
Fifteenth Annual Study Tour —

Denmark : 15th-30th May, 1959

Introduction.

36 members of our Society travelled from Harwich to Esbjerg in Denmark on May 24th on this our fifteenth study tour. We were met on arrival in Esbjerg in the early afternoon of May 25th by Mr. Steenstrup of the Danish Heath Society and Mr. Tolstrup of the Danish Forestry Society and having boarded the very comfortable Copenhagen bus which Dr. Sabroe had arranged to meet the boat we started our 140 mile drive through Jutland to Viborg. On our way we were introduced to the work of the Danish Heath Society which was founded in 1866 and has been doing such important work since then in sponsoring, assisting and initiating the reclamation of the Heath lands of Jutland.

100 years ago 2,100,000 acres was covered with heath and to-day the heath area is less than 430,000 acres. In the meantime the land has been drained and reclaimed for farming, plantations have been established, 25,000 new homes have been started, the population has increased and towns and villages have prospered. The result of the work already done was to be seen all around us in the tidy well cultivated farms, the comfortable looking farmhouses, well constructed out-offices and shelter belts which were a feature of every farm. At Slauggard we stopped for a short time to enjoy a very refreshing cup of tea at the home of Forest Officer and Mrs. Beck and to eat quantities of lovely Danish savouries, sandwiches and cakes which Mrs. Beck had kindly prepared for us. That night in Viborg in the pretty setting of the Salonen Restaurant we were the guests of the Danish Forestry Society for dinner and had the honour of meeting Count Moltke, President of the Society who formally welcomed us to Denmark. On the following night the Danish Heath Society were our hosts with the Chairman of the Society presiding. The first two days of our tour were spent in the Viborg area of Jutland. As well as the work of the Heath Society we saw the work of the State in mixed heath planting on poor soil under the direction of Forest Officer Hviid, who, as President of the Danish State foresters, was our host at lunch in the very pleasant surroundings of Knudstrup Inn. We had an interesting afternoon in the Kongenshus Memorial Park which was established in honour of the pioneers of the Heath. The memorial stones which commemorate the reclamation of the heath demonstrate very strongly the great pride of the Danish people in the development of their country. We were sorry when we parted with our friends of the Heath Society and with Mr. Tolstrup who left us at Horsens. On the first few days he travelled with us on the bus and was our guide, philosopher and friend who answered our many questions cheerfully, joined in our jokes and made us feel at home from the moment of our arrival in Esbjerg. Mr. Elmquist took over from Mr. Tolstrup and in the same way helped us with our problems and answered all our questions. He remained with us until we came to the "Small Belt Bridge" on our return journey to Esbjerg.

Meeting Dr. Sabroe again was a great pleasure for all of us and it was typical of him that he did not allow a serious illness from which he was convalescing to prevent him conducting us personally around his own territory—the Boller State Forest district. Without Dr. Sabroe our visit to Denmark would not have been possible. It was he who arranged everything, our itinerary for the week, our hotels, meals and transport and he left nothing to chance. Mrs. Sabroe was also at Boller to greet us, to extend to us the hospitality of the Sabroe home and of their holiday cottage overlooking the sea near Horsens, where on a perfect summer afternoon we enjoyed a delightful cup of tea in the gardens beside the sea shore. The day we spent with Dr. Sabroe was one of the

most memorable of the tour. In the forest we saw very fine stands of broadleaved trees and natural regeneration of beech and fir. We paid a short visit to a modern highly developed Danish farm as well as the homes of a Danish State Forester and a workman. We also had an excellent lunch at Faddegrav Badehotel at which the Directorate of State Forestry was our host with Dr. Sabroe presiding. Our Society is deeply indebted to the Sabroes for planning such a wonderful tour for us and for their kindness and hospitality to us.

Another visit to remember was the visit to Mr. G. Larsen's estate at Kojkol near Horsens. Mr. Larsen journeyed specially from Copenhagen to meet us and to be our host at supper. His large estate with its acres of woodland and its lovely gardens was much admired by all of us. We also had an interesting day at Frizsenborg on the estate of Count Wedell. The Count and his Manager, Mr. Lovengreen, came around with our party and the Count, with typical Danish hospitality, entertained us to lunch. Our over-night stay at Horsens was unfortunately too short to permit of our visiting any of the interesting shops, but we admired the lovely varieties of flowers we saw there.

