees being brashed. This worked well and was only one half to two thirds of the cost of 75% selection brashing. A form of selection brashing was later introduced in that a tree in the line to be brashed which would obviously be removed in the first thinning, was left unbrashed and the tree in the adjoining row was brashed instead to allow the man to sidestep the unbrashed tree; he then returned to the original row. In 1950, when brashing was started in plantations of the first years of turf planting (1927 onwards) it was found that as the stocking density was so much higher there was great difficulty in felling and extraction. In these areas a return was at first made to selection brashing but only 66% of the crop was brashed. As this, however, was much more expensive than one in three line brashing a compromise was effected and the present practice is alternate single lines brashed. Line brashing may be a poorer method in silvicultural theory bit it seems clear that any form of line brashing is less costly than the same percentage of selection brashing. Generally the less brashing that is done, subject to the bare minimum required for access, the cheaper the total combined operation of brashing, felling and extraction to rideside becomes.

(c) Thinning. The thinning of P.21 Japanese larch was attempted in 1938 but the first area of any size to be thinned was the P.22 and P.23 Sitka spruce in 1948. It was realised at this time that drain repairs were urgently needed and it was felt that it would be unsafe to thin other than lightly until such time as the drains, then being deepened, had had time to have an effect on the ground. Consequently only about 200 cu.ft. to 300 cu.ft per acre were taken out, the drains were deepened and in the second thinning (P.22 and P.23 Sitka spruce to be done in 1951) a "normal" volume will be removed. Generally on wet areas where drain repairs have not been carried out two years prior to the first thinning only a very light thinning has been done. Once the drain repairs scheduled in the Plan of Operations to be done at the time of brashing have been carried out over the whole area, there should be no necessity for the first thinning to be lighter than normal. The thinning cycle at present being attempted is four to five years for Norway spruce and three to four years for Sitka spruce, although some of the areas of Sitka growing on ground considered as yet inadequately drained may have the second thinning carried out two years after the first.

A summary of areas thinned is given overleaf. For convenience the list of areas felled is included in this table - for further details see "(d) Windblow" and "5. Acquired Plantations."

Forest Year	Thinning				Felling		
	1st Area acs.	2nd & Subs. Area acs.	Volume cu.ft.	Remarks	Area acs.	Volume cu.ft.	Remarks
23	10			See *			
28		10		See *			
29					27	70,000	Estimate only
36					3	1,273	
38	24		2,400	Estimate only			
39		15	4,738	* Includes volumes felled in F.Y.23 and F.Y.28.			
44		7	600				
45	1	11	6,477				
46	3		300	Estimate only			
47	1		320				
48	68	37	19,230		8	8,454	Partly an estimate Includes 1 acre windblow = 964 cu.ft.
49	138	4	34,174		7	33,389	Partly an est: Includes 4 acres windblow = 21168 cu.ft.
50	222		40,222		4	21,807	Includes 4 acres windblow = 17301 cu.ft.
51	108	123	68,444		-	2,408	Includes windblow = 1468 cu.ft

Volumes and types of material produced during the past three years are given below. It is to be noted that the conversion of thinnings into pit props ceased at the beginning of F.Y.51. All thinnings are now being sold standing or at roadside as long pitwood.

Produce Category	F.Y. 49		F.Y.50		F.Y. 51	
	Volume in. cu. ft.	%	Volume in cu. ft.	%	Volume in cu. ft.	%
Saw Timber	3000	11	4896	16	2234	6
Pitwood and Props	17234 ⁑	63	20323 ⁑	65	29100 ϕ	82
Fencing Posts	4983	18	1840	6	412	1
Pulp Wood	1580	6	-	-	-	-
Firewood	660	2	3920	13	3830	11
	27457	100	30979	100	35576	100

⁑ All pit props

ϕ 99.7% long pitwood; 0.3% pit props.

(d) Windblow. There has been a number of windblows since 1948, one of which extended to approximately seven acres. It is almost certain that every area blown started with the throwing of a single tree on a drainside. The problem arose as to whether the roots of the trees crossing drains should or should not be cut in the drain clearing operations. It was decided that to leave the roots uncut would result in the drains blocking again in a very short time, and so the roots of drainside trees have been cut out during this operation where they interfered with the free running of the drains.

After the first windblows all trees around the margins of the blown areas which had the slightest lean were felled but it soon became obvious that this was a mistake. Later, only trees with a lean of more than 15 degrees from the vertical were cut and now it is a rule that no leaning trees are cut. It is felt that every tree standing, even although it is leaning and will eventually blow down completely, is a tree sheltering one or more trees behind.

As blowing has taken place where a road line has been cut through a crop of Sitka spruce 50 ft. high, and as scarcely one tree in the forest adjoining a ride has been blown it seems safe to conclude that the earlier in the life of the crop that road lines are cleared the better.

