FORESTRY COMMISSION

HISTORY

OF

RATAGAN

FOREST

N (S) CONSERVANCY

FORESTRY COMMISSION

HISTORY

of

RATAGAN FOREST

1921 - 1951

NORTH (SCOTLAND) CONSERVANCY

HISTORY OF RATAGAN FOREST

Contents

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CHAIRMAN'S COMMENTS

This is a good history and I have not much to add.

I have known the area since its acquisition though the records of early inspections are missing. In my recollection there stood originally some good European larch on the lower slopes behind the farmhouse. This may have been taken as sufficient evidence for the wider use of that species.

Here, as in many other forests, the dotting in of beech in small blanks has been useless, as has under-planting without fencing where there are deer about.

The type of Douglas fir is stated to be unsatisfactory. We received, partly by purchase (from a firm called E. de Hurst - Identification No. 21/17) and also by way of gift from Mr. Lathrop Pack - Identification No. 24/2, a certain amount of seed of dubious origin and it is possible that the Ratagan trees were derived from it.

R.

Feb. 27th, 1952.

DIRECTOR'S COMMENTS

A thorough and interesting history.

Risks - Page 8

If sheep do virtually no damage now, is it worth spending money on fence upkeep or time on sheep drives?

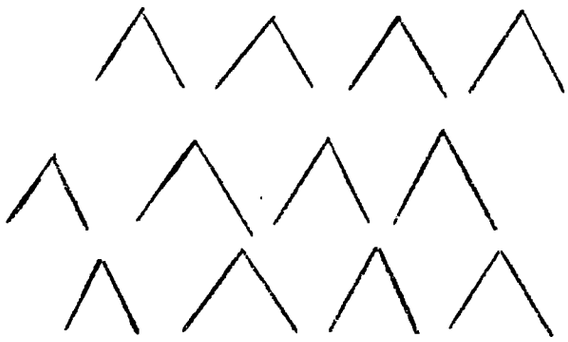
Choice of Species - pages 10 & 11

Attempts to underplant have met with failure, as is almost always the case, due to roe and perhaps rabbits to a lesser extent. Underplanting or filling in failed or blown gaps is often silviculturally most desirable, but is not feasible because of damage by grazing animals. If the area to be treated is sufficiently large, a temporary roe fence may be justified - otherwise underplanting, etc. is better not attempted when roe are present, for even a few can do great damage.

Conclusions - page 21

I agree in the main with the writer's conclusions. I am sure there is much still to be learnt about different types of Douglas fir - and for that matter about other exotic species in common use. We shall make little headway over this till we send one or two officers with thorough knowledge of our home conditions to make a study of Western North American species (including alder) in their natural habitat. I should not be too hard on European larch, though I agree that planting of fairly large pure blocks has not been successful. European larch is, however, a valuable species and we should not lightly abandon its use. Instead, we should plant it on an increasing scale in small groups or as a mixture (perhaps only 5%) through other species even on ground that we would not perhaps class as European larch type.

I remember one interesting though small experiment, not mentioned in the history, which was laid down in a steep early planting at Moyle, I believe at J.M. Murray's suggestion. It consisted of cutting V-shaped drains, with the tops of the Vs pointing up the hill, and the two arms allowing wash to flood over the unbroken surface before being caught by the next V. The lay-out was something like the following:-



It would be interesting to know if the experiment can still be seen, and if any useful results emerged.

(Sgd) H. C. B. P.

31st January, 1952.

District Officer's note on Director's

Comments - Draining Experiment at Moyle

The V lay-out of drains, described by the Director in his comments on Ratagan Forest history, was used at Moyle on the north-east end of Compartment 35. The area was drained in 1928 and 1929 and the experiment suggested by J. McAlpine. The area was planted in 1930 and 1931 with Sitka spruce.

The Sitka spruce on the V-shaped drains has grown at the same rate as the surrounding Sitka spruce planted on normally drained areas. There is now little trace of the V drains. Early growth of the Sitka spruce was slow, but this was the usual state at Moyle; subsequent growth has been satisfactory.

As far as can now be seen, the experiment was carried out over a single plot of less than 1 acre.

(Sgd). D. T. Seal

District Officer,
Fort Augustus.
1.3.52

HISTORY OF RATAGAN FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation

Ratagan Forest takes its name from the sheep farm of that name, which was acquired to form this forest.

The forest is divided into two sections, separated by the watershed running parallel to the south shore of Loch Duich; this watershed also forms the county boundary between Ross-shire (on the north west) and Inverness-shire (on the south west).

Ratagan section lies in Ross-shire in the parish of Glenshiel, and Moyle section lies in Inverness-shire in the parish of Glenelg.

The forest as a whole lies between the south shore of Loch Duich, near the head of that sea-loch, and Glenmore.

The forest was acquired by feu from Colonel Baillie of Dochfour in 1921.

Kyle of Lochalsh is the nearest railway station, 22 miles by road from Ratagan House. A steep and twisting road leads over the top of this watershed (Mam Ratagain) to the Moyle section and thence to Glenelg on the Sound of Sleat.

Area and Utilisation

The total area acquired was 2481 acres, of which 1693 acres have been compartmented. Of the compartmented area, 1563.5 acres are under plantations, and the rest comprises blanks, mainly lying along the high exposed top edges of compartments. Forest Workers' Holdings, including grazing outruns, cover a further 174 acres of the uncompartmented area, and the remaining uncompartmented area is unplanted and unplantable, lying on the exposed ridge watershed between the two sections.

There were no acquired plantations.

A nursery was started at Ratagan in 1923 of about 2 - 3 acres in extent. In 1927 the area was increased to 4 acres by the addition of an acre of nursery at Moyle. In 1931 the Ratagan nursery was increased by a further 2 acres. In 1934 Moyle nursery was abandoned and planted up, and the Ratagan nursery was steadily reduced until only 1 acre remained in 1936. This small nursery continued until 1947, when it was finally closed

down and sown to grass and let for grazing, as had been done with the rest.

Seed beds were sown annually until 1933, and thereafter the nursery was used for lining out only.

Physiography

Ratagan section lies on the moderate to steep slopes along the southern shore of Loch Duich, with a north easterly aspect, rising from sea level to a height of about 1200 ft. on the watershed, in a horizontal distance of some 4500 ft.

Moyle section lies on the south westerly face of the slopes down from the watershed to the Glenmore river.

In the Ratagan section there are two main streams cutting down through the plantations, the Allt Ratagain and the Allt na h-Inghinn. These are deeply cut and steep sided, with precipitous walls and waterfalls on their upper reaches. The slope is also cut into deeply by many smaller burns.

In the Moyle section also there are two main streams. Allt Choire Thorrlaich and the Allt Lionogah. These streams are not so deeply cut as on Ratagan, but have broken rocky beds and steep sides in their upper reaches.

The Moyle section is more gently sloping than Ratagan, rising from about 200 ft. along the Glenmore valley bottom to 1200 ft. on the watershed, in a horizontal distance of some 8000 ft.

Exposure is not a serious factor in either section, except at the top limits of planting generally, and at the north west edge of Ratagan, in particular, where the effects of exposure are noticeable but not serious.

Geology and Soils

The geological formation is mainly granite, with schist coming in at the southern corner of the forest. This is much decomposed near the surface in parts.

Soils are generally reddish brown, loose and gritty. The soil is very shallow on the steeper upper slopes of Ratagan, but is generally of good depth on the Moyle side.

Peat has formed and accumulated to a depth of up to 3 ft. on the flats above Ratagan House, and at the southern end (and in patches throughout) on the Moyle section.

On ridges and knolls on the Ratagan side, a shallow, tough peat layer has developed, 4 in. to 6 in. in depth.

Vegetation

At the time of acquisition, the vegetation was mainly Nardus, Festuca, Molinia, and Scirpus on the higher slopes, with Anthoxanthum and fine mountain grasses becoming more common on the lower slopes.

Juncus, bog myrtle and Eriophorum, with some bog asphodel, Sphagnum and lichen occurred in the wetter and peaty places.

Heather was mainly confined to patches on the higher slopes. Bracken was commonly found, particularly on the lower slopes. There was no timber on the area, and only a very little birch scrub, which was mainly confined to the sides of streams.

At the present time, the vegetation has been almost completely suppressed over the bulk of the area where spruces and Douglas fir were planted, and have become established. In checked areas so planted, there is usually a weakened Calluna vulgaris growth, with abundant Sphagnum, Hylocomium and occasional Polytrichum and liverwort.

Bracken is still common in the Moyle section on rides, under larch and where canopy is still not closed.

Under larches there is still a plentiful ground vegetation of grasses (Holcus spp. Aira caespitosa), Oxalis acetosella, Digitalis and Primula and mosses. (Thiudium, Mnium, Plagiothecium, Hylocomium being common, Polytrichum, Dicranum, Catherina undulatum and liverworts local).

Meteorology

The average annual rainfall is about 75 in. and is evenly distributed through the year, with May usually the driest month. Snow rarely lies for long or to a great depth, and then only on the high land between the two sections, generally above the top limits of planting.

Both late and early frosts are seldom of an intensity to cause any damage. The only recorded instance of frost damage was from a severe late frost in May, 1935. A little damage from the same cause occurred in 1945.