The last two days of our tour were spent in the island of Fyn which we reached by crossing the "Small Belt Bridge" at Middlefart. Here we saw the beautifully situated forest of Langes which surrounds the lake of the same name. We spent an afternoon in the Brahetrolleborg forest district owned by the Reventlow family, which has been in that family since 1700. We were told that it is one of the oldest research areas in Europe. A stop overnight at Odense allowed us time to see the famous Hans Andersen's house and to dine at one of the old world restaurants of the city. There was also the very fine park to see and many fine buildings. Faaborg, on the Baltic, our last stopping place, was a delightful seaport town with its houses built close to the quays. We did our souvenir shopping here and some of our party enjoyed a walk by the sea. Next day we saw Frederiksgave Castle estate and Forest Officer Qvistgaard showed us plantings of exotic trees on poor sand soil. We had lunch at a very pretty restaurant at Wedellsborg on the Baltic on the guests of the estate before starting on our journey back to Esbjerg.

We had ideal weather during the entire week and our memories of Denmark will be of a country of sunshine, of neat, comfortable farms, each one with its shelter belt, of bright cheerful, prosperous towns and highly developed forests. Above all, we will remember the hospitality and kindness shown to us, the courtesy, the friendliness, and the warmth of the welcome we received. Our bus driver from Copenhagen must not be overlooked. His skill and competence in steering his bus over the narrow roads in the forest were the envy of all of us and his little speech before he parted with us was in keeping with his courtesy, good humour and helpfulness during the week.

S. C.

Monday, May 25th:

The drive to Viborg allowed the members to become familiar with the sight of unfenced lands, tilled or meadowed to their exact borderline, and to appreciate the care with which shelter screens of trees and shrubs had been grown so as to shelter the countryside and buildings in an orderly fashion. Belts of spruce (*Picea alba* and *P. sitchensis*) were frequent, but wherever possible hardwoods of the whitebeam, elm, or sycamore types had been used.

The journey was broken by a number of halts. The first of these was in an 80 year old stand of Norway spruce of slow growth, which is being opened out and underplanted with silver fir and Douglas fir with some *Quercus borealis*, beech, and Japanese larch. The slow development of the spruce was attributed to lack of moisture and a shallow root system. As the soil consisted of a deep, free-working sand it was felt that the deeper rooting species would be able to forage more successfully for water and that the overstorey of spruce should abate the effects of drying winds until the new crop was well established. The most successful results appeared to be in areas where there had been *Quercus petraea* scrub on sandy heathland. Birch was common in the second crop regeneration areas.

The discussions were enlivened by refreshments provided at the halt, and members were able to examine the use made of granite boulders set in formal groups. The names of pioneer heath planters were engraved on the stones as a permanent memorial.

The next item was a reception at his beautiful official villa by Chief Forester Beck, who has charge of a farmers' co-operative forest. The house was set in a clearing of several acres at the meeting point of several wide rides through a heathland coniferous forest: groups of hardwoods and ornamental conifers relieved the austere lines of the forest and protected a collection of flowering shrubs. The vistas along the open rides gave a sense of spaciousness, and crops grown in them a sense of agricultural prosperity. The traditional style of roof, with wide eaves over half timbered walls repeated some of the typical shapes and dark brown tones of the forest, and these in turn provided the background for brightly coloured flowering creepers and late spring flowers.

Mr. and Mrs. Beck's kindly welcome was greatly appreciated and Mr. Mangan expressed the thanks of the members.

The last portion of the journey was through the scenically undulating Dollerup Hills, south of Viborg. This is a favourite tourist resort, and a system of roads, adequate for a heavy stream of traffic winds up and down through stretches of unaltered heath which support the full flora of the type, and picturesque woodlands on the slopes overlooking beautiful lakes. A brief halt was made to allow time to enjoy the view and to examine the vegetation in which species of the typical genera, rare or absent at home, were common. *Vaccinium vitis-*

idaea for example, and near the forest edge *Trientalis europaea*, but with a thin growth of *Calluna* dominant.

J. E. J.

Tuesday, 26th May.

The forenoon was spent in the 6,000 HA State Forest of Viborg under the guidance of Forest Officer Hviid, who told us of the many problems of his charge. Not the least of them is fire. "There has been one fire this morning," he announced on our arrival, "so no smoking please." In 1948, 1,300 HA was burned by an unexploded shell which had lain in the woods since the war, and the fire station adjacent to the forester's house was a reminder of the danger.

