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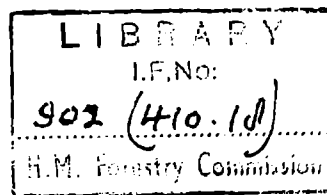
KNAPDALE

FOREST

W(S) CONSERVANCY

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HISTORY

of

KNAPDALE FOREST

1930 - 1951

WEST (SCOTLAND) CONSERVANCY

HISTORY OF KNAPDALE FOREST

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HISTORY OF KNAPDALE FOREST

GENERAL DESCRIPTION OF THE FOREST

Situation and Name

By reason of its topography and geology, its culture and history, its peninsular like nature, and its isolation from the lowlands which lie south of the Highland Border Fault, Argyll is considered an integral part of the Scottish Highlands. Knapdale, with its relatively low ridges and frequent valleys is not typically Highland though this 21 year old forest, amounting to some 19,704 acres, lies in mid Argyll in the Parishes of North and South Knapdale.

The northern boundary is fairly closely defined by the Crinan Canal between Crinan and Craighlass.

The south-eastern boundary is less clear, being marked by old fences, dykes, and unmarked burns. It stretches from Craighlass to a point some $1\frac{1}{4}$ miles north of Castle Sween.

From the latter point the forest is terminated by the sea loch called Sween, the boundary running north-eastwards round the head of the loch, then south-westwards almost as far as Scotnish House.

From Scotnish another march line northwards is followed, defined by fence and dyke as far as Barbae-Dounie on the Atlantic Coast. From this point the sea is once again the march, meeting the northern boundary at Crinan.

The name of Knapdale is derived from the most descriptive Gaelic term of Cnaip-a-dhail meaning hillocks and dales. This is a brief but most adequate description of the area.

Area and Utilisation

The total area of Knapdale Forest is now $19,704\frac{1}{2}$ acres.

Acquisition details and utilisation of ground are given in the following tables (Tables I and II).

TABLE I

Acquisitions from OR Disposals to	By	Date	Plantations Acquired	Plantable excl. Col. 4.	Nurseries	Agricultural	F.W.Hs.	Unplantable excl. Col. 4.	Land Permanently transferred to D.O.A.S.		Land Temporarily transferred to D.O.A.S.		Total Acres
									Description	Acres	Description	Acres	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
From Col. Malcolm - Poltalloch	Purchase	1930											20792.5
From Comdr. Walker - Scottish	Purchase	1941	1	6920	3.5	6127	93	951	-	-	Tenancies	5609	914.0
To Col. Campbell - Castle Sween, etc.	Sale	1936											1998.5
To Capt. Swire - Scottish	Sale	1949											3.5
Total			1	6920	3.5	6127	93	951	-	-	Tenancies	5609	19704.5

TABLE II

		<u>acres</u>
(a) <u>Plantation</u>		
Acquired	1	
Formed by F.C.	<u>4954</u>	4955
(b) <u>In hand awaiting planting</u>		
Blanks after felling	9	
Burnt area	-	
Immediate entry	1695	
ϕ To be resumed	<u>262</u>	1966
(c) <u>Nurseries</u>		3.5
(d) <u>Agriculture</u>		
Under F.C. management	18 tenancies	6127
Under D.O.A.S. management	9 tenancies	5609
(e) <u>F.W.H.</u>	4 holdings	93
(f) <u>Unplantable land in hand</u>		370
(g) <u>Other land</u>		
Lochs	551	
Housing Sites, etc.	<u>30</u>	581
		<u>19704.5</u>

ϕ It is doubtful whether this area will be ceded by the Department of Agriculture for Scotland for planting as it consists of relatively good low ground on the milk producing farm of Ashfield. Our case is worsened by the construction of 24 new houses in the vicinity, all requiring milk.

Sheep Stocks

In 1930 the sheep stocks were some 7300. To-day the sheep stocks are in the region of 2500 but it is believed that an increase in the numbers of cattle (dairy and beef) has occurred. There are some 200 cattle wintered in the forest.

Fishing and Shooting

There are 13 fishing lets and 4 shootings. There is quite a firm demand for both the periodical and perennial lets.

Rent Roll

There are some 90 lettings at Knapdale yielding about £1130 per annum.

Physiography

(a) General Description

Due to the size of the forest, the broken nature of the ground, and variety of features no brief and comprehensive description is possible; nor are there convenient physical features by which the area may be divided into convenient units.

The whole forest is dominated by a series of parallel steep sided ridges and narrow valleys whose axis lies approximately south-west by south to north-east by north. Along practically the whole northern boundary these ridges culminate in a steep bluff which drops down into Loch Crinan and the Crinan Canal. The natural drainage is therefore northerly or southerly with only two breaks in the lines of ridges to form east to west drainage. These two breaks form the waterways of the Lussa and the Barnagad burn on the east side of Loch Sween. Several ridges also tend to run out into an oyster shell shaped depression east of Gartnagrenoch.

A block containing some two-thirds of the existing planted area lies on the east side of the Bellanoch/Ashfield road. This block also carries in it some 500 acres of lochs large and small, most of which supply water for the Crinan Canal to the north. Near the southern edge of the block occurs the highest peak in the forest namely Cruach-Lusach (1530 ft.). This hill lies well outside the planted area which actually ranges in height from sea level to 1000 ft. most of it being between 200 ft. and 600 ft.

The central portion of the forest is broken up by the three heads of Loch Sween which are divided by the forest covered peninsulas of Oib Mor and Oib Greim but the topography is still generally that of sharp sided hills and narrow valleys.

On the west a ridge topped by Cnoc Reamhar (882 ft.) divides what has been planted from Dounie and Barbae Dounie, both of which remain to be afforested.

This general description is given in more detail below.

(b) Elevation

Elevation in the forest varies from sea level to 1530 ft. Most of the ridges do not exceed 500 ft. in altitude, the planted area being generally below this height.

(c) Degree of Relief

The degree of relief is great and characterised by a series of continuous parallel steep ridges and narrow valleys.

(d) Degree of Slope

Moderate to steep slopes are usual and about half the plantations are on these slopes, the remainder being on the flatter valley bottoms.