Prevailing winds are from the south west and reach considerable velocities at times, particularly during the equinoxials. But the forest is nowhere directly exposed and little damage is anticipated or has occurred

except by freak storms, and on the upper limits of Moyle planting. Such small blows as have occurred are usually confined to small wet patches with poor drainage and fast growth.

Risks

The danger from fire is not very serious as the area is, on the whole, wet. The main sources of danger are from fires on the roadside or in the forest, started by hikers or roadmen, and, to a less extent, muirburning by neighbours. Fortunately, most of the road side plantations on Ratagan side have now grown beyond the most dangerous stage.

The only fire which occurred in this forest was in March, 1929, when some 50 acres of P.23 and P.24 were destroyed by a fire starting on the roadside. This was replanted in P.30.

Roe deer are still plentiful and do some damage annually. Rabbits are plentiful outside the forest, but are kept well in check and now do little or no damage in the plantations. Voles gave great trouble in 1935, but not since then.

Both sections of the forest harbour sheep, where grazing and shelter under larch is attractive. Fence maintenance and periodic drives before lambing help to keep them out, but there is always a small population. They do little or no damage now.

Red deer, which were plentiful in the early years, are now uncommon and do little or no damage. There have been no insect attacks of any importance.

As regards fungi, damage to European larch through die back and Dasyscypha calycina has been and still is serious, though the climax of the attack appears to have passed.

About 2 acres of Douglas fir are dying from an attack of Phaeocrypt-opus gaumanii first noted in 1950 spring. No other fungal attacks of any importance have been observed.

Roads

Apart from the County road from Ratagan over Mam Ratagain to Glenelg, and the forest road from that into Moyle Forest Workers' Holdings, there were no roads in the forest until 1946. There were, however, a number of useful inspection footpaths.

In 1946, a start was made, mainly by hand work, on putting in roads to the areas where thinning was becoming necessary.

This work continued by hand and with increasing use of bulldozers and a dumper until 1949 - 50, when a full programme laying out a road system and feeder tracks which would tap all areas likely to become ready for thinning up to the end of 1954, was drawn up.

By 1951, good progress had been made, and it is hoped that the end of 1952 will see the completion of the above programme. Thinnings were in arrears for lack of roads at the end of the war, and are still delayed for this reason, but the position is now satisfactory as the new roads enabled a 3 year contract with a timber merchant to be entered into in December, 1950, which, at its termination, should have brought thinnings up to date.

Labour

Labour has been adequate generally for the Ratagan section, from local residents and Forest Workers' Holdings.

At Moyle, also, the position has always been fairly satisfactory, by using a bothy at that forest to accommodate the extra 5 - 8 men not available from local residents and Forest Workers' Holdings.

There are three Forest Holdings in Ratagan section, and two Forest Holdings at Moyle.

Eight new houses are in process of erection at Ratagan, and some labour may be available for Moyle from the six new houses now in course of erection at Glenelg.

The hostel at Moyle will then be closed down, and labour transported to Moyle to the extent necessary.

SILVICULTURE

Preparation of Ground

(a) Fencing

The first enclosure for P.23 was made for that year's work only, but in the following year the whole of Ratagan section was fenced in. The fence was all rabbit and stock proof, but was made deer proof only on those sections where red deer were most likely to get in.

At Moyle, the procedure was similar, a start on fencing being made in 1928 and final enclosure being completed in 1932, the fencing just keeping about a year ahead of the planting until then, to enable rabbits and other vermin to be brought under control just in time.

(b) Weeding and Scrub Cutting

There was little scrub to clear, but such as there was, was cut out and burnt a year ahead of planting. Bracken growth was heavy on most of the areas planted up, and this was cut over, often twice, in the year, or sometimes for two years, before planting. Heather growth was patchy and mainly confined to the higher ground, and there is no record of this having been burnt or cut prior to planting.

(c) Drainage and Turfing

Very little drainage was done in the first year or two, but became progressively more intensive as the need for it became apparent, and the method of turf planting became established practice. Thus, in the first year or two, an average of some $2\frac{1}{2}$ chains of drains per acre were cut, but this increased to some 25 chains per acre in 1930 and subsequent years. The increase was also partly due to the fact that the best naturally drained slopes were taken up for planting first.

Choice of Species

Appendix III shows the areas of each species originally claimed as planted, and the areas of each species as they exist to-day. Apart from changes due to adjustments of areas, and replanting of a burnt area of some 50 acres, the changes in proportions of the species planted are slight. This tends to confirm the opinion that the original choice of species was usually sound. Roughly, the percentages of species planted and still existing are :-

Sitka spruce - 48%; Norway spruce 19%; European larch 9%, Japanese larch 9%; hybrid larch 5%; Pinus contorta, Scots pine and mountain pine together, 5%; Thuja, Tsuga, Abies grandis and nobilis, 2.5%; Douglas fir 2.5%.

The only serious criticism of choice of species is that European larch has been planted too extensively on doubtful areas. Serious losses from canker and die back have occurred and are still occurring (though the climax of the attacks seem now to be past) and the crop which remains will always be very open. Attempts to underplant have been made on a medium to small scale, using beech, Abies nobilis and Abies grandis, and spruce, but these have largely failed due to the concentration of roe deer on

such patches. The proper policy now is probably to wait until the remaining trees reach an exploitable size, and then to decide whether to accept them as the crop, or to fell, fence and replant.

A lesser criticism possible is that Douglas fir generally is of poor quality, and Sitka spruce would probably have produced as great or greater volume and of better quality; and, finally, that, from the areas still in check, it appears that many very doubtful patches were planted up which it would probably have been better to leave unplanted, and that on the Ratagan side was originally carried too high up the hill.

Changes of species by beating up have not occurred to any great extent. In general, it is true to say that excessive beating up was done up to about 1932. For as many as three years after planting (in each area planted up to about 1932) very extensive beating up was done, using the same species as originally planted. From about 1932, the increasing use of spruces and Pinus contorta indicates that it was about that time that such changes of species as did occur, occurred.

In conclusion, however, it is true to say that, with the exception of European larch, the choice of species used was very sound.

Planting

(a) Spacing

There is nothing special to note on this. The spacings used were those usual at the time when the planting was done.

(b) Type of Plants Used and Source of Supply

Information about the source of supply is rather sketchy, but it is generally true to say that most plants came either from the home nursery or from South Laggan and Inchnacardoch. So far as information goes, most of the Sitka spruce seed came from Queen Charlotte Island, and much of the European larch was of continental origin. There are, unfortunately, no records to show the source of Douglas fir seed used.

As regards type and age of plants used, it is generally true to say that, since 1934, plants used were of the normal age and size, as they were in the first year or two of planting. Between 1925 and 1933, however, there was much use of big plants, e.g.

P.25	Sitka spruce	2 + 1 + 2 and 2 + 1 + 1
	Japanese larch	2 + 1 + 2

P.26	Sitka spruce	2 + 2
	European larch	2 + 2
P.27	European larch	3 + 1
	Norway spruce	3 + 2 + 1
	Sitka spruce	3 + 2
P.28	Japanese larch	3 + 1
P.29	Sitka spruce	2 + 2
	Hybrid larch	2 + 2 and 2 + 1 + 1
P.30	Sitka spruce	3 + 3 and 2 + 1 + 2
	Norway spruce	3 + 2 + 3
P.31	Sitka spruce	2 + 2 + 2
	Norway spruce	2 + 2 + 2
	Japanese larch	2 + 1 + 1
	European larch	2 + 1 + 1
	Pinus contorta	2 + 1 + 1
	Abies nobilis	3 + 3
P.32	Sitka spruce	2 + 1 + 1
	Norway spruce	3 + 1 + 2

(c) Methods of Planting

In P.23 and 24, direct notching with the 'Schlich' planting spade only was used.

In P.25 - 28, mainly notch planting, with a little pit planting, was done, and a very small amount of turf planting was started in P.28.

In P.29, turf planting was on an appreciable scale in the wetter areas, for planting spruce, the rest being notch planted.

From 1930 to 1932, more and more turf planting was done, so that, by 1932, at least half the planting was on turves, and from then on turf planting became general, except on the very best ground where notch planting continued to be used until about 1936.

(d) Annual Rate of Planting

The main bulk of the planting was completed by P.33, and thereafter it was small areas of wetter and tougher ground that was being planted.

The average rate of planting from P.23 to P.33 was about 140 acres per annum, and from P.34 to P.48, in 8 P. years, further areas were planted at the rate of about 20 acres per annum.

(e) Manuring

The use of slag at Ratagan is first mentioned in connection with the beating up operations in 1933, but it appears not to have been used at the time of original planting until 1934 - the last year of the main planting programme.

Slag (and later ground mineral phosphate) appears to have been regularly used in all beating up operations from that date. From 1934, also, a "consolidation" programme was started, and at this time slagging of existing "checked" plants in backward areas was done.

(f) Success of Establishment

An assessment made in 1932 showed that 296 acres were established and 1103 acres not established at that time.

By 1935, 807 acres were established and 634 not established
" 1938, 1116 " " " " 330 " "
" 1947, 1429 " " " " 76 " "

Progress towards establishment has, therefore, been very satisfactory.

(iv) Ploughing

No ploughing was done on Ratagan Forest.

(v) Beating Up

As already noted, in all the main planting, very extensive and probably excessive beating up was done for three years after the original planting. From the third year after planting, beating up was continued on a reduced scale, and in all these works the original species was generally used in beating up.