We looked at a soil profile pit opened on the summit of an unplanted ridge and heard something of the history of the area from Mr. Hviid. When an ice cap covered all the rest of Jutland during the Ice Age here there was no ice. The nearest glacier was 10 miles to the north and during successive summers the melting ice waters poured over the place where we were standing and washed the mineral nutrients out of the soil. What was left was a barren sand, very low in humus, which supported no plant life except a thin crop of heather. "On this spot," said Mr. Hviid, "there has certainly been no forest for 1,000 years as we know it was the site of a battle in 1100 and for that a pitch clear of trees would have been chosen."

There are now 2,600 HA of forest in this section. The first planting was done by the State in 1804 and continued until 1840. Scots pine was used and it suffered severely from leaf shedding due to *Lophodermium* and the plantations were a failure. Norway spruce was then tried and it failed too and the scheme was suspended until 1895 when it was started again with the benefit of the experience gained by the Heath Society on similar land.

As well as fire and poor soil conditions, the management has to contend with drought in years of low rainfall, late frosts nearly every year, windfall and *Fomes annosus* in the shallow rooting Norway spruce and deer damage to the firmer rooted and healthier silver fir. An interesting technique has been evolved to combat all these drawbacks and this was explained to us by Mr. Hviid whose staff gave demonstrations of the actual operations which have led to successful afforestation.

The modern method is to plough 45 to 50 cm. deep with a mounted plough during the summer, disc harrow in the autumn and plant the following spring. About 1 ton of ground lime is spread over an acre in addition to 4 cwt. of a mixture of Phosphate, Potash and Nitrogen fertilizer containing some trace elements and after planting is finished 14 cwt. of rye straw is scattered over the surface of the ground with the object of providing humus. The total cost of the preparation, including fencing against deer, is up to £80 per acre.

We saw a demonstration of planting by machine. A large tractor

pulled a three row planter which seated three operators who planted Norway spruce, Lawson cypress and birch 2 year 1 year transplants at $1\frac{1}{2}$ m. spacing in lines $1\frac{1}{2}$ m. apart. The machine opened a furrow into which the operator thrust a plant; the soil was filled in by a disc and firmed about the roots by a narrow roller.

Nearly all the mixtures contain 50% Norway spruce which is found to be a valuable cash crop, first as Christmas trees from 10 years of age and later as fencing posts and rails, hay tripods, transmission poles and construction timber. There is an established market for the spruce and it is easier to sell than Japanese larch, Douglas fir, silver fir, or mountain pine. Japanese larch is used for its beneficial effect on the soil and because it helps the growth of the spruce. It is well liked for mixing in the fire and shelter belts which border the roads. These are 35 yards wide and besides Japanese larch and spruce contain silver fir, oak, beech, sycamore, cherry (*Prunus serotina*) and *Amelanchia spicata*. The aim is to smother the grass and heather as soon as possible and to maintain a green understorey of non-inflammable hardwoods and shrubs. To speed the early death of surface vegetation the ground in between the lines of newly planted trees is kept cultivated by a small four-wheeled tractor carrying a spring tined harrow. Killing the grass also reduces the frost danger.

Points of interest which came out in the course of the many discussions were :

Fertilizers are of little value on the unimproved sandy soil as they are washed out because of the lack of humus. They rye straw provides humus and they find that there is a noticeable improvement in fertility when soil is brought from older plantations and shovelfuls are sprinkled over the straw. A zoologist from the nearby concientious objectors' camp has found earthworms in a straw strewn plantation and Mr. Hviid hopes that the straw and soil treatment will lead to an increase in the numbers of worms—"the unpaid tillers of the soil."

Silver fir is protected against deer damage by "twinning" with mountain pine or alder. The two species come from the nursery tied together with string and they are planted in the one pit. They grow up side by side and the nurse is not removed until the silver fir is in need of relief—usually it is not necessary to remove it at all.

The roads and fire-lines divide the forest into compartments of about 500 acres.

The forest workers are able to earn 30 kroner a day on piece-work and take home £7 10s. 0d. to £9 a week.

The rotation of Norway spruce depends on the soil. The first generation was left for 60 to 70 years which is equivalent to 45 years growth allowing for initial checks.