(e) Aspect

Aspect is somewhat confused as a result of the broken nature of the territory. The bluff above the Crinan Canal faces north-north-east. From this the ground divides up into parallel ridges and valleys that tend to fall away towards the south south-west and fade out near the three heads of Loch Sween. Valleys and ridges recur on either side of Loch Sween and generally maintain their level though some run out at Achnamara on the east side of the loch.

The relative lowness of the ridges and the general fall away to the south south-west means that during the growing season when the sun is high, most of the forest enjoys very considerable periods of sunshine. This remark does not include the northerly facing bluff.

(f) Exposure

Exposure is not severe as not only does the Island of Jura provide some distant protection but the elevation of the forest is not great and the ridge tops, which are generally unplatable, provide local protection. Some of the forest is adjacent to the sea and suffers to a minor extent from salt spray and blast.

Geology and Soils

(a) Geology

The whole forest is based on metamorphic rocks consisting largely of Dalriadan quartzite broken by long north-east to south-west intrusive bands of epidiorite together with some smaller bands of hornblende schists. Neighbouring bands of limestone with black slate or clay slate occur along the line of the old Daill/Seafield road.

The evidence of glaciation is poor, the characteristic rounding of hills and deposits of moraines and boulder clay not being at all well marked.

There are several raised beaches round Loch Sween covering quite extensive areas on Oib Greim, Oib Mor, Achnamara and Kilmichael-Inverlussa.

(b) Soils

Probably a third of the planted area is on peat which, being derived from a ground water vegetation, is often very fertile. This is no doubt due to the amelioration provided by the erosion of the more basic types of rocks mentioned above. The peat is frequently deep. Occasional patches of rainfall vegetation (e.g. Sphagnum) peats are found and while these were often left unplanted, they were drained and their change of state during fifteen years or so is most marked. Some of them have been planted recently with at least initial success.

The fertile peats are mainly found on the valley bottoms along the line of, but not necessarily coincident with, the bands of epidiorite.

The flanks of the valleys show the effect of natural drainage for they carry, or have carried, favourable vegetation indicators such as hardwood scrub, pasture grasses, and heavy growths of bracken. The dominant soil is a heavy loam with the loam lightening in character on small knolls and higher up the ridge sides. The higher areas are relatively bare of soil with occasional pockets of peat or loam.

Occasional screes of large boulders with pockets of soil between the boulders are to be found. These may be found at Scotnish and Oib Greim. In other parts of the forest, notably on the Dunardry/Bellanoach face, above the Crinan Canal, the heavy loam degenerates occasionally into what is nearly a stiff clay.

The western half of the forest shows generally lighter soils of a reddish colour than does the eastern half which tends towards the heavier peat loams. The clay and slate bands on the eastern side alleviate this heaviness to some extent.

There is little evidence of any prevalence of pan conditions.

Vegetation

There is a pre-afforestation vegetation map in existence and the following description is compiled from this map and from what is on the ground that is still left to plant.

The higher ridge tops are bare or carry only a few of the more primitive

plants. Small pockets of peat bogs occur amongst these higher ridges and these are invariably covered with a Scirpus/Calluna/Sphagnum mixture. At lower elevations these peat bogs also occur but are less acid, no doubt due to the amelioration provided by the erosion of basic materials from the hillsides above. Bog myrtle is usually found on these lower bogs, while in the absence of grazing, birch also establishes itself.

High rainfall has a good many compensations and soil forming erosion is one of them.

The hillsides present, as a rule, a grass covered appearance broken where soil is (a) thin by heather, (b) more basic by bracken, (c) a flush by Juncus. The grass consists of Molinia, Aira species and some Agrostis. The valleys almost always contain a productive type of peat bog where vegetation is a Calluna/bog myrtle/Molinia type.

Single trees or small blocks of birch occur over a lot of the area but much of it consists of young trees indicating the exclusion of sheep in recent years.

The factors of sheep, rabbits and muirburn must have had a considerable effect on the vegetation, for the estate was run for sheep farming and game prior to acquisition.

The woodland areas were to be found on the better drained and sheltered mineral slopes. The origin of this woodland in the case of the hardwoods was most probably natural with an artificial development, the oak and birch being coppiced for tanning bark, bobbins and charcoal. It consisted of oak, birch, hazel and alder. Ash, sycamore, beech, elm, rowan and willow were also present to a very small extent.

A considerable area of woodland was reported in the Acquisition Report. This amounted to some 1100 acres of which area a half was birch scrub with few stems per acre. These were all small in height and diameter.

The remainder of the woodland area will be dealt with under the section dealing with silviculture.

Meteorology

Many vegetative species are most critical of the micro-climate and in the broken hilly county of Argyll a ridge of hills can make a difference of 30 in. in the annual rainfall. The sharp ridges and narrow valleys must make a considerable difference to the hours of sunshine on either side of

a valley while rapid changes in elevation affect ground and air temperatures

Thus, local records of temperature and rainfall give a general picture of the local climate but save for indicating the high level of the rainfall, do not have a great deal of significance concerning the silviculture of Knapdale.

The general picture of climate at Knapdale influenced so greatly by its topography, its seaboard, and the dominating effect of the Atlantic Gulf Stream is given below:

- (a) Actual mean annual temperature (i.e. not reduced to sea level) - about 44° to 45° F.
- (b) Mean January temperatures (reduced to sea level) - 40° F. The mean minimum is 36° F.
- (c) Mean July temperature (reduced to sea level) - 57° F. The mean maximum is 65° F.
- (d) Mean annual rainfall - about 70 in. over about 200 days. A significant point is that February to June are usually relatively dry months.
- (e) Mean duration of sunshine - about 1250 hours. The June daily average is about 6 hours.
- (f) Frosts - It is safe to say that hard frosts do not cause significant obvious damage in Knapdale, but late spring frosts affect trees in low lying hollows. No local statistics are available, only impressions and the loss of stock in frost hollows.
- (g) Winds - The prevailing wind is southwesterly and is frequently at gale force. The orientation of the valleys and distribution of high ground together protect much of Knapdale from blast or breakage. There are minor exceptions to this and these are generally at sea level. In 1927 a good half of the timber remaining in Oib Mor was blown over while two areas of badly blown timber were cleared and extracted in the 1914-18 war from the same place. It appears from local information that management was greatly to blame in these cases due to neglect of drains and maintenance.