All the damage in the main area of windthrow has been caused by north-westerly gales; the prevailing wind from the south-west has caused practically no damage anywhere in the forest. North-easterly gales are not uncommon but these too have not proved dangerous so far. Once a hole in the crop has been made by wind it has been noted that if the area extends the trees most likely to be blown are those in the windward face of the area, that is, the area extends in the direction from which the wind comes.

No natural regeneration has yet occurred in the cleared areas and it seems probable that planting will be necessary. To establish a new crop other than spruce it seems certain that fencing against roe deer will be essential. It may be possible to introduce Tsuga, Abies grandis and Lawson's cypress into these cleared areas, with the possibility of beech on the more favourable soil sites.

In forests of this type, growing on shallow peat overlying boulder clay, windblow is bound to occur and drain deepening cannot eliminate this hazard. It is hoped, however, that it will reduce the risk considerably and allow the crop to grow to a much greater age before liability to windblow again becomes great. It is not impossible, however, that the wind blow which then does take place, should lead to a mixed, uneven-aged forest.

4. Rates of Growth

Information concerning rates of growth in the past is scanty, but from observation of lengths between whorls of branches it is clear that growth has not been fast. This is confirmed by data obtained from Thinning Yield Plots laid down from 1948 to 1951. From the measurements of 45 plots of Sitka spruce varying from twenty to thirty years of age it is found that 80% of the plots contain dominants which are in Quality Class IV and 20% dominants which are in Quality Class III. Fourteen plots of Norway spruce of 24 or 25 years of age have been measured and 79% contain dominants which are in Quality Class II and the remaining 21% (3 plots) dominants which are in Quality Class I or Quality Class III.

One record of growth of flat planted Norway and Sitka spruce is to be found in an article entitled "The effect of Voles on Vegetation" by V. S. Summerhayes and published in the Journal of Ecology, Vol. XXIX No.1. February 1941.

The average heights of trees in inches at the ends of growing seasons for the period 1931 to 1937:-

	1931	1932	1933	1934	1935	1936	1937
Age in years	6	7	8	9	10	11	12
Norway spruce (40 trees)	33"	40"	45"	57"	64.5"	76.5"	93.5"
Sitka spruce (25 trees)	28"	33"	43"	56.5"	60"	70"	82.5"

This gives a mean annual height growth of 10in. for Sitka spruce (with a range of 5 in. to 17 in.) and 9 in. for Norway spruce (with a range of 5 in. to 13.5 in.) The area where these measurements were made - Compartment 5 (P.26) has an altitude of 700 ft. is sheltered and has a gentle slope to the north-west. The dominant trees in this area at the end of the 1951 growing season, measured 27 ft. for Norway spruce and 32 ft. for Sitka spruce. Current annual height increment for Norway spruce is about 12 in. and for Sitka spruce about 18 in.

Since the publication of Hummel and Brett's article "A Simple Method of Estimating Volume Increment in Stands of Young Conifers" assessments have been carried out in some compartments where second thinning had taken place. The results of these are shown overleaf:

Compt.	Species.	P.Yr.	Age	Geology and Soil	a) Altitude b) Aspect c) Slope d) Exposure	Top Height of crop	Mean * Annual Height Increment.	Quality Class	Approx. Vol. * increment per acre per annum.
25	S.S.	22	30	(Scottish (calcifer- (ous sand- (stone of (carboni- (ferous age.	(a) 900' - 1000' (b) N.W.	46'	1'9"	IV	260 cu.ft
27	S.S.	22	30	(3'6" peat (overlying (boulder (clay.	(c) Moderate (d) Exposed to N&W	46'	1'10"	IV	275 cu.ft
28	S.S.	22	30			45'	1'11"	IV	285 cu.ft

* Based on measurement of growth of last three years.

Thus it is seen that in these three compartments about 275 cu.ft. per acre is being laid on annually, and over 800 cu.ft. in three years, the period of the thinning cycle adopted at present.

The Sitka spruce trees of about 28 years of age were felled and the height increments during the last 17 years of their lives were measured. The mean annual increment was found to be 2 ft. 4 in. Growth had been fairly even, 62% of the annual growths being within 10% of the mean and 83% of the growths within 25%. Site details are as follows:-

Compt.	Species	P.Yr.	Age	Geology and Soil	a) Altitude b) Aspect c) Slope d) Exposure	Top Height	Mean Annual Height Increment (Over 17 yrs)	Quality Class	Approx. Vol. * increment per acre per annum
23	S.S.	23	28	Scottish calcifer-ous sand-stone 3" peat over-lying boulder clay.	a) 900' b) N.W. c) Moderate d) Exposed to N & W.	49'	2'4" (The mean increment over the past 3 yrs is also 2'4").	III	350 cu. ft.