We had lunch in Knudstrup Inn as guests of the Society of Danish State Forest Officers. Mr. Hviid who is president of the Society was our

host at a most enjoyable meal in a room appropriately decorated with sprays of tree foliage by the local forestry staff. Mr. McEvoy expressed our thanks for the hospitality and we then set out on our afternoon session visiting the woods in the charge of the Danish Heath Society.

The Danish Heath Society is a non-profit-making body whose aim is the improvement of the soil of Denmark. It has 19,000 members and its headquarters is in Viborg. It is governed by a committee and a board of 9 directors, 4 of whom are elected by the Committee, 3 by the Ministry of Agriculture, 1 by the farmers' associations and 1 by the small holders' association. It was founded in 1866 when there were 1,000,000 HA of uncultivated heath. Since then 700,000 HA of this area has been converted into arable land, the society has assisted in establishing plantations with a total area of about 100,000 hectares and the Government through the State Forestry Department and the Dune Directorate has planted another 90,000 HA of plantations.

From 1880 the State granted annual subsidies for the work of planting. A few years earlier the planting of shelterbelts and small plantations was commenced and from 1882 the work of planting shelterbelts was organised in local societies which are enabled by the State grant to distribute trees at reduced prices.

The Society has assisted in the establishment of about 3,100 plantations occupying about 270,000 acres of which 30,000 acres belong to the Heath Society itself.

As we drove along towards our first stop to right and left of the road we saw evidence of the Society's work. It was hard to realize that 100 years ago these prosperous farms had been barren heath and that the transformation had been wrought by deep cultivation, marling and by the planting of shelter belts. Colonel Dalgas, the founder of the Heath Society and its director during its early years, first hoped for sufficient shelter from widely spaced belts but before long he realized that high production was not possible without close shelter and that this was achieved by single rows of trees around the fields. Now every field has its high "hedge" of Norway spruce mainly about 20 to 30 feet high and in nearly every instance in a single row.

And then we came to Kongenshus Mindelpark, a 3,000 acre memorial park to the pioneers of the heath reclamation, and drove into one of the long shallow valleys along a narrow road flanked with boulders set up in commemoration of the work done in improving the heath lands since 1866. Each district has a boulder and on it are carved the areas of heathland, woodland and farmland in 1850 and in 1950, and round each district stone are smaller stones for every parish bearing the names of the local heath pioneers.

Shortly after leaving the memorial park we entered Guldborgland plantation, which is the property of the Heath Society. We were welcomed by Mr. Christiansen who presented each of the ladies in the party with a bouquet of flowers. He explained the problems of the

area under his charge which extends to about 1,000 acres of Norway spruce planted in the heather from 1875 to 1885 and now undergoing regeneration. Clear felling is not favoured as it leads to the growth of a dense mass of grass and gives no protection against frost or the drying effects of sun and wind which are serious on the sandy soil and with a rainfall of only 25 inches. The system found successful is artificial regeneration in narrow strips under a light shelter-wood, planting a mixture of Norway spruce, *Abies grandis*, silver fir, Douglas fir, Japanese larch and birch. In some compartments the birch (*Betula pubescens*) and silver fir were planted in the same hole so that the birch would protect the fir against roe-deer. Every plant was given $\frac{1}{2}$ oz. of a mixed fertilizer at the time of planting. Ploughing before planting is usual.

We were given this data for Compt. 25 :

Species	...	...	Norway spruce.
Age	...	...	88 years.
Total increment (1955)			9,900 c.ft. per acre.
M.A.I.	...	...	128 c.ft. per acre.
Volume in 1955	...		5,200 c.ft. per acre.

Over half of the stems in this plantation suffer from *Fomes annosus*. About 3 feet to 6 feet of the butt of affected trees is unsuitable for saw timber and goes for firewood or pulping.

Heaps of Norway spruce poles were seen on the roadsides. Felling and extraction are done by the forestry workers, who measure the logs and mark the dimensions on the butt of each. Standard prices based on size classes but not quality are agreed at an annual meeting of timber merchants and these prices are a guide in all the sales which take place during the year.

Our next stop was at Dalgas Plantation, an area of 1,050 acres called after the founder of the Heath Society, which was planted from 1887 to 1930. We looked at Compartment 43 dating from 1894 when a mixture of 75% Norway spruce and 25% mountain pine was planted on trench ploughed heath. Seven years later the furrows were ploughed back against the plants because they showed signs of ill health and later all the mountain pine was taken out. In 1955 the Norway spruce was 40 feet high and volume 1,900 cubic feet per acre. 80-90% of the stems were attacked by *Fomes annosus*.