In 1934, a definite consolidation programme was introduced, which comprised a full cleaning of existing drains, and the making of many additional drains, particularly in the areas planted in the first few years (where the original draining was very inadequate), and in all "checked" areas, which were mainly in inadequately drained wet hollows and on wet ridges and slopes with a tough peat covering.

In this consolidation operation (which lasted from 1934 to 1943), Sitka spruce was the main species used, being planted invariably on turves and slagged. Scots pine and Pinus contorta were also used, to a much less extent, while Oregon (and some grey) alder was also extensively used up to 1936. Most of the alder have since died out or remain as stunted bushes.

All the plants used in beating up were slagged or given ground mineral phosphate, the first use of which is noted in 1933, and at the same time, existing checked plants, whose recovery seemed possible, were also manured.

The results of the consolidation work and extra draining have been very satisfactory, except on a few tough peat ridges and knolls, where progress towards establishment still continues in most cases, but is very slow. It seems probable that better results in such places would have been achieved if more Scots pine and Pinus contorta had been used and less Sitka spruce.

In 1931, beech was used to interplant through the larch areas of almost all areas planted to that date, and in P.30, about 2 acres of larch was similarly interplanted with Abies nobilis. Roe deer, which found cover in the established spruce areas, played havoc with the interplantings and only occasional plants have survived, which are of little importance in the crop now.

In general, big plants were used in all beating up operations. The plants used in interplanting were generally 2 + 2 or 2 + 2 + 1, beech and Abies nobilis.

(vi) Weeding

The main weed species throughout was bracken and luxuriant growth of grasses. In addition to the cutting of bracken for one or two years prior to planting, cutting of bracken and grass was continued for several years after planting. In some cases, almost the whole planted area had to be weeded for about three years after plantings, and continued, in the worst cases, on an annually reduced scale for as long as ten years after planting.

In only a few areas, where growth of bracken was exceptionally heavy, was bracken cut more than once in a season.

While it now seems that weeding was done on too big a scale and continued for an unnecessarily long time in some cases, there is little

doubt that the quick and even establishment of the crop can be largely attributed to the extensive and thorough weeding regime adopted at this forest.

(vii) Mixture of Species

So far as records go - and examination of the existing crop bears out this statement - practically no intimate mixtures were originally planted at Ratagan forest, with the possible exception of small areas on hard knolls and even then, mainly at the upper planting limits, where some Scots pine and mountain pine were introduced among the Norway spruce and Sitka spruce. Even this is doubtful, as the mixture in these places may have been made at the time of subsequent beating up.

In general, species were planted in pure blocks, the species most suitable for the changing soil conditions and exposure having been selected and planted. The heavy beating up in the first two or three years after planting was usually confined to using the same species as had been originally planted.

Such intimate mixtures as do occur are almost all the result of the "consolidation" beating up which was carried out over the long period 1934 - 1943 (the introduced species being mainly Sitka spruce and alder (mainly Oregon but some grey), with a fair amount of Scots pine and Pinus contorta and some small quantities of mountain pine, Thuja, Tsuga and Abies,) and also the introduction of Abies nobilis and beech by interplanting through the poor larch areas, mainly European larch.

Of all these, the areas which carry intimate mixtures of any extent and importance to-day are confined to the following:-

(a) Douglas fir and Sitka spruce. (b) Norway spruce and Sitka spruce. (c) Sitka spruce and Scots pine or mountain pine or Pinus contorta.

In addition, beech and some alder still persist in many of the larch areas, but generally only a few beech remain to the acre, and these broad-leaved species are very stunted and twisted. It is doubtful whether more than a very few will persist to the end of the rotation, and the only effect they are likely to have is as soil improvers. They are unlikely to be of any value for timber.

(a) and (b)

In the case of these mixtures, the main crop will continue to be the originally planted species, i.e. Douglas fir or Norway spruce, and the introduced species (Sitka spruce) which is generally more vigorous and of better form than Douglas fir will only form a small part of the final crop. It will generally be favoured in Douglas fir, but in Norway spruce it will be treated equally with the Norway spruce, keeping whichever species will be more valuable and will fit in best with the general crop up to the end of the rotation.

The inter-action of one species with another is not clear, and the main value of the introduced Sitka spruce is to give a useful crop on areas too poor for the original species.

(c)

Here the original choice, Sitka spruce, was beaten up with a pine, and this mixture occurs mainly on the harder knolls and at the top of the planted areas. The pines have, in some cases, suppressed the Sitka spruce, which never came out of check, but generally the pine has and is acting as a nurse, and the spruce is coming out of check. Each area will be treated on its merits in deciding whether to retain some or all of the pine permanently or for only part of the rotation.

Rate of Growth, Form, etc.

A tabular statement is given as Appendix IV which describes the growth and condition of the main species, in areas selected as showing the best growth for that species.

The following comments have more general application to each species :-

Hybrid larch

Growth and form are both generally very good.

European larch

This species appears generally to be unhappy. Attacks of canker and die back have left most crops rather open, with many trees looking sickly, crooked and showing poor growth. There are now signs that the crops as a whole are recovering and growth appears slightly more vigorous.

Japanese larch

Growth generally is good, but the form is variable. There are many rough-headed and bent stems and, in some cases, the greater part of the crop is composed of this type of tree. But generally such trees occur as wolves in a crop of good form, so that thinnings should enable a crop of good form to emerge after about three more thinning cycles.

Douglas fir

Growth is generally good, but the crop generally is of the coarse-branched type of tree, with stems not quite straight and much tapered. Volume yields will probably be good, but quality poor.

Sitka spruce

Growth is generally very good, and form also is generally good. Almost all faulty stems are removable in the first two thinnings. There are, of course, backward areas on poor sites, but even these show promise.

Norway spruce

Growth is generally satisfactory, with the exception of backward patches which are more frequent than in Sitka. Form is fairly good generally, but there is in most areas a tendency towards swollen bases of branches, and often much fluting at the base of the tree, with signs of spiral grain in many stems.

Scots pine and Pinus contorta

The small areas of these species are usually on exposed sites with poor soil. Bearing this in mind, growth is satisfactory and form fairly good, except for the tendency in Scots pine towards swollen bases of branches giving a rough stem.

Abies nobilis and Abies grandis

Growth is fair to good for both species, with Abies grandis the better. Form is poor for Abies nobilis, with stems often slightly crooked, branch bases swollen and taper quick. The form of Abies grandis is usually good.

Mountain pine

Growth is fair and form hopeless.

Tsuga and Thuja

Growth and form are both fair, but there have been severe losses in the Thuja.

Broad-leaved Species

Beech, used for underplanting, persists as slow-growing misshapen bushes. Patches of sycamore are growing well, but are of poor form. Very little alder persists as stunted bushes, except along the burn sides.

(ix) Past Treatment of Established Plantations

The first opening up of established plantations took place in 1935, when the removal of "wolf" trees was started over some 2 acres of Japanese larch in P.23.

In 1937 a small acreage of brashing was started in Douglas fir, European larch and Japanese larch in P.23 - 26 acres. The method of brashing has always been the same and comprised the removal of side branches to a height of 6 ft. - 7 ft. of a varying proportion of stems, but always choosing the best stems for brashing. In the early days, only the very poor stems were left unbrashed. Later, as a measure of economy, only the best were brashed. Thus, to begin with, all stems left after first thinning had been brashed, and many brashed stems were removed; whereas, in later years, almost none of the brashed stems were removed in first thinnings, and some unbrashed stems remain even after two thinnings.

The area brashed increased annually, being some 60 acres by 1940, and 200 acres in 1945; and then dropping to about 90 acres in 1950, at which figure it is likely to remain for some years.

Cleaning was generally done along with the brashing, and this remains the practice, the areas increasing and decreasing corresponding to the brashing, though less in area.

Pruning was done to a height of 15 ft. over 2 acres on trees selected as likely to remain to the final crop, over some 2 acres in Compartment 1, P.23, as an experiment, in 1937.

Thinnings, which were started on a small scale about 1938 in Douglas fir and larches (2 - 3 acres), increased in these species in the areas first planted to some 20 acres in 1940, then stayed steady at 30-40 acres per annum up to 1943, still in the same species. Very little

preparation of produce or extraction was done up to this time, and this was mainly for fencing material. In 1944, the thinning programme increased to 100 acres and remained at about that figure or rather less until 1950. It was in this year that first thinnings in Sitka spruce were started. Extraction increased, and pitwood production started in 1944, since when about 10,000 cu. ft. of pitwood and fencing material were produced annually until 1950. For the period 1950 to 1954, the thinning programme is expected to be in the neighbourhood of some 150 to 200 acres per annum.

As regards intensity of thinning, the only thinnings done were rather light, but, as the areas of larches and Douglas fir to be thinned were small, second and third thinnings were done after two to three year intervals, and the thinnings were adequate to keep the crop open and healthy

The thinnings in Sitka spruce in 1944 and up to 1949 were also light and, due to the war years and increasing areas, subsequent thinnings were delayed. In 1949, the intensity of thinnings was increased and appears to be satisfactory, provided a return can be made in three years to do a further opening, or within five years at most.