* Based on measurement of growth of last three years.

In Dykecrofts Wood a stem analysis of a 63 year old Norway spruce was carried out. From this analysis it was seen that for the first fifty years height increment had been steady at an average of 15 in. per year. From 51 to 63 years, increment fell off and averaged only $6\frac{1}{2}$ in. annually. Diameter increment at breast height was fairly even for the first 40 years at an average of 0.27 in. yearly. For the period 41 years to 63 years, annual increment averaged only 0.10 in. Volume increment from the 25th to the 63rd year remained steady, the average annual volume laid on being 0.64 cu.ft. This tree at 63 years of age fell into Q.C.III but up to the age of 50 it was within the range given for Q.C.II in Forestry Commission Yield Tables, 1946. It is interesting to compare the top heights of Norway spruce at present 25 years of age with the height of this tree at the same age. When 25 years old this tree had a height of 35 ft. Fourteen plots of Norway spruce of 24 and 25 years of age (with the 24 year old heights adjusted to the probable for another year's growth) show a mean top height of 34 ft. Thus the young Norway spruce seems to be developing in much the same way as this representative tree from Dykecrofts Wood.

5. Acquired Plantations

Fifty acres of woodland were acquired in 1920 and 40 acres were felled in three blocks between 1926 and 1948; Dykecrofts Wood (9 acres) alone remains. This wood was planted by contract between 1875 and 1880 with alternate rows of Scots pine, European larch and Norway spruce at a spacing of three feet. Various light thinnings were made up to 1939 when 25% of the crop was removed to leave only the best stems. At present the crop consists of Norway spruce mostly of a rough, coarse type, and a few very poor Scots pine; the wood appears considerably underthinned. Some windblow at one edge has taken place since 1945 and a small group of trees has died within the last few years. As present height increment appeared negligible and as diameter increment at breast height (taken with a Pressler's borer) was shown to be very poor over the past twenty years, a stem analysis of a Norway spruce tree, carefully selected as typical in size of the crop, was carried out. The result showed that while height growth had fallen sharply in the past ten years, and diameter increment at breast height had started to fall off about twenty years ago, the volume increment had dropped only very slightly in the past ten years; the tree was, in fact, becoming more

and more cylindrical. Thus it seems safe to assume that the wood is still growing moderately well.

6. Note by present District Officer.

Following the evolution of the establishment technique at Newcastleton, it may be of interest to consider the methods which could be used today if the planting of the forest were to begin only now.

While the principle of planting the best ground first remains, of course unaltered, there would be very few, if any, patches of ground considered now sufficiently bad to warrant their being left over for later planting. Thus, as all the land may be considered equally plantable, the most accessible ground would be planted first to avoid, for one thing, the necessity for building roads through some miles of unproductive young plantations in order to reach the areas ripe for thinning.

A carefully laid out system of contour drains would be made, probably by Cuthbertson single furrow plough, and at intervals ranging from 27 ft. on the better ground to 12 ft. on deep, heather-covered peat. No drains running directly down the slope would be dug. To allow for ease of drain maintenance - possibly by mechanical means - in later years, and to minimise the risk of drainside trees being wind blown, no tree would be planted nearer the centre of a drain than three feet six inches.

The species used would probably still be largely Norway spruce and Sitka spruce, but the heathery areas of peat would be planted with Pinus contorta/ Sitka spruce mixture and phosphatic fertilisers would be used where heather occurred.

A programme of adequate drain repairs would be undertaken throughout the development of the crop with special attention being paid to the slight hollows on exposed hillsides.

All these proposals are based on the results of the work which has been carried out at Newcastleton and at other forests over the past thirty years. It is salutary to remember that these present day methods have been built up only on the slowly evolved practices of the past.

Present Problems

The most pressing matter of the moment is that of attempting to lower the water table in the wet soil of the forest in order to reduce the

liability to wind throw. At present in the areas already thinned the drains have been deepened to just below the line between the boulder clay and the overlying peat, and this, it is agreed, will lower the level of the water in the peat. There are, however, great differences of opinion as to whether a deepening of the drains below this level will have an effect on the clayey subsoil. However, until there is sure evidence to the contrary, the drains will be cut deeper into the clay at each cleaning on the assumption that there will be an effect on the upper layers of the clay. Arising also from this problem of too high a water table - and perhaps even more serious - is the possibility of die-back occurring on a large scale. So far only one small group of Sitka spruce has been found and it occupies a remarkably well drained spot.