The area is now under regeneration. The general plan is to work from east to west clearing strips 8 metres wide with 16 metres left in between. Stumps are removed and the entire area of the strip is ploughed and planted with a mixture of Norway spruce, Douglas fir, silver fir, and Japanese larch. Trials are, however, made with other methods—one area had two-thirds of the trees cut out and the

remainder retained as an overstorey. The branches were collected in windrows and the spaces in between were ploughed by horse plough. Birch seed was sown in the furrows, and a mixture planted consisting of 50% silver fir, 34% Norway spruce, 8% Douglas fir and 8% Japanese larch and in the following year $\frac{1}{2}$ oz. of mixed fertilizer was applied to each plant. They plan to leave the overstorey for 10 years or until the young trees form canopy.

Points from the discussions—

In Denmark site quality classes are from I to VI. Dalgas plantation is on quality VI and the soil is a poor glacial sand with a pH of 4.6. By introducing soil improvers such as birch and Japanese larch they hope to raise the quality in the next rotation.

Mr. Christiansen said they had a "desert" climate in June and July—60° temperature by day and frost every night.

In reply to Mr. Clear, Mr. Christiansen said that clear felling and complete ploughing would be all right if the stumps could be easily removed.

H.M.F.

Wednesday, 27th May.

The journey from Viborg South East to Frijsenborg Estate near Hammel where we studied forestry on this day was full of interest. Our friend and guide, Mr. Tolstrup, gave us many tit-bits of information concerning the district through which we travelled, and pointed out many items of interest to members. Along the route we saw several extensive commercial forest tree nurseries ranging from 50 to 150 acres and among them one owned and managed by the Danish Heath Society for the production of Norway spruce transplants for its more sandy northern forests.

The demand for transplants can be appreciated when one realises that half of Denmark's million acres of forest is in small plantations on farms of less than 50 hectares. Indeed, a feature of this district is the number of small farms which have their own plantations properly managed to provide much of the timber requirements of the holdings. Of interest too was a pig breeding station, and an artificial lake built about 30 years ago as a source of power for the production of electricity.

Count Tido Wedell, owner of the Frijsenborg Estate, met us at Hagsholm Forest and extended a warm welcome to the Society before handing over to his forest manager, Mr. Lovengreen, to conduct us on a tour of the forests. Throughout the tour Count Wedell accompanied us, entertained us to lunch and joined in discussions.

The Estate Forest area of over 4,000 hectares is evenly divided between hardwoods and conifers as follows :

Hardwoods:			Conifers:		
Beech	...	1,009 hectares	Norway spruce	...	893 hectares
Oak	...	439 "	Sitka spruce	...	356 "
<i>Quercus borealis</i>	...	72 "	Silver fir	...	450 "
Ash	...	186 "	<i>Abies nordmanniana</i>	...	139 "
Maple	...	40 "	Douglas fir	...	70 "
Birch	...	179 "	Scots pine	...	25 "
Alder	...	124 "	Japanese larch	...	171 "
Others	...	16 "	Others	...	40 "
Total 2,065 "			Total 2,144 "		

At present more than half the forest crop is less than 35 years old. This is due to severe wind storms in 1934 and 1937 when over 10,000 M³ of timber was damaged, and to extraordinary heavy felling during the war years. Soil conditions vary considerably but on the whole the soil is good and conditions reasonably favourable for tree growth. The rainfall for the area is 660 mm.—the average for the country is 625 mm. but frequent and severe late spring frosts and prolonged summer droughts give the forests many headaches and cause much damage to tree crops despite their best attention. Birch is extensively used as a nurse for the more tender species which cannot be grown successfully on exposed sites here.

First to catch the eye was a magnificent stand of *Abies grandis*, age 45 years, f.f. .425, h. 28.9 m. diam. 39.9 cm. No. 301, b.a. 37.6 and volume 462 M³ per hectare. First treated in 1934, it had been thinned 11 times and had yielded 438 M³ per hectare from 2,327 poles removed. Between 1934 and 1949 during which period it was thinned bi-annually an average of 12% of the crop was removed in each thinning. Since 1949 thinning was every third year and the cut was reduced to an average of 8.2% of the crop for each thinning. Mr. Lovengreen favours frequent light thinnings to produce big crowns and gross stems. This crop was the second rotation, the first being Norway spruce before which the area was covered with heather.