Risks

(a) Fire

Knapdale is an area of low hazard and generally has a short season of

severe danger.

There are no railways in the district and while there are fifteen miles of public roads in the forest, traffic on them is slight.

Muirburn, fresh water fishers and our own employees are the main sources of danger. These are offset to some extent by:-

- (i) The high rainfall and generally short fire danger season.
- (ii) The number of fresh water and sea lochs, waterways and burns.
- (iii) The areas of scrub left unplanted.
- (iv) The broken nature of the ground.

Items (ii), (iii) and (iv) above tend to place limits on the possible spread of fire and confine it to small areas. Access to most of the forest is poor but this operates as a protective measure as well as a hazard.

(b) Animals

- (i) Deer. Red deer are fairly common on the high ground to the east and south. Roe deer are frequent throughout the forest. Damage to plantations is small due probably to the number of unplanted Calluna sites, hardwood scrub on rocky ridges and the low incidence of snowfall. One exception to this is that small areas originally classed as unplantable have been planted subsequently and have been quite extensively cut back by deer. These areas - usually carrying Calluna - were probably regarded as browsing sites by the deer and, because of this, damage was concentrated. In the case of a forest in the thicket stage it is probably best to leave these small areas to the deer as the eradication of these animals is most difficult because of the cover. They appear to be on the increase in the forest.
- (ii) Rabbits Rabbits are common and numerous outside the forest fences. Inside the forest on the northern boundary only one area shows signs of a few rabbits and these are now being eradicated.
- (iii) Other Sheep do not trespass and do not cause any damage. Badgers occasionally become numerous and local poultry keepers suffer before the number of badgers declines.
- (c) Birds Destructive birds are rare. Nesting golden eagles from our southern neighbour - Ellery - are found in the southern half

of the forest while it is believed a pair have nested on the northern end.

Insects and Fungi

No epidemics of insects or fungi have as yet seriously affected the forest.

Norway spruce are dying as single trees throughout the forest but this is not serious as yet. It is believed to be due to pathological causes.

Douglas fir are considerably damaged by the alternating generation of Chermes cooleyi while Neomyzaphis is present on Sitka spruce.

There is also an attack on the larches by a Chermes species but this does not appear to do much damage.

Fungi have not yet been observed as damaging any of the forest.

Roads

The forest has reasonably adequate external access by public roads of low specification but the internal access is poor due to the absence of forest roads and the ridged topography.

The problems of access for extraction are great and it is difficult to find suitable road lines in pole stage plantations.

Rides have been frequently laid down based on early views on extraction or as road lines but there is often a major snag in their development and diversions have to be found to avoid very expensive cutting and filling.

Labour

From the success of establishment and the standards of workmanship it appears that the quality of labour and supervision have both been excellent. The supply of labour, save for the war and immediate post-war years has been reasonably adequate though the quality has deteriorated. A small nucleus of skilled and good forest workers has been developed during the 20 years of planting but most of these men are now in the last third of their life and adequate replacements are not easily found. Twenty-eight new houses almost completed should solve this problem.

SILVICULTURE

Knapdale's first planting was done in 1931 and by then establishment practice appears to have become consolidated along certain lines.

Preparation of ground has been fairly standard, the only innovation being the use of the Cuthbertson single furrow mould board plough in 1946 and 1947 when drains were cut at 21 ft. Selection of species was based on tried experience and save for small individual experiment, has followed fairly rigid lines. This will be dealt with in detail below.

Preparation of Ground

(a) Scrub

P.31 and P.32 appear to have had heavy clearance of light scrub with subsequent ringing of the big remnant. In the following years the clearance was less intense but more extensive ringing followed. During the war years some heavy oak stands in the vicinity of Barnagad were planted without any treatment.

Most of the serious arrears of scrub clearing have now been cleared off.

(b) Draining

Draining was carried out in a most thorough way from the commencement of planting. All wet areas were mounded and hand drained to an intensity of about 30 chns. per acre. Due to the small fall on many of the best type of peat bogs the main leaders have had to be kept frequently at depths of 30 in. The success of this practice is obvious to-day.

A little Cuthbertson draining was done at Scotnish and Kilmahumaig in 1946 and 1947 but the forest topography does not lend itself to machine draining.

Choice of Species

It is difficult at this date to state definitely what prompted certain choices of species. On the whole, selection was made along conservative lines and as a result establishment has been good. Only three exceptions stand out from a background of generally successful establishment. The European larch on Dunardry face and at Achnamara have suffered badly from die-back but now show some sign of recovery. This unfortunate result with

European larch is not of course peculiar to Knapdale. One bog at Oib Mor is a frost hollow and there has been an almost complete loss of stock in this. Thick oak scrub has been underplanted with Norway spruce at Barnagad and the young plants have been browsed badly by deer.

The main planting in Knapdale has been of Norway spruce and Sitka spruce. In the 'thirties Norway spruce led the acreage slightly. This may be accounted for by the amount of felled woodland and scrub to be planted. Since 1941 the lead which Sitka spruce then began to enjoy has increased year by year.

The less commonly planted conifers plus such hardwoods as oak, ash and beech, have been planted on a small scale over much of the forest and were confined mainly to the 1930s and early 1940s. The sites chosen were varied but usually followed the pattern of favourable soil conditions and shelter. It is a pity that a few trial areas of these species were not laid down with a view to ascertaining their tolerance of poor soil conditions, exposure and frost.

Sitka spruce

Up to 1951, 2412 acres of Sitka spruce had been planted. Practically all this area was planted on the higher slopes or on grassland covering mineral soils. In P.31 and P.32 Oib Mor, an exception to this occurs where most of the Sitka spruce was planted on a felled woodland site. Soil conditions here were of a peaty loam character and the vegetation was typically wet woodland comprising bracken, Juncus, grass, Scilla, Oxalis, Mercurialis, etc.