A problem which will probably present itself in the future is the arrestment of windblow in the unstable areas previously mentioned. It has been noticed that the extension of these areas usually takes place along the windward side only and on the main areas showing windblow three to four rows of trees on the windward face have been topped in an effort to prevent further blowing. It remains to be seen how effective this method is. There is always the possibility that windblow will continue to occur at Newcastleton and in future plans of management this factor will have to be recognised so that these recurring windblows can be dealt with from the silvicultural point of view.

The problems concerning the extraction of thinnings alter with each new area thinned. Generally the principal difficulty is the removing of timber from stump to a main forest road, not infrequently uphill, often over long distances and always over wet, soft ground.

The Future

One of the most important and interesting questions, the answer to which lies in the future, concerns the length of the first rotation. Liability to windthrow in the Border Forests growing on peat may be reduced for some years by adequate draining but never eliminated. A time must arrive, whether sooner or later will depend partly on the draining, when the hazard again becomes great. This liability to windblow, however, should develop unevenly, and only in pockets, through the forest. The windthrow which must take place in these pockets - unless of course felling is carried out - may well

lead to the establishment of the mixed uneven-aged forest, and it may not be too much to say that the major yield from the forest may be obtained from these windthrown pockets.

The regeneration of the small areas felled or blown - and there are blown areas at present on which the ground vegetation is returning rapidly - constitutes another difficulty. Natural regeneration seems most unlikely to occur and that replanting will be necessary appears almost certain. Species other than spruce may be introduced but fencing against roe deer will be necessary. Unless a new type of plough can be developed which can break through or uproot stumps, laborious hand draining and mounding will have to be carried out on the areas which originally were inadequately drained.

The best thinning intensity to adopt in the future may prove a difficult problem and it may be emphasised in conclusion how important to Newcastleton will be the discovery of what is the most effective and economic combination of thinning and draining for the type of ground found in the Border area.

G. G. Stewart,

District Officer.

February, 1951.

RESEARCH - Note on Research Branch Work

This forest received one experiment of a very early series on spacing which was planted in 1921, but unfortunately it was destroyed by the fire of 1935 before any information of value had been obtained. There was a long interval after the planting of this experiment during which no Research Branch work was carried out.

In 1936 at the instigation of the then District Officer, J. Maxwell MacDonald, an attempt was made in Experiment 2 P.36 to obtain information on the effects of grazing and burning on poor Molinia-Scirpus land at 1000 ft. elevation; land which was at the time considered unplantable. Most of the experiment was left open to grazing for six years, parts being drained and others burnt every two years but controls were planted at the start and the remainder of the experiment in 1943. Careful records of vegetation data were kept, the main change being the destruction of heather by burning. The experiment has been largely vitiated by different weather conditions in different seasons, frost having done great damage to certain lots of plants and not to others, in any case no resulting alterations in growth rates of the trees have yet been observed. In 1936 also two series of spruce spacing plots were planted by the Division for Research Branch. These, part of a country wide series, have recently been surveyed and assessed.

In 1937 and again in 1939 forest extensions of nursery experiments on density of lining out and age and type of spruce were planted out. Results of these two experiments are to some extent conflicting but 3+0 and 1+2 Norway spruce and Sitka spruce appear to be less satisfactory than 2+1, while denser lining out than 1 in. may result in heavy losses in the forest as well as in the nursery.

In 1938 a Sitka spruce sample plot (S.132) was established in P.22 and thinned to C-D grade.

The most important trials at Newcastleton so far are the series of spruce races planted out from 1938-41 (4.P.38 and 5.P.38). These lie on a shelf on the hillside where frost is frequently experienced; in April 1945 damage was particularly severe. Of the Norway spruce the fastest growth was generally made by Carpathian and Black Forest lots and the poorest by Swedish and Alpine plots. Few Norway spruce were killed outright but a number were killed back, often several feet, damage being worst in Hartz

and Alpine lots, least in the Carpathian.

The Sitka spruce suffered far more severely, practically every plant being killed or badly damaged. Growth up to the time of the frost was fairly even but the incidence of damage varied greatly. In particular, plots from Masset, Queen Charlotte Isles, lost only 11% killed whereas three other Quality Class I lots lost 20%-40% and three Washington U.S.A. lots lost 45%-55%. These results raise considerable hope that frost resistant races can be isolated.

A small trial of some sixteen species on typical white lands planted in 1939 was also by 1946 almost completely destroyed due to persistant frosting (7.P.39). The underlying cause here appears to be that small plants are particularly vulnerable among the dense Molinia which overruns the turfs.