Due to the very great numbers of stems to be removed in the somewhat delayed thinnings in some Douglas fir and Sitka spruce areas, it has been found better to leave much of the smaller, uneconomic and dead or suppressed poles standing at the time of first thinning, to decrease the amount of lop and top on the ground, to make the horse extraction easier, and also to protect the trees to be left. This practice appears to be sound and is to be continued. Such stems are generally removed at the time of second thinning as a measure of "forest hygiene."

The main products from these forests so far have been fencing material (from the larch) and pitwood from the rest of the larch, the Douglas fir and Sitka spruce, and from the small quantity of Norway spruce so far thinned.

Much of the earlier thinnings, except in the most accessible areas, were left lying due to extraction difficulties. The heavy thinning programme carried out in 1949 brought this problem very much to the fore, and in that year the first heavy road-making programme was undertaken. The road system started in 1946 on a small scale, began to bear fruit in 1949-50, and the roads alone brought many areas within the range of economic extraction. A caterpillar and sulky; a wheeled tractor fitted

with 300 yards of hauling cable and a winch, and a light outhaul cable, for dragging timber; wooden chutes; together with a very early and not very successful overhead cable extraction system; all these methods have been and are being tried, to supplement the normal horse-drag and lorry extraction. It seems that those and other methods will all have their uses in the varying conditions of slope, and soil conditions, on this forest. Recently, a three year contract for sale of timber at Ratagan and Inverinate jointly has been entered into with a timber merchant (Messrs. J. Macdonald, Inverness) under the provisions of which 251 acres have been sold standing and 380 acres will be felled, sned and extracted to roadside departmentally in this three year period, from Ratagan Forest. From these areas, the anticipated yields are expected to be in the neighbourhood of 66,000 cu. ft. (standing) and 86,000 cu. ft. (sale at roadside).

Appendix V comprises a statement of data obtained from 1/20th acre thinning plots.

Research

There are no Research Branch areas on Ratagan Forest, but there are five permanent sample plots which have been reported upon as follows:-

"In March, 1949, five permanent sample plots were established in Ratagan Forest.

These plots cover the growth of five species from different P.years and on various sites. Details are as follows:-

Plot No.	Site	Species	Age (1949)	Quality Class
195	Compartment 23	Hybrid larch	22	-
197	" 40(B)	European larch	17	I
198	" 5	Sitka spruce	19	III
199	" 6	Pinus contorta	16	-
200	" 19	Norway spruce	23	I

With variables of age and location particularly elevation, the plots are not strictly comparable. The data, however, show that the hybrid larch with a top height of 50½ ft. have at present outstripped the others in height growth, for the next best, the Norway spruce of Quality Class I, are 7 ft. shorter.

At their establishment thinning, plots 195, 198 and 200 respectively, produced 622, 620 and 538 cubic feet per acre Q.G.U.B. and they are again due for treatment in 1952.

The Pinus contorta was the slowest growing species of all for its average height at 16 years was 24 ft. and canopy was not yet complete.

(Signed) Alex. M. MacKenzie."

18.8.51.

(xii) Conclusions in the light of experience gained

As far as the planting and establishment of the forest is concerned the main conclusions to be drawn are that the selection of species for planting and the methods of planting and subsequent tending adopted were on the whole sound. In regard to choice of species, for original planting, only European larch appears to have been used on too great a scale, and in unsuitable sites, to any considerable extent.

Sitka spruce and Norway spruce were generally correctly selected for the sites, but in some cases more pine should have been used, generally as a nurse, but in a few of the worst cases, in place of the spruce, especially on the most difficult hard knolls at higher elevations.

The necessity for full draining and turfing in the wet peat areas became apparent very early, and extensive additional draining and mounding was done as soon as the need did become apparent, together with the use of phosphatic manures, as soon as the need and advantages of this became known (about 1934).

The futility of attempting to interplant larch with any species without adequate opening up, particularly where roe deer have become established in neighbouring thickets, has been proved beyond doubt. The fine crops of hybrid larch obtained on Ratagan indicate that this species should be used to the greatest possible extent on suitable ground in similarly situated forests, to the exclusion of European larch, except on the very best ground. Japanese larch should similarly be used in preference to European larch. Pines should always be used in mixture with Sitka spruce om the poorest sites and on knolls, as a nurse.

The quality of Douglas fir is generally rather poor, tending to have coarse branches, slightly crooked stems, and a quick taper. The sites

selected for planting this species seem suitable, and the poor quality is, therefore, probably due to using plants from seed of unsuitable origin. Had the seed been from trees of suitable type, the crop would probably have been quite satisfactory. Alternatively, the excellent growth and form of Sitka spruce introduced in beating up Douglas fir areas shows that this would have been a satisfactory alternative.

The conclusion to be drawn here is the necessity of ascertaining the quality of Douglas fir seed sources, if this species is to be used, and of further experiments to see if this, and not site factors, is the reason for the poor quality of Douglas fir found so often on sites apparently suitable for the growth of this species.

Comments by Mr. J. Fraser, Conservator North (Scotland)

Page 1 - Name

The name "Ratagan" means "small fortified enclosure" (see Watson's "Place Names of Ross and Cromarty", page 172). The name "Bealach Ratagain" (the pass of the small fortified enclosure) is probably a great deal older than the name of the farm. There are other local explanations of the name "Ratagan", but the authority quoted is reliable.

Page 5 - Acquired Plantations

Drummond records correctly that there are no acquired plantations of any importance. A note of a few older trees planted on the land should be recorded.

In the Allt Ratagain below the water-fall, there are about thirty trees, Norway spruce, aged probably 60 years. At acquisition, there were more trees, but the Commission felled and used for fencing of early plantations some of the acquired trees. The timber was used to make split stobs.

In Compartment 26 there were the remnants of a larch plantation felled about 1905 by Morgans of Crieff. Poor trees in the plantation were left, and some of those were standing when I first saw the place in 1931. There are still a number of those larches scattered through the planted larch. A few scattered larches through the planted larches of P.26 in the valley of the Allt na h'Inghinn are possibly naturally regenerated trees. There are remains of stumps of wide spaced larches in P.27.

There is reported to have been a small European larch plantation in Compartment 4, now P.30, which was cut in P.20 before acquisition by the Commission.

Page 8

The old twisted road over Mam Ratagan is part of the old military track giving access to the barracks at Glenelg. The mason work on the bridges is worth examination. (See "The Road from the Isles", Pochin Mould, 1950, and "Wade in Scotland", Salmond, 1938). The track and the pass existed long before they were improved for the use of foreign garrisons.

Page 6 - Geology and Soils

A 6 in. sketch map showing the geological information is forwarded along with the plan. A green crayon line shows the outlines of the plantations. The map is useful as some measure of the use which we can make of geological information. The area is probably one of the most fertile properties which we have acquired, but a planting prescription based on maps alone might be far off the mark. Differences of slope, elevation and minute configuration of the surface exercise very marked effect on the soil and on the soil fertility on the one rock type. Again, in the south east corner of P.23, the soil overlying rocks with a poor character for fertility shows a fast growing Japanese larch crop.

Page 10 - Choice of Species

Our biggest mistake in choice of species was in the use of Norway spruce for the high elevation planting of P.23 and P.24. The mistake was one of the time and was not confined to the North Conservancy, but the lesson was learned; perhaps even too well. In earlier years also, in spite of many lessons in the matter of planting European larch, we failed to appreciate the importance of natural drainage. We failed also to appreciate the effect which the dead herbage from a heavy grass crop may make on the water retained in a soil when that dead herbage is left on the soil surface. We failed also in providing sufficient surface drains to counteract this effect. The "unhappiness" of the European larch, the swinging and the twisted form must be partly attributed to those drainage faults.

Page 14 - Oregon alder

The amount used was small. Ratagan was one of the few places where the species was given some reasonable chance on mineral soil. In most places we expected too much from all the three alders, and in most places the trees developed stag-headed crowns very early. This was specially true on peat covered soils. In P.27 Oregon alder seemed to have done a useful service in filling up gaps in Douglas fir and grew well up to the winter of 1946-47. The frost of that winter killed many, but there were a few survivors. The Director (Scotland) stated recently in conversation that, if we are to try Oregon alder again, we should make certain that the home conditions of the imported strain are at any rate something like our own. He quoted a Danish Forester in support of the view.

Page 21 - Conclusions

Ratagan experience, along with the experience of other west coast forests, allows the view that Douglas fir should be grown in those forests only on soil which has a good natural drainage in the sub-soil. Scott's later views on the importance of using strong stocky plants once or twice transplanted deserves the greatest respect, and he learned from his misfortunes.

Mr. James MacDonald, Director of Research, at his one visit to the forest, made the observation that there should be no undue hurry in clear felling of small failure patches of either European larch or Japanese larch. He made the point that any mature survivors would probably be a hardy stock worth considering for future seed collections. The observation might be considered along with the plans which must be made within the next twenty years for the formation of permanently uneven aged woods within the forest.

On the adjoining property of the Baillie Estate, close to the Baillie Ratagan boundary, there is a useful demonstration of the unaided power of recovery of a poorly grown and neglected plantation. Twenty years ago, the wood appeared to be fit only for immediate felling, even in the best patches. To-day the good patches are worth thinning, and the wood is worth thinning and consolidation.