Small patches of Sitka spruce were planted in tree by tree mixture with Pinus contorta on Callunetums in F.Y.37 and F.Y.38. In F.Y.51 the Contorta have reached a height of some 8 ft.- 10 ft. while the Sitka spruce at half that height are now beginning to produce leaders 9 in.- 12 in. in length and should soon overtake the pines.

Sitka spruce on the whole does well in Knapdale and in its 21st year is able to stand a thinning of some 500 cu. ft. per acre without being overthinned in any respect.

Norway spruce

1607 acres of this species were planted between 1931 and 1951. The sites for the choice of this species were mostly under scrub or on old

woodland. The soil was almost always a peaty loam or fertile valley bottom peat. From the vegetation map, outside the woodland sites, Norway spruce was planted on ground which was covered by various combinations of grasses, bracken, bog myrtle and Juncus. Where the canopy has not yet closed, this vegetation appears to have changed to a bracken/grass type with bog myrtle and Juncus persisting on the less well drained areas.

The success of the use of this species is well evident and Norway spruce to-day, while showing evidence of the customary slow initial growth, is now producing annually leaders whose vigour and length almost compare with those of Sitka.

Small examples occur of Norway spruce in mixture with Sitka spruce, poplar and Pinus contorta. Most of the poplars have disappeared but Sitka spruce and Pinus contorta, at least in the early stages, have both given shelter to Norway spruce and the crop has profited accordingly.

Japanese larch

Between 1931 and 1951 289 acres were planted.

This species was nearly always planted along the middle of the slopes on a bracken/Molinia mineral soil. In the main it has done well when viewed in terms of what will be left when the worst of the stems are removed.

The tendency since 1945 has been to plant this species on a drier mineral soil site and if possible confine it to a vegetation type of heather/bracken.

European larch

200 acres of this species are to be found in the forest, some having been planted in almost every year between 1931 and 1947 with the biggest acreages in 1932 and 1934.

Of all the species planted in Knapdale this is the most disappointing. The P.34 block on Dunardry face is the worst. It faces north and was pit planted on a bracken/grass vegetation. The soil is a light red loam becoming very stiff and clay-like in places. It may be significant that with the change from the clay to the lighter loam quite a noticeable change in quality is evident, the drastic thinning on the former being not nearly so necessary on the latter. In P.42 a small block was planted on a well cleaned east facing slope of scrub oak and birch. The soil had good natural drainage. The crop looks very good to-day but die-back appears to

develop at a later age than nine years and the crop is too young to assess from this point of view.

In general, European larch at Knapdale is poor. Beautiful European larch suitable for boatskins and such like items demanding high quality timber has been grown in the west of Scotland. It may be that the old estate mixture of European larch, Norway spruce and Scots pine is the only way to grow it. Such a mixture was felled at Ashfield before the war and contained some quite good Norway spruce and European larch though the Scots pine was apparently poor. The site was unfortunately fully exposed to the south-west sea blast.

Hybrid larch

The amount of Hybrid larch in Knapdale is limited being only 13 acres.

It is growing well though the majority, having been planted in 1943, it is still too young to be judged. It appears to have been planted on grass covered mineral slopes.

Douglas fir

This occupies 133 acres of the forest and was mainly planted in 1932, 1933 and 1934. In P.32 it was planted on an old woodland site - a moist dark loam - and to-day that Douglas is very poor. Careful thinning and no windblow may produce a final crop but intermediate yields will be of poor quality being generally sabre shaped.

It may be significant that in the small blocks of Douglas fir in Knapdale the straightest and cleanest trees usually have a somewhat green coloured bark whereas the poor trees have a much browner coloured bark. Whether this morphological detail has genetical significance is not known.

From the acquisition reports of 9000 cu.ft. to the acre in Oib Mor, and a local sawyer's report (this man and his father worked the timber) of beautiful trees, from which three and four sleepers were cut it seems a pity that site selection and provenance for this species is not more exact. It appears that the Douglas fir averaged 57.3 cu.ft. at about 50 years of age when they were felled.

Scots pine

This species covers 55 acres but is confined to the poorer Calluna or Erica sites and shows little promise of success. Average volume for Scots felled in the 1920s was about 6 cu.ft. at 55 years of age.

Pinus contorta

The 21 acres taken up by Pinus contorta are borderline sites where it has been used as a colonising species sometimes in mixture with Sitka spruce. Exposed Calluna sites have also been planted with this hardy pine.

Tsuga, Abies procera, and Abies grandis

These three shade bearers occupy some 106 acres of ground. From the extent of scrub woodland which has been felled or ridged in Knapdale, and the way in which these species produce clean volume rapidly, it seems a pity that a greater acreage has not been planted.

The silver firs generally have been planted on poorer sites than the spruces. The Noble fir tends to have a heavy butt, and tapers rapidly, being very 'carrotty'. On the other hand grandis is cylindrical in shape and has a better height growth. It is not very stable at Knapdale, due perhaps to thin soil rather than to type instability.

A little Tsuga was planted before 1940 but most of it dates from the 1940s and scrub was selected as the appropriate planting site. The Tsuga promised well and should be a fast and heavy volume producer.

Thuja, Cryptomeria japonica, Lawson cypress

Some 29 acres are taken up by these species, Lawson cypress occupying over 23 acres.

None of them is significant in the history of the forest. Most have been planted on fairly good loams in shelter and are prospering but none is fast growing. Cryptomeria creates a dense shade similar to that of Tsuga but appears to have also the ease of cleaning habit of the larches. Much of the Lawson cypress was used too as edge trees (P.32) and to isolate Japanese larch provenance tests (P.34).

Corsican pine

Some 5 acres of this were planted in 1933 on exposed heather sites and have thrived, comparing well with Sitka spruce on more favourable adjacent soils. The height growth, varying between 6 ft. and 20 ft. is not as uniform as that of the Sitka.

Oak, Ash, Beech, Sycamore and Maple

100 acres of oak are to be found but little of this is planted or of recent origin. As scrub it has a value for firewood, stobs and chocks but little of it is worth keeping for timber purposes. When scrub clearing

any promising specimens are retained.