Next we saw stands of 48 years old *Abies nordmanniana* and 44 years old *Abies nobilis*—poor in comparison with the *grandis*. The *nobilis* stand had been thinned annually to provide Christmas decorations for which there is good demand at a remunerative price. A belt of 64 years old silver fir on the west and windward side of this conifer block was underplanted with beech in 1958. As the silver fir is regarded as a wind firm species it is planned to retain it as long as possible for protection and the beech is introduced to improve the soil and form an understorey. We wondered at the close spacing of the beech in the lines which were 6 feet apart, but only a few inches apart in the lines.

The Danes believe in close spacing of beech to get the best results. A stand of common oak underplanted with sycamore in 1942 was admired and discussed. Some members expressed the opinion that the sycamore would eventually outgrow the oak but Mr. Lovengreen plans to keep the sycamore as an understorey for the benefit of the oak only. The oak is now 47 years old; f.f. .606, h. 14.0 m. diam. 18.7 cm. No. 547, b.a. 15.1 and Vol. 128 M³ per hectare. It has been thinned 5 times since 1931 and promises excellent results.

At Haurum Forest on the same Estate beautiful plantations of spruce and oak were to be seen. A 20 years old stand of Sitka spruce which was not yet pruned was receiving its first thinning. By our standards the thinning was light, but the felling and extraction to roads was extremely difficult in this thicket. Of particular interest was a plantation of Sitka spruce specially selected for seed supplies. Stems are now reduced to 300 per hectare and at 51 years old they are 30.5 m. in height. They are obviously classically bred and this is appreciated by the owner and forester. Here, too, we saw a stand of sessile oak from special (Spessard) seed now 45 years old and full of promise.

At Pot Molle, beech 60 to 80 years old was the attraction before driving to Sonderskoven where numerous interesting plantations of beech, silver fir, Japanese larch and Norway spruce were seen and compared. Members were surprised to see Norway spruce thinnings being prepared for transmission poles, but there is apparently a ready market for good quality Norway spruce for this purpose. An unusual method of protection against wind damage was the subject of a lively discussion at a 36 year old Norway spruce plantation. Some of the trees on the edge of the stand had been blown down during a recent storm making it more difficult now to protect the remainder of the crop. Realising that the wind was likely to penetrate deeper and deeper into the wood unless the trees on the fringe were kept standing, Mr. Lovengreen had several whorls of branches pruned from the centre of the crown of these trees, leaving the top and bottom green whorls untouched. In this way the area of crown exposed to the wind is reduced and the force of the wind gradually weakened. There is little light penetration to the forest floor and very little loss of increment.

A most instructive and interesting tour of Frijnsborg Estate ended at a 13 year old beech plantation which had been treated with artificial manures including Nitre, Potash and Phosphate. Growth is pretty even, and so far the experiment has shown little results.

Our President and Mr. J. Galvin thanked Count Wedell for his lavish hospitality, and for the great privilege of viewing his numerous excellent plantations. To Mr. Lovengreen and his able assistants, Mr. Norgaard and Mr. Graam, for arranging the itinerary, providing a wealth of information, and patiently answering questions words of appreciation were also spoken.

Travelling via Himmelbjerget we paused here to admire the scenery.

Here, indeed, trees have added much to the beauty of the landscape and it reminds one of how much remains to be done to improve our scenery, where we have lakes and hills in abundance in Ireland.

Driving through a community forest which is the property of local farmers our guide explained that it was managed as a single unit although the boundaries of each owner's plot are clearly demarcated.

Arriving at Højkøl, the residence of Mr. Gunnar Larsen—a familiar figure in Irish Industry—he invited us to have a look around the estate before entertaining us to supper. Here, too, we met Dr. Axel S. Sabroe so well known to our members and Mrs. Sabroe who also visited Ireland some years ago.

In extending a hearty welcome to the Society Mr. Larsen invited us to make ourselves "at home" which we really did, partaking of a substantial meal in the cool of the evening. Dr. Sabroe also spoke warm words of welcome, and apologised for being unable to meet us on landing in Denmark on Monday morning, being advised by his doctor not to travel.

The President and Mr. M. Flannery offered thanks to all concerned for the wonderful hospitality and kindness which we received.