Appendix I

Notes from Inspection Reports

(i) Inspection in June 1926 by J.A. MacAlpine

It is noted that planting to date was by Schlich spade, the plants being "notched" in after screefing. The types of soil and vegetation were noted as falling into four main types:-

Type	Soil	Vegetation	Species Planted
1	Shallow peat varying from 1 in. - 4 in. in depth over a heavy dark loam intermixed with small rock particles.	Juncus, Erica, Calluna, Carex, Myrica, with some Scirpus, patches of Polytricum and bracken where the peat disappears.	Japanese larch European larch Sitka spruce.
2	Deep reddish loam - on a section of the area previously cropped with European larch.	Bracken, Molinia Aira and other grasses.	Japanese larch European larch
3	Fairly deep peat (6 in.-12 in.) mixed with small rock particles and a visible amount of mineral matter.	Myrica, Scirpus, Northecium with Erica and Calluna.	Sitka spruce Norway spruce
4	Loose gravelly soil on banks of streams composed chiefly of partly disintegrated rock, but with sufficient finer particles to form a good forest soil.	Chiefly Erica, with Calluna and bracken.	Douglas fir

Comments on choice of species and present conditions of growth at the time of inspection can be summed up as follows:

Generally speaking, the soil conditions seemed quite suitable for the species chosen. Possibly mountain pine would have been a better selection than Norway spruce in some places. More intensive planting methods would have been advantageous and the use of mattock planting was suggested.

Sitka spruce

Noted as doing well and very satisfactory.

Norway spruce

Some of the worst soil conditions were found in this area, and here satisfactory growth of any species was not to be expected. It was noted that growth was good in the better sections, and that the addition of a few surface drains might yet give a fair crop all over.

Douglas fir

About 2 acres were beaten up with Norway spruce, and now the area was fully stocked and all plants looked extremely healthy. About 2/3 of the Douglas were believed to be of Fraser River origin and their height growth was not so great as the rest of Oregon origin.

Japanese larch

Excellent growth and very few casualties noted.

European larch

Parts of the area had made a good start, but voles had caused considerable damage. Elsewhere, plants did not recover from the check of planting, and Sitka spruce was therefore introduced in 1926 beating up. Very heavy vole damage occurred, about 90% of the spruce being cut back, though many sent up fresh shoots. It was noted that, where Sitka spruce had been planted in 1925 in parts immediately alongside the 1926 beating up Sitka, the beating up plants had been attacked by voles but the 1925 plants were untouched by voles.

(ii) Inspection by F. Scott, Divisional Officer - April 1928

P.23 Norway spruce

Still backward. Any further beating up to be done on turves.

P.23 Japanese larch

1927 Beat up plants were of poor quality. More filling up should be done in 1929 if good quality plants available.

P.25 Norway spruce

Recovery in colour good and plants will soon be free of ground vegetation, which is less rank here.

P.25 Sitka spruce

Slow improvement noted in worst areas, but elsewhere crop is now established and growing well.

P.26 Japanese larch and hybrid larch

Full stocking and good growth noted, and it was now thought that the very intensive beating up given was scarcely necessary.

P.26 Norway spruce

Colour good but growth poor, especially in less fertile areas.

Mass weeding will have to be continued for some time over most of the area.

(iii) Inspection by Sir John Stirling Maxwell, Assistant Commissioner and Divisional Officer - October 1928

P.24 A poor area with Scirpus, Calluna, Erica tetralix vegetation planted with mountain pine showed fair recovery. Part of this area to be experimentally planted with Sitka spruce on turfs from turf drains, giving basic slag to half the section so planted. Douglas fir growth noted as good, and Sitka spruce variable, depending on site factors, but generally satisfactory. European larch noted as of a better type than usual.

P.25 Recovery of both spruces patchy but promising.

P.26 Norway spruces and larches are forming an encouraging crop, but most of the European larch was considered to be of a poor type.

(iv) Inspection by Commissioners - April 1935

Present - Sir Alexander Rodger, Major Strang Steel and Mr. H.C. Beresford Peirse, District Officer.

A general inspection of P.29, 30, 31 and 32 in Moyle showed excellent growth, which Major Strang Steel stated was, especially in regard to spruce, the best stocked and most promising block he had seen in the north. The intensive initial draining and subsequent deepening of a proportion of the original drains was favourably noted and stressed as being an important deterrent to future windblow.

(v) Inspection by Chairman - June 1937

Present: Sir Roy L. Robinson, Chairman.
Mr. J. M. Murray, Asst. Commissioner (Scotland)
Mr. J. Fraser, Divisional Officer (North)
Mr. F. Oliver, District Officer.
Mr. D. S. Spraggan, District Officer.
Mr. W. Murray, Forester.

Inspection of Japanese larch, just pruned preparatory to thinning in P.23, and hybrid larch in P.26, convinced all present of the necessity of breaking the canopy to allow smaller but better stems to develop. The Chairman suggested that the Divisional Officer (North) should thin an acre as an example of what was required.

An area of P.27 where Douglas fir had been beaten up with Sitka spruce was inspected. Divisional Officer (North) stated that the intention was to cut out the rough Douglas fir and let the Sitka spruce go through to the final crop. The Chairman and Assistant Commissioner disagreed and said the Douglas fir should be left to form canopy and then be treated from below by under-planting with Tsuga or other shade-bearers.

It was agreed that "consolidation" work in backward areas in P.25 should be continued, but that it should not be done too far up the hill. Draining reconsolidation on Moyle should proceed. The squad should be kept at about 8 men.

The Chairman's observations on this visit were:-

"In this and other forests, where planting is approaching completion, and the necessity of keeping permanent men employed is a consideration, I hope we shall not be led into "tinkering" with plantations. Much money can be wasted in striving after the perfect plantation. More useful is the work that can always be done with advantage in improving accesses.

R.L.R."

(vi) Inspection by Divisional Officer (Mr. J. Fraser) and District Officer (Mr. D. S. Spraggan) - August 1938

It was decided to try alders on knolls to attempt to nurse up Norway spruce in P.26 and 27.

Also to remove the worst European larch trees and try under-planting with Norway spruce.

Where larches in Moyle had been beaten up with Sitka spruce, these should be cleared of rough-headed larches, but, where the larch was reasonably good, no help should be given to the Sitka spruce.

Similarly on Ratagan P.26 and 27, Sitka spruce in Douglas fir areas should be aided by removal of very rough Douglas fir, but should not be given special assistance where the Douglas fir was forming a good, if somewhat rough, crop.

(vii) Inspection by A/Assistant Commissioner - February 1943

Present: A/Asst. Commissioner, Mr. A.H. Gosling.
A/Divisional Officer, Mr. A. Watt.
District Officer, Mr. A.M. Fraser.
Forester, Mr. W. Murray, Grade I

A small area of Japanese larch in P.23, just ready for thinning, was inspected and the type of thinning was agreed after demonstration by Messrs. Gosling and Watt.

A discussion on the possibilities of sea transport was held. It was noted that in European larch and hybrid larch already thinned in P.26 more still required to be taken out, especially semi-suppressed European larch stems still retained after thinning.

Areas of P.23 where Japanese larch was developing mis-shapen crowns were examined with a view to future treatment. It was decided that correct procedure appeared to be successive heavy thinning, in which spruce could be introduced by underplanting where this still appeared necessary. Clear felling and replanting could seldom be justified, however high the proportion of bad stems might appear to be.

The need to increase labour and provide extraction routes to cope with the big areas of Japanese larch on Moyle just reaching the thinning stage, was noted and discussed.

(viii) Inspection by Chairman - August 1943

Present: Chairman, Sir Roy L. Robinson.

A/Asst. Commissioner, Mr. A. H. Gosling.

A/Divisional Officer, Mr. A. Watt.
Mr. C. A. Connell.

District Officer, Mr. A. M. Fraser.

Forester Grade I, Mr. W. Murray.

Extraction problems were discussed in connection with thinnings in European larch, Japanese larch and hybrid larch in P.26 taking place as required. The necessity for proper drainage and water control on all roads and tracks in such places was emphasised, and the suitability of such sites for wire rope extraction was pointed out by the Chairman, who explained the method. Equipment for this was being arranged by the A/Divisional Officer.

The necessity for carrying out thinning in larch, whether extraction was possible everywhere or not, was emphasised by the Chairman. In the worst European larch areas, the Chairman advised heavy thinning and underplanting with such species as Tsuga, Norway spruce and Douglas fir.

The exceptionally good stocking, growth and form of hybrid larch as compared to European larch was pointed out by the Chairman.

In connection with the suggested underplanting, and with a small area so treated with Tsuga as the underplanted species, the possibility of heavy roe damage (seen in the underplanted area) was discussed. It was pointed out by District Officer that control of roe deer was almost impossible until neighbouring spruce areas (which harboured these deer) had reached the brashing stage. Very slow growth of Norway spruce P.26, planted on heather, was noted, and the Chairman stated that the choice of species was wrong, and should not be repeated in such places, even though drainage did assist the spruce. The moral was pointed by observation of a bracken and heather knoll planted with spruce and Scots pine where the Scots pine was showing excellent growth.

Later, a visit was paid to Moyle. The excellent and comparatively even growth and full stocking on this section was noted, with only European larch again showing less promise than the other species.