The other hardwoods occupy 40 acres, mostly on the best ground in the forest. Growth is not remarkable nor promising though butt logs of timber size up to 20 ft.- 25 ft. long should be possible on a long rotation.

The real advantages of hardwoods here are not easy to define. Amenity, stability, soil improvement, economic requirements for hardwoods are all controversial topics, and consequently use of broadleaved species is very much subject to individual whim and experience.

Planting

Almost all planting has been done with the Schlich spade or the garden spade. On bare ground the plant was notched in, the type of notch not appearing to make much difference to the subsequent growth unless the roots were damaged or badly inserted. Mounds, at Knapdale, have almost always been of a size so that they could be split right through.

Bare ground planting is now almost wholly confined to drier slopes carrying short grasses and herbs or bracken.

(a) Spacing

This seems to have followed conventional lines, the pines and Norway spruce having been put in at about 1750 to the acre with the remaining species at 1550 to the acre.

Sitka spruce in far out compartments are now being put in at 6 ft. spacing but this is not a general practice.

The only close spacing apparent is a very small patch of Douglas fir in Oib Mor which was planted in P.31 at 4 ft.

(b) Type and Source of Planting Stock

At Knapdale there has been very little planting of seedlings up to the present day. Almost the whole forest has been grown from transplants and while during the first 15 years the transplants were very variable in age, the later years have seen a steady supply of 2+2 Norway spruce and 2+1 or 2+2 Sitka spruce to the unit. The pines and European larch have been nearly all supplied as 2+1s but the remaining species planted were very variable in their ages. It is almost impossible at this stage to state accurately where any particular type of plant was put and derive information therefrom.

No investigation has been carried out into the source of seed but 95% of the plants have come from West Conservancy nurseries with well over 50% originating from Tulliallan. The home nursery started producing in 1936 and has provided considerable numbers of good transplants since that time.

(c) Annual Rate of Planting

1931	175 acres
1932	244 "
1933	359 "
1934	346 "
1935	353 "
1936	327 "
1937	300 "
1938	320 "
1939	320 "
1940	300 "
1941	289 "
1942	210 "
1943	210 "
1944	172 "
1945	109 "
1946	49 "
1947	253 "
1948	100 "
1949	- "
1950	200 "
1951	354 "
	<hr style="width: 10%; margin: 0 auto;"/>
	4990 acres
	<hr style="width: 10%; margin: 0 auto;"/>

(d) Manuring

No records exist which show that manuring has been done at Knapdale and local information indicates that none has been done except on a very small experimental scale in F.Y.50.

(e) Success of Establishment

(i) Seedlings

Very few seedlings have been used at this forest, the majority of these being 2+0 and 3+0 Norway spruce. A few Douglas fir 2+0 and Sitka spruce 2+0 have been planted but no information exists as to their success or otherwise and their presence cannot now be traced.

(ii) Transplants

The success of establishment is obvious to-day but this must be weighed against the extent of beating up which is dealt with below.

Ploughing

Due to the hilly nature of the territory and very small areas suitable for ploughing, all that has been done at Knapdale amounts to a few acres ploughed at 21 ft. spacing in 1946 and 1947. Establishment and growth on these sites has been good but as they were Molinia areas, good establishment is not significant.

Beating Up

The R.1s only show the number, age and species of plants used together with the planting year being beaten up. In general, establishment must have been good, for little beating up was necessary compared to the areas planted.

The most notable beating up has been of European larch. While no guarantee is given that the European larch was only used for beating up European larch very small patches or single specimens of this species are not to be found generally in the forest.

P.40 was beaten up rather extensively but this was due to bad early frosts in the winter of 1940/41.

P.41, P.42 and P.43 also received considerable attention, but in the war time, labour supply was not always of the best.

The beating up of P.40 and P.41 in 1949 was prefaced by considerable preparation of ground.

In all cases weeding had to be carried out subsequently.

The bulk of beating up was always done in the year following planting. This would naturally take advantage of the existing preparation of ground

and of the comprehensive weeding still being carried out in that area.

Weeding

The removal of sheep stocks and the high rainfall combine to make grass weeding in the first two years after planting extensive and most essential. Thereafter on non-check areas the extent of weeding declines rapidly save for small patches of grasses and rushes on flushes. The long growing season enables grass cutting to go on until November in the case of Sitka spruce but Norway spruce and the larches must be done earlier to prevent heating.

Where bracken is concerned it is found in all species except the larches that one cutting per year is enough but several instances have shown that it is necessary to cut it for three years and sometimes five years. This is because of the immense vigour of bracken on some sites.

Mixture of species

This has been dealt with under choice of species. Without areas of control alongside, it is difficult to be dogmatic about this, but the following impressions are probably correct. Poplar was used as a nurse to Norway spruce in what seemed to be frost hollows in Oib Mor. The spruce is now growing well and should be a good crop but the poplars have almost completely disappeared. Sitka spruce has been mixed with both Pinus contorta and Corsican pine with subsequent good growth by both the pines and a later recovery from initial check by the Sitka spruce.

Rates of Growth

Prior to acquisition the bulk of the original coniferous woodlands was on Oib Mor. This peninsula, while suffering to some extent from exposure, enjoys a milder climate than the whole of the rest of the forest, and apart from the limestone influence at Achnamara and Daltote, has the best soil conditions, the quartzite formation being ameliorated by some intrusive hornblende schist covered by old forest soils.

Oib Mor was planted about 1870 and felled in two cut overs (much was windblown) in 1914-18 and 1923-27. The area planted was 33.7 acres at a cost of £768. Stocking was 141 to the acre when felled and the average volume (H.ft.) per tree was Scots pine - 5.6, Austrian pine - 23.2, European larch - 9.8, Douglas fir - 57.3, Abies procera - 29.1, Norway spruce - 10.3. The Douglas fir and Abies procera were considered excellent

quality, being closely grown, while the European larch and Austrian pine were very good and Scots pine poor. The final return on the planting outlay, in cash, showed $4\frac{5}{8}\%$ return compound interest on 54 years.