The sun was setting as we left to continue our journey to Horsens where we stayed for the night. We were sorry to part with Mr. Tolstrup there after a perfect day.

D.McG.

Thursday, May 28th:

Leaving Horsens at 9.30 a.m. we soon arrived at Boller State Forest where Dr. Axel Sabroe was our guide for the day.

Boller was, until 1930, part of the great Frijsenborg estate. But after the death of the late Count it was sold to the State which divided the farmland into 18 acre holdings and took over control of the forests. When Dr. Sabroe took charge in 1935 he continued a system of silviculture more or less corresponding to the German *Dauerwald* ideas: thinnings were carried out every two or three years and slow, natural regeneration, especially of beech, was started. This proved very successful during the second World War when a good reserve of naturally regenerated material was found to exist under the old stands.

Figures for the forest are as follows:

Total area	...	...	3,458 acres
Total broadleaved trees	...	...	2,561 acres
Total coniferous trees	...	...	622 acres

Beech predominates among hardwoods and silver fir among conifers.

Average standing volume for all species was 2,415 cubic feet per acre in 1933 and 2,258 cubic feet per acre in 1948. The intention is to increase this to 2,800 cubic feet per acre.

Precipitation averages 28 inches per annum. The soil is rich, but in places too heavy. Chalk is abundant.

The first stop on the excursion was at plot No. 3 where we saw an excellent example of selection treatment with mixed hardwoods. Ash, beech and sycamore were the predominant species. A very excellent second storey of sycamore was of great interest as, even at an early age, one could see 15 to 20 feet of perfectly formed and clean stem in all dominants of that age group. All were allowed to come up at very close spacing, i.e. about 6 inches apart, and only after 6 to 7 years of intense competition was any thinning carried out and then only slowly. This area is an experimental one where Dr. Sabroe has carried out very careful and intensive treatment with excellent results.

Plot No. 16 being one of coniferous mixture of Douglas fir and western red cedar (planted 1951) gave rise to the question of mixtures of species. Dr. Sabroe, although in favour of mixtures, preferred the idea of grouping the species, e.g. a group of Douglas, another of *Thuja* and so on. For an eight years' old plantation the mixture showed good promise, and even the shade-loving *Thuja* was coming on well.

A plot of beech which in its early years, at the beginning of the century, had been seriously damaged by game was then shown to us. Although considered poor by Danish standards it would easily reach Quality Class II in Ireland. The quality of hardwood stands in most of the Danish forests was really an eye-opener for us.

We then visited a plot of beech where group regeneration was carried out. The beech standards are 145 years old, showing 30 or more feet of clean, first-class timber. In Denmark the trunk is sold as first-class timber for furniture, etc., the main branches may be used for floor blocks, and small lumber and the lesser branches are sold for firewood.

Further to this we visited Plot No. 294 where we saw selection treatment of ash, sycamore and beech. The first storey was ash, the second beech and the third sycamore. The combination, although not very outstanding does show the compatibility of these species with each other.

Our final wanderings of the day took us through "Grund" forest where another fine stand of beeches, 135 years old, was pointed out to us. This region is on the banks of the Vejle Fjord and yet the beech stems are very well shaped. Interesting to note was the absence of root competition with the second generation coming up which may have been secured by the gradual opening up of the stand, thus retaining the soil moisture more completely.

After driving through Ullerup forest we soon arrived at the Sabroes' summer residence where we had afternoon tea before heading over the Lillebaeltsbroen and on to Odense where we spent the night.

L. G.

Friday, May 29th:

This day we visited two forest areas, the first one being at Langeso. When we left Odense we met Mr. Elmqvist who replaced Mr. Tolstrup as our travelling guide.

Langeso is situated a few miles to the north-west of Odense, and the forest area totals 1,895 acres. In 1958 the area under trees was divided among species as follows:

Beech	...	...	...	...	819 acres
Oak	...	...	...	...	142 acres
Ash	...	...	...	...	72 acres
Other hardwoods	...	...	...	...	90 acres
Larch and Douglas fir	...	...	...	...	154 acres
Other conifers	...	...	...	...	420 acres

The hardwood areas are often mixed with conifers which influence the form and growth of the beech. The mixtures have generally been achieved by underplanting in smaller groups and filling up beech stands damaged by mice and frost, the age difference between the beech and the after planted species being about 10 years. Many areas consist solely of conifers.