A small area in P.33 showing good growth of Pinus contorta and poor growth of Sitka spruce on a poor heather knoll was visited, and a plot in P.26 where the mountain pine planted then was planted through later (P.37) with Norway spruce and Sitka spruce. The spruces looked promising on the better type of peat, and the Chairman advised the cutting back of branches of the mountain pine where these were interfering with the growth of promising spruces.

Chairman's Observations of this Note

Ratagan, with the exception of "heather" ground (to which I refer in a separate General Note) has developed well. The Moyle section as seen from the road looks particularly promising and was a pleasant surprise to me.

"R.L.R".

Chairman's General Note on Certain Forests in the Western Highlands, following Inspections at Achnashellach, Ratagan, Inverinate, Slattadale, North and South Strome in 1943.

Afforestation has now been proceeding long enough to show up clearly the main successes and the main failures in these and similar areas, and it is the purpose of this note to draw some conclusions and to speculate on the future lines of advance.

The natural conditions in relation to tree growth are of course not identical in all the forests but broadly speaking they are very similar. The climate is maritime, very wet, and exposure to westerly winds considerable except at relatively low elevations. Spring frosts can be a nuisance locally. The soils are broadly either "creep", and are then associated with a good surface vegetation or the remnants of indigenous broadleaved species; or morainic, associated with heather and heather associations characteristic of the wet mild climate. This broad generalisation omits "flush" types and inter-moraine peat developments.

The growth of selected species on the first broad type is very rapid. The chief problem is to select from the spruces, larches, Douglas fir, etc., that which will give the optimum result, and there is already enough evidence on the ground to avoid gross errors in the future.

The second broad type, namely, the moraines, constitutes the major problem in afforestation. Morainic deposits are often more extensive than would appear at first sight. In the valleys and on the lower slopes they are easily detected by their characteristic rounded shape, but they also occur extensively higher up the hills in less characteristic form. They are sandy in composition and on most, I suspect, the soil has been leached and a pan formed. Our experiments show that, except in exposed places, it is possible to raise certain species (Japanese larch, hybrid larch, Sitka spruce, Pinus contorta) moderately well, provided the surface is deeply trenched and basic slag is applied.

Practically everywhere the planted morainic areas show up as backward or unstocked. Spruce (generally Norway) was planted in the earlier P. years and was quite obviously the wrong choice. Extensive deep drainage has got the plants slowly on the move in some cases, but future development

also is bound to be slow.

The first important point to note is that the morainic soils require special attention and the second that they can be detected with certainty before planting. The gross errors of the past can therefore be avoided if only by refraining from planting. That course, however, would be a confession of impotence to which I am not prepared to subscribe.

How then are we to proceed? There are two courses open: first the mechanical method of developing our ploughing technique to overcome the special topographical difficulties and second to adapt our silvicultural methods to the special conditions. Both courses must be explored. I have asked that the experimental ploughing shall be pushed at Achashellach next spring. Here I am concerned only with the silvicultural method, which incidentally should help also on ploughed ground.

I think it is almost certain that these moraines were originally covered with Scots pine which reached pleasing dimensions on the lower parts and presumably tailed off into scrub at higher elevations.

There is evidence that the indigenous pine when planted will behave in much the same way though probably the first crop will be poorer and the limit of scrub pine will be lower than with the old indigenous forest. If therefore we had planted Scots pine originally on many of the morainic deposits the lower parts of the forests at least would have presented a continuous as opposed to the present moth-eaten appearance. On the other hand, on the upper moraines, the Scots pine would have been blasted and as a pure crop would have been hopeless.

In the experimental treatment of moraines more attention has been paid to Pinus contorta and mountain pine than to Scots pine and more attention still to the larches (hybrid and Japanese) and spruces than to the pines. In my opinion the pines are a better pioneer crop than the larches or the spruces because they are deeper-rooting and thus activate a greater volume of soil. How far this is essential in such a wet climate remains to be seen. I have seen Sitka spruce growing really well up to 30 years on almost bare igneous rock at Thirlmere (Lake District). Nevertheless, depth of activated soil is obviously of importance and I view with some suspicion the shallow-rooting habits of the spruces and larches in pure plantations.

Coming now to the characteristics of the individual species. My present view is that as regards the pines, Scots pine should be planted pure on these sites which are reasonably sheltered and in mixture with Sitka spruce on those sites where it will develop sufficiently well to get the spruce away. Mountain pine I would relegate to the worst and peatiest morainic sites again in mixture with Sitka spruce. I am still uncertain of the part Pinus contorta should play. It suffers severely from deer damage which is a great drawback. Silviculturally, it is in some ways unsatisfactory: it casts very little shade compared with Scots pine and mountain pine and is therefore slow in suppressing surface vegetation. It is very apt to be top heavy and to grow crooked. On the other hand, it appears to be deep-rooting and to stand exposure better than Scots pine. I know there is a difference of opinion on the status of this species, and I think it important to review the data which are available. My own inclination at this stage is to rely much more on the indigenous Scots pine than on a tree of which we have relatively speaking very small experience.

As regards the larches we can obviously write off European larch at any rate in pure crops. I was impressed with the growth and form of hybrid larch on good sites but on the experiments on moraines there did not appear to be much in it between hybrid larch and Japanese larch up to 8 years or so. I did not see any older experiments.

To summarise my views as to possible future advances in the treatment of morainic soils:-

(1) An important point to be kept in view is the deepening of the active soil. This can be started by ploughing and where that is impossible by deep rooting species which should also form a part of the crop on ploughed ground.

(2) We require to know far more about the rooting systems of all species which come into consideration. This calls for systematic investigation not only of experimental areas but also of older stands. For example, we should learn a lot by investigating the root systems of Scots pine and European larch on the areas being felled near Achanalt. The loan of a caterpillar from the Newfoundland Unit would enable stumps to be uprooted easily.

(3) We require to know more about the silviculture of the indigenous Scots pine on the West Coast - how much exposure will it stand, how fast does it grow, and so on - I have the feeling that with soil preparation it will not only grow quicker but will also stand a good deal more exposure than we have hitherto thought.

"R. L. R."

(ix) Inspection by Chairman - September 1947

Present: Chairman, Lord Robinson.
Conservator, Mr. J. Fraser.
Divisional Accountant, Mr. M. Nicolson.
District Officer, Mr. Orr-Ewing.
Head Forester, Mr. W. Murray.

The road work on Moyle was seen, and the Chairman emphasised the need to use mechanical equipment as fully as possible in such places which lent themselves to this, and especially where there was, as here, a labour shortage.

Small patches of Japanese larch in P.30, being thinned, were inspected and the Chairman observed that such small patches were a nuisance and should be avoided, as they needed more frequent attention than the crop as a whole, and extraction from such small scattered plots was difficult.

In P.30 some poor European larch was seen, and it was decided that this should be well thinned out as it was too early to decide whether it would form a useful crop or not. In P.31, Japanese larch of poor form was inspected. The Conservator considered it might be advisable to thin out heavily and put in groups of Norway spruce and Sitka spruce.

The Chairman said he would prefer to see two more routine thinnings carried out before making the decision. If the crop was still poor after this, the next thinning thereafter should be heavy, and the crop underplanted with Douglas fir or Norway spruce. He did not favour the use of Scots pine as an under-plant. The Conservator canvassed the more extensive use of Abies grandis for such work. The Chairman said he had a theory that, if larches in general were green-pruned at an early age, many diseases which later spoilt the tree would be avoided, as such attacks usually started low down on the tree in recent wounds there.

A discussion on the choice of species for planting on hard knolls led to the Chairman commenting that the previous winter had proved Pinus contorta was too frost tender and that he would like to see more Scots pine used in such places. The Conservator suggested a trial of Pinus banksiana. He did not altogether agree that Pinus contorta could be condemned, but the use of Pinus contorta with Sitka spruce had given trouble because of the rapid growth of Pinus contorta, and for this reason, he was suggesting Pinus banksiana, a slower growing non-exacting pine, as a solution for the difficulty.

(x) Inspection by Conservator (Headquarters) - February 1949

Present: Conservator (H.Q.), Mr. A. Watt.
Conservator (North), Mr. J. Fraser.
District Officer, Mr. D.S. Spraggan.
Head Forester, Mr. W. Murray.

Ratagan Section

Thinnings in progress and recently carried out were inspected in P.26, Compartment 12; P.29, Compartment 8; P.24, Compartment 26, the species being Sitka spruce.

Discussions mainly concerned the period of time which could be expected to elapse between thinnings, the intensity of thinning to be done and possibility of using length of crown or the proportion of length of crown to total height, as a guide in this matter. Also, on the stage at which first thinnings became necessary in a Sitka spruce crop.

The general consensus of opinion was that, while shorter thinning cycles might be advantageous, the limitations imposed by labour and increasing areas becoming ready for thinning, made it probable that a five year thinning cycle would prove reasonably satisfactory, and possible to achieve. In view of this, thinnings should probably be heavier than they were being done. The small suppressed trees had been left standing, as the forester considered that it was more economical to do so, and it avoided littering the ground. They did not interfere with extraction so much when left standing, and helped to prevent damage to good stems in dragging operations. Although it left the appearance of the crop denser and more ragged, this had no adverse effect on the crop.

In one area where thinning had been delayed, the crowns had been reduced to 1/4th to 1/5th of the total height, and it was estimated that 15 ft. to 20 ft. or about half of the crown had died by congestion and suppression in one season. As height growth was continuing, the crowns appeared to be recovering satisfactorily after thinning.