A mixture of Douglas fir and Abies procera in Oib Mor gave a return of 9000 cu.ft. to the acre at 50 years of age. While it is not anticipated that anything like this will be achieved over all Oib Mor, it is reasonable to expect about 6000 cu.ft. to the acre in the northern block and probably 5000 cu.ft. to the acre in the southern section.

At the present time some of the best 20 year old Sitka spruce is standing at a little over 3000 cu.ft. to the acre which just brings it into Quality Class I but most of this species at this age stands at about the middle of Quality Class II with a value of about 2500 cu.ft. to the acre. Thinning yield plots show returns ranging from 405 cu.ft. to 770 cu.ft. per acre for P.31 Sitka spruce. The average return for a recent standing sale was very near to 500 cu.ft. per acre over some 50 acres.

Japanese larch on Oib Mor, P.31, with a standing volume after four thinnings of about 800 cu.ft. to the acre, is Quality Class II.

Norway spruce, while we have no volume statistics for the species, at 20 years of age have top heights of 25 ft.- 30 ft. This would put the species into Quality Class II on the old yield table figures.

The old woodland at Achnamara (felled before acquisition) had some quite heavy stocking of Norway spruce and European larch. At 55 years of age these species were standing at about 6500 cu.ft. and 3500 cu.ft. to the acre respectively.

From existing statistics and the general growth and vigour of the tree crop in this forest, one can reasonably assume an average return from the whole forest amounting to Quality Class II for all species except European larch. Small areas at Achnamara, Oib Greim and Oib Mor may well give much higher returns. Abies grandis (P.35, 1750 cu.ft. to the acre) may provide a high volume per acre.

The above facts indicate the trend of productivity but while an overall picture of the forest presents a general return of good Quality Class II for all species, some immature areas such as the P.38 and P.39 blocks at Achnamara have high promise at this stage of their life.

Past Treatment of Established Plantations

(a) Brashing

Brashing in practice amounts to about 80% of the number of stems. At this forest, and in the spruces particularly, brashing on a less intensive basis has been found undesirable since it has been realised from the first that the marking of thinnings in this region of high rainfall and strong winds must be carefully done, and moreover, that much of the actual thinning would have to be done by timber merchants.

Brashing is done with the two edged brashing saw, an ordinary hand saw or a curved pruning saw. About 95% of the brashing is on dead branches.

(b) Pruning

This has not been done at Knapdale.

(c) Cleaning

This is done as necessary and is confined mainly to coppice shoots from old woodland or cleared scrub. With the increase in ringing and decline in clearing of scrub, cleaning operations have also declined.

With European larch it has been found necessary to give it an early cleaning at about the 11th or 12th years for the sake of tree hygiene. It is believed that a heavy cleaning at this age, cutting out diseased, poorly shaped and sickly trees, enables the remaining crop to recover from die-back and canker. This was done to most of P.31 and P.32 European larch but owing to the war this work had to be deferred in the case of P.33-P.36 European larch until the 16th or 17th years, e.g. P.34 European larch on Dunardry Face. Here the trees remaining after the cleaning appear to have put on more than average height growth and have a more healthy appearance but this may be largely due to the last two growing seasons (F.Y.49 and F.Y.50) having been extremely favourable to tree growth. Management cannot therefore safely claim 100% credit for the recovery of the European larch.

The rapid and coarse growth of Japanese larch requires that this species be cleaned and possibly thinned between the 10th and 14th years, according to site. Douglas fir usually requires similar

attention between the 14th and 16th years.

In the case of Hybrid larch the early cleaning tends to become a thinning in that it shows a good return in produce.

It has not been the practice in the past to clean the spruces or the silver firs but to thin them at between 18 and 20 years of age according to site.

(d) Thinning

Knapdale is a forest of rapidly changing site characteristics and age classes. Consequently the main preoccupation of management after the planting programme is achieved has been to see that no part of the forest is missed so far as treatment goes and that due priorities have been given to maintenance.

Small patches of larches, Douglas and silver firs, and Sitka spruce are now being thinned or cleaned.

A compact block of P.31 Sitka spruce with a little larch and Noble fir amounting to some 27,000 cu.ft. has been sold standing to trade this year (F.Y.51).

Some second and third thinnings of Japanese larch have been achieved in the P.31 and P.32 blocks.

Drain Repairs

Good drainage is of paramount importance at this forest. Considerable arrears of drain repairs existed immediately after the war but by the end of 1949 most of these arrears had been cleared off and at the present day (1951) the drainage done, and that coming due for repair, almost balance.

In established crops drain cleaning and repairs are done just before the canopy closes, immediately after it has been opened up by racking and brashing and at each thinning. On the productive peats it has not been found possible to decrease the intensity of the original drainage and with the increase in thinning as first and subsequent thinnings become due and overlap, the drain repair programme is certain to become much greater. It is hoped that with maturity a water equilibrium between trees, soil and rainfall may reduce the intensity of drainage required.

Research

Experimental planting of species of eucalyptus was tried in the years 1935, 1938 and 1939. Over the course of a few years all species eventually

succumbed to frost.

One of the sets of Japanese larch provenance experiments planted by J.M. Murray in 1934 is situated in Knapdale on the west side of and close to Dunardry burn. There are ten plots of larch originating from different parts of Nagano Province, Japan. There are no clearly marked differences between any of them and it must be concluded that differences, if any, are too small to be brought out by an unreplicated experiment.

In September 1939 two permanent sample plots Nos. 121 and 122 were established in a nine year old block of hybrid larch at Knapdale. At that age the top height of the crop was 27 ft. but it was not yet ready for thinning. Both plots received a moderately heavy low thinning in December 1942 and they have been twice thinned since then. After the last treatment in September 1949, the maincrop number of trees per acre was 371 in Plot 121 compared with 339 in Plot 122. Thus in three thinnings the number of trees per acre in both plots has been reduced by just over a thousand, giving an identical volume of 875 cu.ft. Q.G.U.B.

The stand has made excellent response to these early and frequent thinnings and the crowns with a depth of 40% are widespread and vigorous.

Height growth has now slowed down to an average of two feet per annum compared with growths of almost three feet in the earlier years. Top height at 19 years of age was 47 ft. and periodic mean annual basal area increment was being maintained at the high figure of 6.2 sq.ft. per acre.