The same frost as damaged the provenance experiments also destroyed three other forest extensions planted in 1940, two of which concerned the use in the nursery of alternative measures to lining out. Interesting results were, however, obtained before their destruction. In the first, undercut 3+0 Sitka spruce seedlings had lost four times as many plants after planting and survivors had grown slower than 2+1 transplants. In the second, while the same result was obtained for undercut 3+0 and normal 2+1, it was shown that wrenched or pruned and also untouched 3+0 suffered even heavier losses. The third extension of 1+2 Sitka spruce from greencropped and composted land at Tulliallan gave no result before being killed almost completely, (10.P.40)

In 1949 a new series of extensions began on this frost shelf on which so much Sitka spruce had been killed out (11.P.49). Late and early flushing spruces selected in the nursery lines have been planted out in small plots to observe the persistence of this character and also the incidence of frost damage should it re-occur. To these plots are now being added rooted cuttings from selected late and early flushing spruces (14.P.51.).

A completely new project was opened in 1949 with the laying down of a pilot trial to determine how far deep draining can influence the level of the water table (12.P.49). This was considered necessary following Silviculturist (North)'s 1948 report on drainage and windblow in the Borders and the first actual windblow in this forest which occurred that year. Within a short period it was shown that while the water table as seen in

test wells fluctuated widely, its average height was lowered by 50% by deep draining. As a result a long term experiment is now being laid out to test the effects on the tree growth of different intensities of drain maintenance and deepening (13.P.51). Different thinning regimes are also incorporated as another potential method of reducing the risk of windblow.

J.W.L. Zehetmayr.

Edinburgh,
February, 1951.

APPENDIX I

Notes from Inspection Reports

A list of the most interesting and important inspections which have been carried out at Newcastleton is given below, along with some extracts and brief notes. The information contained in these reports has, of course, been drawn on freely in the compilation of the main body of the history.

24th June, 1922: Technical Commissioner, R.L. Robinson.

Choice of species is discussed and mention made of the boldness of using so much Sitka spruce; more Norway spruce is suggested. (The choice of Sitka was made after comparison of the area with "the remarkable results at Drumlanrig"). The unsuitability of small Sitka spruce seedlings on this type of ground is noted and the fact that screefing often produces only a hollow for the collection of water was emphasised.

30th June, 1924: Assistant Commissioner (Scotland), John Sutherland.

Comments are made on frost injury to Sitka spruce and the failure of Japanese larch. Deaths on Scirpus ground are noted and the comment is "some more draining should be done". P.23 Norway spruce is remarked upon as "generally bad except between drains." The holding of water in the hollows made by screefing is again thought to be a major cause of failure; "it is proposed that P.25 will be entirely planted without any cutting of the surface."

16th July, 1924: Divisional Officer J.M. Murray.

The results of analyses of soil samples taken at Moorburnhead show pH values of 4.5 to 5.5 (samples taken earlier at Newcastleton gave values from 4.0 to 5.0). Comments are: "The samples showed a better decomposed peat than on Tweedenhead. The success of planting is in inverse proportion to the degree of acidity. When the pH value falls below 5.0 there should be no hesitation in putting in more drains.

8th December, 1924: Assistant Commissioner (Scotland), John Sutherland.

"Efforts have been made to release water in screefed holes but the main cause of failure arises from (1) acidity, (2) frost."

More drainage is advocated to overcome the acidity and pit planting in all peat areas is recommended. More shelter is suggested; "wide rows (of pines) closely planted in the rows and the rows running in the direction of the prevailing wind".

8th September, 1926: Technical Commissioner, R.L. Robinson.

Failures in early planting have been attributed to screefing and small plants; plants notched in P.25 and P.26 look better. Choice of species; "Sitka should be predominant tree with Norway as a subsidiary species where frost danger is excessive". Beating up: "Use of Norway should be restricted to pure Norway, otherwise Sitka should be used. The forester proposes, in beating up some of the screefed land, to place the plants on material thrown out of the screef. It will be best in the long run at Tweedenhead to go in extensively for mound planting".

16th December, 1927: Technical Commissioner, R.L. Robinson.

An area of Calluna, Erica tetralix, Scirpus and Eriophorum, earlier classed as unplantable, was seen. In 1925 mountain pine was planted in double rows about thirty feet apart. "Where reasonable success can be regarded as assured with this species, further cultural operations will be undertaken and the shelter of the pines should be of assistance in starting a better crop".

5th May, 1931: Assistant Commissioner (Scotland), Sir John Sutherland.

The improvement in the earlier plantations is noted as "remarkable". "P.27 to P.30 is developing with practically no check".

25th November, 1937: Commissioner, Sir Alexander Rodger.

The extreme regularity in the growth of P.30 to P.33 is contrasted with the irregularity of P.23 and P.24. The "very great progress" made in the past three years is commented upon: "It was noted that changes in geological formation had no apparent effect on the tree growth". Road construction is discussed.