Thinning in hybrid larch P.26 was inspected. It was agreed that a five year thinning cycle would now seem adequate here also, but a few more trees should be removed if the area had to be left for five years.

Areas of P.24, 25 and 26, originally planted with Norway spruce, but beaten up with Sitka spruce on turf, after draining and slagging in 1937, were inspected. Both Sitka spruce and Norway spruce were now making steady growth except in the very worst patches.

Moyle Section

Thinnings in European larch and Japanese larch were inspected and particularly small areas in P.30, 31 and 32, where underplanting in gaps with Norway spruce and Sitka spruce had been attempted. These appeared to be doing well, and it seemed clear that the ground was more suited to these species than to larch. While it was uncertain whether European larch and Japanese larch would eventually make a reasonable crop or not, it seemed probable that it would have been better to treat more of it in this way earlier, as in the case of these small plots, i.e. in 1937 and 1938.

Brashing in an area of Sitka spruce P.30 was inspected, in which brashing of trees at about 12 ft. apart had been done. It was hoped that this would enable horses to work, and, if so, it would be continued as a measure of economy.

Extraction problems were considered and the use of ropeways or metal chutes seemed advisable to bring material to a basic road system which required development.

(xi) Inspection by Director (Scotland) - August 1949

Present: Director (Scotland), Sir Henry Beresford Peirse.
District Officer, Mr. R. O. Drummond.
Forester, Mr. A. Mackay.

Thinnings in P.26 and 27, mainly with Sitka spruce and some Norway spruce, were inspected. The thinning generally was approved, but

caution was necessary in the case of Norway spruce at the edge of backward patches of that species.

Erosion in a main drain was noted, and plugging with branches, pegging these down if necessary, was decided upon in an effort to stop erosion.

Methods of extraction and means of reaching the thinning programme target set in the Plan of Operations were discussed. The need to save our labour by getting sales standing, or at roadside, to the maximum possible extent was stressed by the Director. The making of a shelter and provision of a small saw bench for conversion of larch to fencing posts, etc., for sale in the Skye market was approved as a means of providing wet weather work. The heavy thinning done in poor European larch now apparently recovering from die-back was approved, and the Director stated that no replant should be undertaken until deaths ceased, so that a replant or underplant could be done over the whole area in one operation.

The excellent success on Moyle indicated that every effort should be made to acquire more land adjacent to it, as there was much good plantable land, carrying much bracken and very few sheep close by, and in the hands of the Department of Agriculture.

Appendix II

Supervision - Ratagan Forest

Divisional Officers

Mr. F. Scott	1921 - 31
Mr. J. Fraser	1931 - 39
Mr. D.S. Spraggan	1939 - 42
Mr. A. Watt	1942 - 45
Mr. J. Fraser	1945 - 46
Mr. J.T. Fitzherbert (S.F.O.)	1948 - 49
Mr. J.A. Dickson (S.F.O.)	1951 (cont.)

Conservator

Mr. J. Fraser	1946 (cont.)

District Officers

Mr. L. A. Newton	1921 - 25
Mr. J.W. Mackay	1926 - 27
Mr. J. Meldrum	1927 - 31
Mr. H.C. Beresford Peirse	1932 - 35
Mr. D. S. Spraggan	1935 - 39
Mr. A.M. Fraser	1939 - 46
Mr. A.L. Orr-Ewing	1946 - 47
Mr. D.S. Spraggan	1947 - 49
Mr. R. O. Drummond	1949 (cont.)

Foresters

Mr. J.A. MacAlpine	1921 - 29
Mr. W. Murray	1929 - 46 (Gd. I) 1946 - 49 (Head)
Mr. A. Mackay	1949 (cont.)

Appendix III

P. Year	Area originally claimed (O) and existing now (N) by Species																										Total Areas	
	E.L.		J.L.		H.L.		D.F.		N.S.		S.S.		S.P.		M.P.		P.C.		Th.		Ts.		A.N.		A.G.		Br.Leaf			
	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	O	N	Orig.	Now
23	-	-	60	32	-	-	13	5	31	8	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	51
24	26	9	4	2	-	-	16	7	5	2	63	68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	88
25	6	4	5	-	-	-	-	1	86	73	28	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	108
26	9	10	-	1	8	9	4	4	61	49	24	23	-	-	6	2	-	2	-	-	-	-	-	-	-	-	-	-	112	100
27	33	33	-	-	8	12	7	8	36	30	63	58	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	150	144
28	-	-	8	11	4	8	-	-	1	-	40	37	12	9	4	-	-	-	-	-	-	-	-	-	-	-	-	-	69	65
29	8	6	4	5	6	8	1	2	23	22	91	81	-	-	7	2	-	-	3	1	-	-	-	-	-	-	-	-	143	127
30	26	30	28	40	-	2	-	-	85	70	87.5	100	9	4	4	1	-	-	-	-	-	-	-	-	-	-	-	-	239.5	247
31	27	25	30	54	-	-	-	-	28	32	69	75	9	2	-	-	15	-	2	1	2	2	8	10	-	-	1	2	191	203
32	21	21	17	4.5	-	-	-	-	7	7	106	106.5	1	1	-	-	2	2	-	-	-	-	-	-	2	2	4	-	160	144
33	11	11	6	6	-	-	-	-	7	7	83	85	5	1	-	-	7	9	-	-	-	-	-	-	-	-	-	-	119	119
34	-	-	-	-	-	-	-	-	-	-	28	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	28
35	-	-	-	-	-	-	-	-	-	-	17	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	18
36	-	-	-	-	-	-	-	-	-	-	5.5	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.5	55
39	-	-	-	-	-	-	-	-	-	-	17	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	17
40	-	-	-	-	-	-	-	-	-	-	17	16.5	-	-	-	-	2	2	-	-	1	1	-	-	-	-	-	-	20	19.5
41	-	-	-	-	-	-	-	-	-	-	26	26	-	-	-	-	4	5	-	-	-	-	-	-	-	-	-	-	30	31
42	-	-	-	-	-	-	-	-	-	-	16	17	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	17
48	-	-	-	-	-	-	-	-	2	-	29.5	31.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.5	31.5
Totals O	166		163		26		41		372		810.5		37		24		30		5		3		8		2		5		1692.5	
Totals N		149		155.5		39		27		300		829		17		28		20		2		3		10		2		2		1563.5

Difference of 129 acres less claimed now is due mainly to write off of 113 acres in 1934 due to resurvey. Upper boundary having been claimed too high.

The big drop in years 1923 - 1925 was due to a fire, the area being replanted in 1930 and 1931

Compartment	Speo.	P. Year	Age	Geology	Soil	Aspect.	Slope	Altitude	Exposure	Ground Vegetation	Best Growth Tot. Ht.	Best Growth Q.G. B.H.	Average Growth Tot. Ht.	Average Growth Q.G. B.H.	Form	Mean Annual Height Increment	Current Annual Height Increment during last 5 years. ⁑
								(ft.) (MSL)			(ft.)	(ins)	(ft.)	(ins.)		(ft.)	(ft.)
17	H.L.	26	25	Red Granitite	Shallow brown earth. Depth 2 to 10 ins. Slight podsolization. Drainage free.	N.	Medium	300 ft.	Sheltered	Grass spp. a Digitalis o Pteris Aquilina o Polypodium spp. o Hylocomium a Hypnum a	60	10¼	53	6½	Good	2.12	2.11
17	E.L.	26	25	Red Granitite	Shallow brown earth. Depth 2 to 10 ins. Slight podsolization. Drainage free.	N.	Medium.	300	Sheltered	Pteris aquilina a Grass spp. a Digitalis purp. f Polypodium spp. o Hylocomium) spp. a Hypnum)	56	8¾	50	6	Moderate	2.00	1.26
11	J.L.	25	26	Red Granitite	Brown earth. Depth 4 to 16 ins. Mainly shallow. Drainage free.	N.W.	Medium	500	Sheltered	Grass spp. a Digitalis purp. o Hard Fern o Hylocomium) spp. a Hypnum) Other Moss spp. a Oxalis acet. o	63	11½	56	6¾	Moderate to good	2.15	1.70
26	D.F.	24	27	Red Granitite.	Deep brown earth. (Average depth about 12 ins.) Colluvium with red granitite fragments. Drainage moderately free.	N.W.	Gentle	100	Sheltered	Polypodium spp. o Hylocomium splend.) Hypnum schreb.) a Hylocomium trig.) Other moss spp. f	66	13½	58	8	Moderate	2.14	2.25
19	S.S.	26	25	Red Granitite	Weakly defined podsol, with a 3 ins. humus layer. Drainage free. Average soil depth @ 9 in.	N.W	Gentle	350	Mod. Sheltered	Nil. (In rides - Grass sp. a Bracken f Moss spp. f)	-	-	60	7¾	Good	2.40	2.27
22	S.S.	27	24	"	"	"	"	"	"	"	67	11½		-	-	-	-
19	N.S.	26	25	Red Granitite	As for C.19 S.S. above.	N.W.	Gentle	350	Mod. Sheltered	Nil	60	10¼	52	5½	Poor	2.08	1.70

⁑ Measurements of last "5" years' growth were taken during second week in August; they are therefore tending to be under-estimates.