Conclusions

The progress of the plantations on what is shown by the Geological Survey to be predominantly a quartzite area would be surprising were it not for the ameliorating effect of the numerous epidiorite intrusions. The extent of the old scrub woodland and the high rainfall have also been major contributory factors to the fast growth of most of the conifers.

European larch has been the only failure but this is not rare in Scotland.

In the light of the access problems the Forest and Engineering branches are now co-operating in the siting of road lines through plantations due, or nearly due, for thinning. Once the arrears have been cleared off it is intended to treat similarly younger plantations and areas scheduled for planting.

With regard to thinning, it is hoped that what has to date been piece-meal work will gradually begin to coalesce into a comprehensive thinning plan. This hope is based on the grounds that a third thinning in Japanese larch will coincide with perhaps a second thinning in the Sitka spruce roundabout, and this with a first thinning in adjacent Norway spruce. Thus may all species be brought into a common thinning or time spaced cycle of approximately three years and so facilitate planning and control, for the accumulation of thinning areas is like an inverted pyramid. Whilst the first three or four years in a forest's thinning history allow scope for silvicultural thinning, in a large forest control is not practicable if pure silviculture is to be the guide for all thinning. Silviculture and management must compromise if they are to produce a working solution to the problem of running a forest.

(Sgd). KENNETH N. V. TOWNSEND

District Officer.

History of Knapdale Forest

APPENDIX I

Notes from Inspection Reports

Below are given in chronological order all the visits made by senior officers. The salient points of each visit and report are indicated briefly and summarised at the end.

Chairman - 15.9.32

During this visit an inspection was made principally of the Oib Mor P.32 and P.31 sections. The fertility of this area was observed to be high and the Chairman considered that the spruces were the main species for this area. The poplar, Populus trichocarpa, noted in this report have either disappeared or are badly cankered. Their use as a nurse for the Norway spruce appears to have been justified.

Chairman - 12.9.34

The P.34 European larch were commented upon favourably, particularly the 2+0 seedlings ex Tulliallan.

The need and importance of an adequate system of inspection paths and graded roads were emphasised.

The Chairman and Commissioners - 14.6.35

The P.35 draining was well done and P.31 and P.32 plantations of all species were seen to be growing rapidly.

Some damage to Sitka spruce by honey fungus and Aphis was noted.

Chairman - 30.5.37

P.34 European larch were growing rapidly. The big hardwoods in P.32 (Ashfield Cottage) were not to be felled or girdled.

Windthrow and browning of needles from exposure in acquired plantations were observed.

Chairman - 1.9.40

This visit concentrated on P.40 and P.31 Oib Mor, the Chairman indicating the necessity for the early and frequent treatment of Japanese larch. He also pointed out the desirability for inspection racks.

Chairman - 1.9.41

There was a considerable improvement in the vegetation on the unplanted

areas of P. 34 and P. 35 and these were to be consolidated by planting.

The P. 34 and 35 larches (including the European larch) were still making good progress.

The planning of the location and route of the many new roads that would be required must be carefully done and there would be great need for these.

The development of the plantation generally was considered most satisfactory.

Chairman and Minister for Reconstruction - 5.9.42

The growth of both spruces in Oib Mor (P. 31 and 40) was seen to be excellent. The use of poplars as a nurse to Norway spruce in frost hollows had proved beneficial.

Thinning in both larches had started and the Minister asked for samples of larch pit props from 12 year old trees for demonstration at a Cabinet meeting.

The growth of all species was considered excellent.

Chairman and Advisory Committee - 12.7.43

The favourable growth of both spruces in Oib Mor (P. 31 and P. 40) was again noted.

The use of poplar as a nurse for Norway spruce and the retention of alder as an overwood for protection against frost in frost hollows were both noted.

Chairman - 26.8.47

The P. 34 European larch were now noted as suffering badly from dieback.

The general condition of the plantation was again viewed favourably.

Director (Scotland) - 6.6.50

This report caused considerable comment at all levels on the subject of scrub ringing. This District Officer believes that from the various comments, the underlying intention is that where public taste is likely to be offended a balance between amenity and timber production is required. When scrub ringing offends the general public's eye then it should not be done and necessitous removal of overhead shade should be done by felling. Agreement is general on the retention of good or promising hardwood stems. Agreement is also general on the value of scrub as a nurse or for shelter. Ringing is a cheap method of combining shelter and the removal of overhead

cover from a young under crop but it is very bad propoganda when seen by critical members of the public.

Considerable attention was paid to the progress of plantations and the Director's general opinion was that thinning was still tending to be late and light.

The use of more Norway spruce on favourable sites to redress the increasing dominance of Sitka spruce was requested.

Access, extraction and roads once again received attention.

Chairman - 13/14.6.51.

This inspection fell into three groups (1) General Management (2) Plantations and (3) Access. The report indicates that the Chairman appeared generally pleased with the plantations, his main criticism concerning the site selection for the larches (European larch and Japanese larch).

Access and extraction occupied much of the Chairman's attention, the need for economies and adequate access being uppermost.

Chairman and Minister of Local Government and Planning - 22.8.51

The general opinion was that of reasonable satisfaction.

The Chairman's comments on the reports of 13/14.6.51 and 22.8.51 were:

"The two inspections were made with a short interval between, namely mid June and the latter half of August. The interval coincided with the main period of height growth, which seemed to me to have made a notable difference in the development of some of the younger plantations. The reports are adequate and I have little comment to make.

Housing. The new village at Achnamara was approved by the Minister of Local Government and Planning.

Roads. We must keep steadily at construction, which will tend otherwise to get out of hand. Nothing which I have seen of ropeways convinces me that we shall be able to dispense with well designed road systems.

A negotiation access should be secured and developed into the 400 acres proposed to be planted in Dounie."