15th September, 1938: The Chairman (Sir Roy Robinson)

"The comparative urgency" of extraction problems is discussed. Checked spruce on Calluna was seen and commented on; "earlier use of pines would have resulted in canopy having been formed by now. Pine/

Pine/spruce mixtures might be used".

The immunity of Picea omorika from the 1935 frost was observed. The problems of windblow were discussed: "windblow must be expected in spruce growing in soft peat over stiff clay and management must deal with such windblows as a natural adjunct to the growing of spruce in these localities and not as an indication that large areas are ripe for clear felling".

25th May, 1939: Assistant Commissioner (Scotland), J.M. Murray.

The necessity for drain repairs in P.27 is remarked on. Some success with Sitka spruce on Calluna-Eriophorum ground is mentioned and the difficulty of planting Pinus contorta because of black game.

1st May, 1941: The Chairman, Sir Roy Robinson.

P.21 Japanese larch is noted as poor: "the ground is really a spruce site". The difference in growth between flat planted and turf planted spruce is remarked upon as still noticeable. The need for drain maintenance and the value of "racking in older plantations to see what is happening in the crop" are emphasised.

2nd June, 1943: The Chairman, Sir Roy Robinson

Dykecrofts Wood: "growth on the whole was considered excellent". The importance of not doing complete brashing was stressed.

5th May, 1944: The Chairman, Sir Roy Robinson.

Beating up P.35 Norway spruce with Tsuga is recommended. Roads layout considered.

27th August, 1946: The Chairman, Sir Roy Robinson (with Chancellor of the Exchequer and Minister of Agriculture.)

More intensive draining is thought necessary "to bring away checked areas of Norway spruce" (P.25 and P.26). The lack of roads is again emphasised.

4th August, 1948: The Chairman, Lord Robinson.

First thinning in P.23 Sitka spruce is considered to be light. (The light thinning was done "because wind blowing of dominant trees had occurred and it was decided to thin lightly and to clear drains in an attempt to stabilise the crop before a proper thinning was carried out").

Roads layout considered and necessity emphasised for "careful planning work to ensure that a proper system was obtained and that it served a sufficient area".

18th January, 1949: Directorate Conservator of State Forests, A. Watt.

Apprehension is expressed about wind firmness of P. 23 Sitka spruce. "lack of draining in the initial years and the absence of contour drains makes the whole area waterlogged. Thinning will have to be done most carefully with drainage upkeep being attended to in advance if at all possible".

The removal of a complete row of drainside trees is suggested.

22nd February, 1949: Director (Scotland) H. C. Beresford Peirse

"The number of swinging and blown trees on flat planted areas was noted with concern. The trouble obviously lay in the drains". It is thought best to carry out the main repair of drains immediately after brashing. "It was agreed that a greater stress should be laid on the marking of trees which were near the drainsides".

1st June, 1949: Silviculturist (North), J. A. B. Macdonald.

"A lot of drain repairs amounted to cleaning out but not to deepening. It is almost certain that the small turf drains used at Newcastleton after 1925 and perfectly good enough to provide turfs and ensure a good start for spruce are not now draining the area sufficiently to allow the roots to develop properly or to prevent wind damage".

30th May, 1950: The Chairman, Lord Robinson

The good rate of growth of the older plantations is noted. It is emphasised that it was almost as important not to thin too early as to delay thinning. The problem of windblow is discussed: "It may be that our systems of management and silviculture will be conditioned by windfalls".

20th October, 1950: Directorate Conservator of State Forests; A. Watt.

The difficulties are mentioned of restocking the windthrown areas - "openings in the middle of pure spruce" - where there are roe deer. It is suggested that drainside trees be removed at the pre-thinning drain cleaning rather than at the time of the first thinning.

30th October & 1st November, 1950: Director (Scotland) Sir Henry Beresford Peirse.

Dykecrofts Wood: The very poor height and diameter increments are mentioned and a stem analysis is suggested. P.23 Sitka spruce : The extension of the wind thrown area is noted and it is decided that "no (further) cutting of wind blown trees will take place; in particular will all leaning trees be left standing". It is remarked that generally there seems to be "A marked improvement in stability" in the forest.

11th December, 1950: Silviculturist (North), J.A.B. Macdonald

Some bog areas examined and their improvement noted; This "can be put down largely to protection from burning. Bogs of the Newcastleton type can now be treated in our stride with every hope of success".

14th June 1951: Directorate Conservator of State Forests, A. Watt.

Some areas of second thinning thought to be too light. Areas of first sale of thinnings standing inspected.

16th August, 1951: Deputy Director General, W.H. Guillebaud

".....first visit for many years to older plantations ..... impressed with their excellent growth and form". An electrical discharge suggested as a cause of the Sitka spruce dieback in Compartment 23.