APPENDIX IV

RATES OF GROWTH

Moyle Block

Compartment.	Spec.	P. Year	Age	Geology	Soil	Aspect.	Slope	Altitude (ft) (MSL)	Exposure.	Ground Vegetation	Best Growth Tot. Ht. (ft.)	Best Growth Q.G. B.H. (ins.)	Average Growth Tot. Ht. (ft.)	Average Growth Q.G. B.H. (ins.)	Form	Mean Annual Height Increment. (ft.)	Current Annual Height Increment during last 5 years. ✱ (ft.)
31	S.S.	29	22	Glacial conglomerate largely Mica Schist & Gneiss fragments in sandy gravel over Schist	Deep sandy brown earth. 2 ins. humus layer. Drainage moderately free.	S.	Gentle	150	Mod. Sheltered	Nil (In rides - grass spp. Frequent Juncus comm. o Moss spp. f)	-	-	45	5½	Moderate	2.13	2.10
38	N.S.	29	22	Glacial conglomer Largely schistose Loose and sandy. Over Red Granitite	Deep brown earth. Sandy. 2 ins. humus. Drainage mod. free.	S.E.	Gentle	100	Mod. Sheltered	Little ground Vegetation. Grass sp. o Moss spp. f	37	5½	-	-	Moderate	1.68	1.75
38	J.L.	29	22	As for C.	38 N.S. above.	S.E.	Gentle	100	Mod. Sheltered	Grass spp. a Bracken f Digitalis o Potentilla erecta o Moss spp. f	42	5¾	-	-	Moderate	1.90	1.93
41	A.N.	31	20	Alluvium. Largely Granitite and mica schist.	Deep brown earth. Sandy. Freely drained.	Open to the South	None	100	Mod. Sheltered	Nil	-	-	20	4¾	Poor	From an estimated total height 1.25	1.25 average vol. per stem = 3.13 cu. ft. (h)
40	A.G.	32	19	Glacial conglomer Largely mica schist Loose and sandy, deep Over red Granitite	Deep brown earth, (Slight discontinuous podsolisation). Sandy, freely drained.	S.W.	Gentle	200	Mod. Sheltered.	Nil	38	5¾	-	-	Moderate to good	2.00	2.25
53	S.P.	33	18	) These species are showing satisfactory growth at 1000 feet elevation, in exposed positions with a southerly aspect.) Top height is as yet under 25 feet and Q.G. B.H. under 3 inches. Both Pinus contorta and Scots pine are in shallow) podsols with occasional peaty hollows.													
51	P.C.	33	18														

✱ Measurements of last "5" years' growth were taken during second week in August. They are, therefore, tending to be under-estimates.

Appendix V

Data on Thinning Yields at Ratagan

(a) From Thinning Yield Forms, 1/20th acre Plots

C.No.	23	21	21
Species	H.L.	N.S.	S.S.
P. Year and Age	P.27 - 22 years	P.26 - 24	P.27 - 23
Number of Thinning	3rd	2nd	2nd
Years since last thinned	5	3	4
Elevation	500	400	300
Aspect	N.E.	N.E.	N.E.
Date	October 1949	March 1950	March 1950
Before Thinning:-			
No. stems per acre	740	1100	1193
Av. B.H. Q.G. ins.	$5\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{3}{4}$
Upper Ht. ft.	50	30	49
After Thinning:-			
No. stems per acre	470	960	960
Av. B.H. Q.G. ins.	$5\frac{1}{2}$	$4\frac{1}{2}$	5
Thinnings:-			
No. stems per acre	270	140	233
Av. Total Ht. ft.	46	27	39
Vol. Pitwood cu. ft. Q.G.	751	98	335

(b) From marking figures for Sale Lots

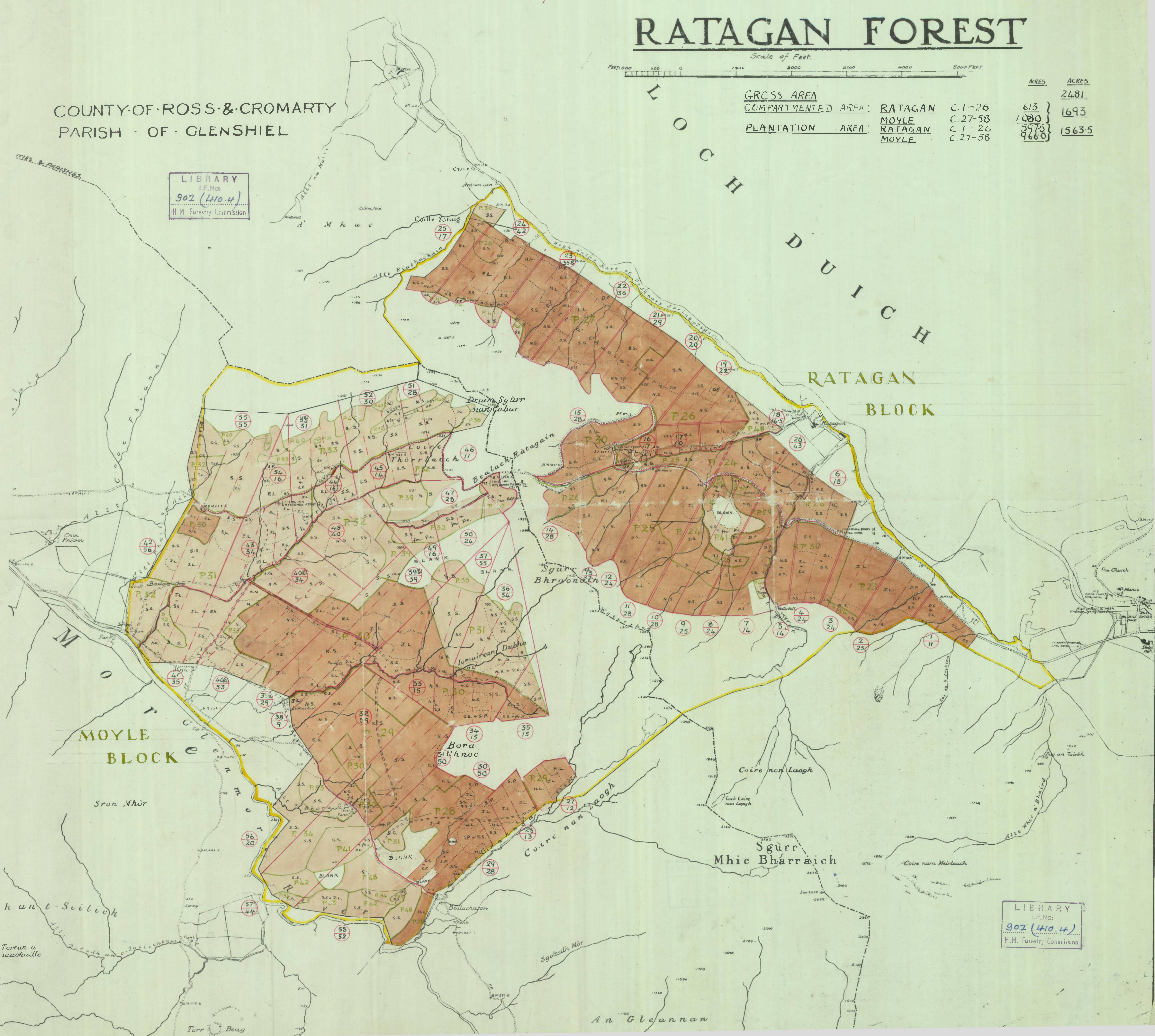
			Marked per acre		Average of Thinned Stems		
Species	P. Year	Age	No. of Stems	Volume C.F. Q.G.	Length (ft.) to $2\frac{1}{2}$" dia.	Q.G.O.B. ins.	Vol. to $2\frac{1}{2}$" dia.
S.S.	27	24	221	355	23	$3\frac{1}{2}$	1. 8
S.S.	28	23	448	1149	26	$4\frac{1}{4}$	2. 4
S.S.	29/30	21/22	380	689	24	4	1. 8
N.S.	26	25	113	167	21	$3\frac{1}{2}$	1. 5
E.L.	27	24	115	245	30	4	2. 1

(c) Also refer to Research Branch Sample Plot from No. 9.

Plots sited in Ratagan Forest Nos:-

S.195	Species	H.L.
S.197	"	E.L.
S.198	"	S.S.
S.199	"	P.C.
S.200	"	N.S.

Ratagan


RATAGAN FOREST
Scale of Feet.
1000 500 0 1000 2000 3000 4000 5000 FEET
ACRES ACRES
GROSS AREA 2481
COMPARTMENTED AREA: RATAGAN C. 1-26 613
MOYLE C. 27-58 1080 1693
PLANTATION AREA: RATAGAN C. 1-26 597.5
MOYLE C. 27-58 966.0 1563.5
COUNTY·OF·ROSS·&·CROMARTY
PARISH · OF · GLENSHIEL
LIBRARY
I.F. No:
902 (410.4)
H.M. Forestry Commission
LOCH DUICH
RATAGAN BLOCK
MOYLE BLOCK
Drum Sgùrr nan Cabar
Bealach Ratagain
Coire Thorr'lach
Sgùrr Bhraonain
Iomairtean Dubha
Bora Chnoc
Coire nan Laogh
Sgùrr Mhic Bharraich
Sron Mhòr
Coille Sraig
A' Mhuc
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