History of Knapdale Forest

APPENDIX II

Supervision

Conservators

1946 - 1948	A. Watt
1948 to date	J. E. James

Divisional Officers

1930 - 1934	J. M. Murray
1934 - 1938	O. J. Sangar
1938 - 1939	A. H. Gosling
1939 - 1945	J.A.B. Macdonald
1945-1946	A. Watt

State Forest Officers

1947 - 1948	J. E. James
1948 to date	H.V.S. Dier

District Officers

1930 - 1931	J. Fraser
1931 - 1938	A. H. Gosling
1938 - 1944	H.V.S. Dier
1944 - 1946	T. E. Edwardson
1946 - 1951	D. A. Woodburn
1951 to date	K.N.V. Townsend

Foresters

1930 - 1934	A. D. MacRae (Foreman)
1934 - 1936	G. T. Thomson
1937	A. D. MacRae
1937 - 1945	W. S. Ferguson
1945 to date	H. MacKinnon

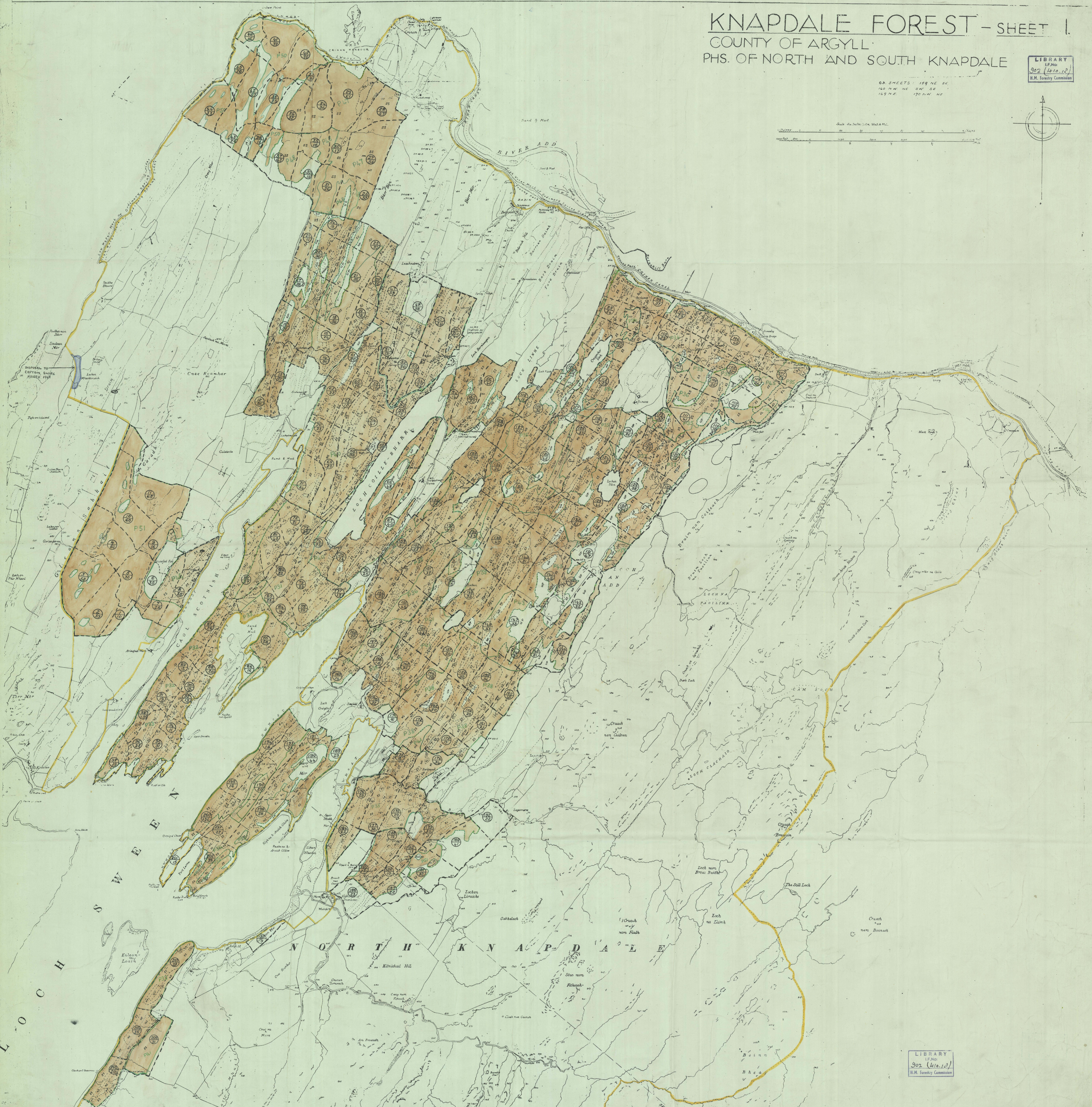
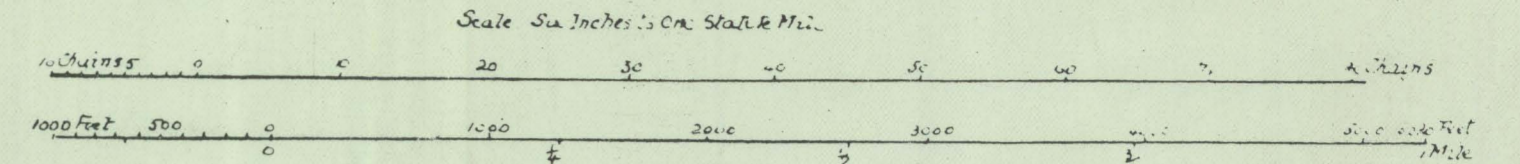
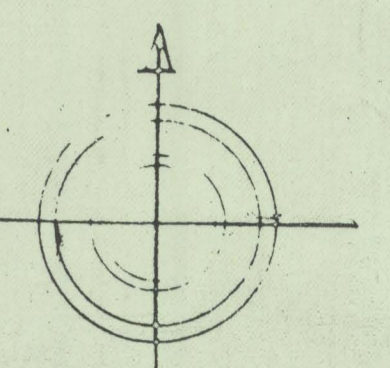


KNAPDALE FOREST - SHEET 1.

COUNTY OF ARGYLL
PHS. OF NORTH AND SOUTH KNAPDALE

LIBRARY
I.F.No.
902 (4/10.10)
H.M. Forestry Commission

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160 NW NE SW SE
169 NE 170 NW NE



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