27th August, 1951: The Chairman, Lord Robinson (with Minister of Planning and Local Government).

"There is now a most impressive drive from Dykecrofts, through (the) plantations to the Kershope Burn (Bailey Bridge) crossing and through the Kershope plantations".

APPENDIX II

SUPERVISION

CONSERVATORS

1946 - 1947	J. R. Thom
1947 (March - May)	F.W.A. Oliver
1947 - 1951	J. R. Thom
1951 to date	J.A.B. Macdonald

DIVISIONAL OFFICERS

1920 - 1934	J. M. Murray
1934 - 1938	O. J. Sangar
1938 - 1939	F.W.A. Oliver
1940 - 1942	A. Watt
1942 - 1945 1947 (March to May)	J. R. Thom
1948 - 1951	R. E. Fossey
1951 to date	W. N. Gibson

DISTRICT OFFICERS

1921 - 1922 1924 - 1925	W. H. Whellens
1925 - 1928	No District Officer
1928 - 1931	A. H. Gosling
1931 - 1937	J. M. MacDonald
1937 - 1938	J.S.R. Chard
1938 - 1939	R. F. Wood
1940 - 1943	No District Officer
1943 - 1950	W. B. Sutherland
1950 - 1951	G. G. Stewart

FORESTERS

1922 - 1924	W. H. Whellens
1920 - 1940	J. F. MacIntyre
1941 - 1947	W. J. Robertson
1947 to date	J.F. MacIntyre

From 1921 to 1938 the forest was a part of the South-West Division of Scotland. In 1938 it came under the newly constituted South Division and from 1st January, 1946, this Division became the South (Scotland) Conservancy.

APPENDIX III

Some notes on Moorburnhead Plantation and Research Branch Work on the Area

Moorburnhead plantation belongs to the Duke of Buccleuch. The plantation is in Dumfries-shire and lies approximately one mile west of the Newcastleton-Cannonbie road and some four miles from Cannonbie station. It extends from 400 ft. to 910 ft. above sea level. Planting began in 1913 and the oldest block, planted up to and including 1924, is just over 500 acres. Before planting, the area was sheep grazed and was considered to be one of the poorest grazings in the district, being valued at only 2/- per acre. The ground is said to have been extraordinarily wet. Moorburnhead is in a high rainfall area of probably over sixty inches per annum, the prevailing wind is from the Solway, i.e. the south west, and late frosts are severe at times in hollows and terraces, but not on the slopes. A certain amount of damage was experienced in the early years as a result of dry east winds in the spring.

The whole area slopes gently to the southwest and is underlain by calciferous sandstone except in one part where there are outcrops of diorite. Over the greater portion of the area there are deep glacial deposits often of a clayey nature, and in the upper part of the plantation there is a layer of peat which varies in depth from an inch or two to four feet. As a rule the peat is of good Molinia type, nowadays easy to afforest, but other types under Eriophorum and under heather, were much more difficult to deal with. Three main types of herbage were recognised: Aira caespitosa type, Molinia type and Calluna/Eriophorum/Scirpus type.

The Forestry Commission's interest in the plantation was considerable from the early 1920's, not only because Newcastleton forest, which enclosed similar ground types, is within a few miles of Moorburnhead, but because Moorburnhead was typical of tremendous areas of potential forest land on both sides of the border. In order to make full use of the experience gained at Moorburnhead a special examination of the area was carried out in 1926 by Forestry Commission research workers.

In their survey, considerable use was made of comparisons between external grazed conditions and the type of growth made by different tree species on the identical vegetation types within the forest. In many instances the difference in growth on two adjoining vegetation types was very marked. Except on a small patch of the poorest peat type all planting had been by direct notch into the peat or surface soil. As a result the early growth had often been extremely slow because the plants tended to check until adventitious roots had formed a new root system near the surface. On the better vegetation types, thanks to careful and rather costly cleaning, subsequent growth had been very good. Distinctly slower rates of growth were found on the Molinia types, and as we would now expect, trees were badly checked on the Calluna/Eriophorum/Scirpus. Even turf planted Norway spruce on this type was making only about one inch of shoot growth per annum although Sitka spruce was averaging three and a half inches.

The importance of adequate drainage was clearly demonstrated in different parts of the plantation; for instance the growth of spruce trees above and below a contour drain differed by almost 100%, the improved growth being, of course on the downhill side of the drain. Among the suggestions made in 1926 for dealing with similar land, it is interesting to note that turf planting was advocated and also the experimental use of a plough for the provision of turfs. The need for draining experiments was also recorded. The general impression, however, was that the better types occurring at Moorburnhead should eventually support very satisfactory tree crops. So far as the Calluna peat types were concerned it was noted that these were quite unsuited for the direct planting of spruces. A mixture of spruce with pine was advocated with a view to producing an ultimate spruce crop, or a preliminary pine crop. Moorburnhead has been visited by the Chairman and officers of the Forestry Commission many times since that date.

In one section of the poorest peat type an experiment was laid down in 1913 to ascertain the effect of basic slag and kainit with and without sand on turf planted spruces. There was also a gas-lime treatment and a sand only treatment. Except that kainit had in almost every case proved fatal nothing could be made of the experiment when it was inspected in 1926. At the request of the Forestry Commission in 1929 a poor, turf planted area in Knowehead was used for a basic slag top dressing experiment.

Increased rate of growth was recorded in 1930, both in the control and in the treated strips. This is probably partly due to the slag having blown about from treated to untreated strips, and partly to the fact that roots had intermingled even before top dressing. As early as 1932 it was recorded that the "improvement of growth of all plants inside the experiment is very marked compared with the untouched areas surrounding it."

In December, 1938, two permanent sample plots Nos. 131 and 132 were established in the oldest Sitka spruce of the Moorburnhead plantation and near its highest part at an elevation around 750 ft. The original vegetation had been dominant Molinia with sparse cotton grass, but this had completely disappeared by 1938.

Peat varying in depth from twelve to thirty inches overlies the glacial boulder clay in the upper layer of which, fragments of alder were found.

At thirty-one years of age Plot 131 showed a total production of 4416 cu.ft. quarter girth under bark compared with 3658 cu.ft. quarter girth under bark in Plot 132 at thirty-three years of age. Mean annual increment had therefore been 142 cu.ft. in Plot 131 and 111 cu.ft. in Plot 132, which corresponds with the figure of 117 cu.ft. given for thirty year old Quality Class IV Sitka spruce in the revised Yield Tables (1950). This yield approximately equals that of Quality Class I Norway spruce at the same age, so that the apparently unpromising site has shown a relatively high timber production potential.

An assessment of the volume removed by a normal estate thinning was begun at Moorburnhead in 1938. No satisfactory data were obtained as the area was not quite ready for treatment then for the branches were green to within ten feet of the ground. With the advent of the war the investigation lapsed.

By 1944, when the Advisory Committee on Forest Research visited Moorburnhead plantation, large numbers of one or two year old seedlings were to be found in the rides especially where thinning extraction work had been carried out. At the Chairman's request some seedlings were collected and lined out in a nursery for observation; these were later planted out into the forest at Benmore. The Chairman had hoped that there might be some natural Norway spruce x Sitka spruce hybrids, but all

seedlings have turned out to be pure Sitka spruce.

While the rate of growth has been satisfactory over the greater part of the Moorburnhead plantation, wartime lack of labour resulted in rather disastrous neglect of thinning and more especially of draining operations on the peaty and more level parts of the area. By 1942 one or two spots appeared where Sitka spruce and in one case Norway spruce had been killed after the trees had reached thirty to forty feet in height. The roots die first and it is common in the early stages to find everything alive above ground level. The spots where the die back occurred were usually very restricted, seldom as much as a tenth of an acre. The phenomenon has been noted in other spruce woods in recent years and is under investigation by the Commission's pathologists.

Infinitely more extensive damage, however, has been caused by the rising water table resulting from neglected drain maintenance; some very large wind-blows have occurred and direct drowning is also common. Possibly the most important lesson Moorburnhead has to teach officers of the Forestry Commission is the absolute necessity for preventing any rise in the water table.

J.A.B. Macdonald

8.8.51

Newcastleton

NEWCASTLETON FOREST

COUNTY OF ROXBURGH
CASTLETON Ph.
Survey Revised to FY 36. Based on
O.S. Edition of 1924 (New Series)
Roxburgh Sheet 41

Conifers 1 – 20 years
21 – 40 years

SCHEDULE OF AREAS

P YEAR	AREA PLANTED (ACRES)	TOTAL AREA PLANTED TO DATE (ACRES)	AREA RECORDED ON DIRECTOR'S MAP
1921	100	100	
22	110	210	
23	146	356	
24	99	455	
25	121	576	
26	74	650	
27	90	740	
28	136	876	
29	100	976	
30	178	1154	
31	160	1314	
32	178	1492	
33	134	1626	
34	176	1802	
35	87	1889	
36	288	2177	
37	201	2378	
38	180	2558	
39	161	2719	
40	179	2898	
41	72	2970	
42	61	3031	
43	69	3100	
44	110	3210	
45	1	3211	
46	5	3216	
47	12	3228	N.E. 1/10/47
48	15	3243	N.E. 27/10/48
49	22	3265	N.E. 27/10/49
50	11	3276	N.E. 31/10/50