Stjerneberg, section 61 el: A fine stand of Douglas fir planted in 1883 in an open field at 3 × 3 ft. spacing. The idea, according to Mr. Marstrand Jorgensen, the forester in charge, is to retain the stand as long as possible. The present price for Douglas of that quality in Denmark is about 7s. per cubic foot, but even at that attractive figure the Danes are reluctant to fell. Whether or not they are carrying the stand beyond its financial rotation through overstressing the silvicultural aspect is a debatable point.

The importance of foliage as a marketable crop was one of the main features noticeable at Langeso. The sale of branches produces an additional income of about £5 per acre per annum.

The overall impression of our short visit to Langeso was one of a scientific approach to forestry with adaptation of the financial aspect to the silvicultural rather than *vice versa* as in Ireland.

After lunch at the Komigen Kro we travelled south towards Faaborg, stopping off at Brahetrelleborg estate, owned by Countess L. M. Reventlow, which is 3 to 6 miles from the coast north-east of Faaborg in the south of the Island of Fyn. Here oak and beech grow well. Conditions are poor for ash, and many trees show black seed at 25 years of age. Norway spruce is badly attacked by heartrot. Regeneration in beech is carried out partly by self-seeding and partly by planting, oak chiefly by direct seeding, all other species by planting.

In a visited beech plot the area was being prepared for natural regeneration. The stand has not been thinned since 1944 to prevent encroachment of ground vegetation which would hinder natural regeneration. When a good mast occurs the ground will be prepared by

a cultivation which will make strips 1 metre apart, then in the following winter the stand will be thinned.

Finally our tour took us to an oak stand severely defoliated by the moth *Tortrix viridana*. On these oak stems a large number of epicormic shoots have appeared due to the attack of the moths. Underplantings of lime, sycamore, ash and beech are used to retard the development of watersprouts, but here the attack was so heavy that the canopy had been opened up and in many cases stripped completely. Discussion of the situation followed, and the Danes, including Mr. Bistrup, forest officer, seemed rather reluctant to use insecticidal sprays for fear of harming other wild life and predators on the moths.

The night we spent in Faaborg, dining at Rasmussens hotel and thence wandering to our respective beds, scattered through three of the town's hotels.

L. G.

Saturday, May 30th:

After a restful and pleasing evening followed by a good night's rest in the ancient town of Faaborg on the Baltic coast, we headed north westward. An air of sadness prevailed—we were now commencing our last day; turning homewards, reluctant to leave Denmark and its friendly people.

After a pleasant run we halted at the Forest of Weddellsborg (Area 160 hectares). We were met by Forest Officer H. P. Ovistgaard who welcomed us and gave us a short history of the forest area. He pointed out that the strong winds from the south west were troublesome as the forest had a long boundary facing those prevailing winds.

The soil in the area is derived from a deep glacial deposit, rich and showing signs of careful management. Many broad-leaved species including oak, beech, sycamore, rowan (*Sorbus*) and ash are cultivated. Of the conifers Norway spruce, Douglas fir, *Abies alba*, Sitka spruce (and it was the first area with a plantation of *Cupressus Lawsoniana*) were to be seen. To an Irish Forester the absence of *Tsuga heterophylla* was noticeable.

Oak and beech are grown for veneer and fine stands of pedunculate oak of approximately 130 years were seen. Beech 160 years old was here too. The selected stems of the oak are kept pruned of water sprouts from June to September each year. The failure to carry out this operation in any one year would ruin the stem for veneer purposes.

The system under which these oak and beech are grown is a two storied and often a three storied forest. The first length of an oak grown thus and of first quality (about 10 ft. long) is valued at between twenty and thirty-five pounds sterling per cubic metre. The second length often obtained is valued from ten to fifteen pounds.

When growing oak of this quality the Danish Foresters aim at producing 14 to 16 sq. metres basal area per hectare at 50 years and to

maintain this basal area throughout the life of the forest. This includes the basal area of the second storey, usually beech, and the third storey, usually of sycamore. *Sorbus* and similar smaller trees are also used in this storey which forms a protection for the forest floor.

Green pruning of the spruce and Lawson cypress was practised to take advantage of the Christmas trade in greens and, to supplement the Christmas trees, for decorative purposes.

The use of branches and brushwood to conserve the moisture in the areas being re-planted or re-seeded was practised. Deer had caused damage in this area.

Absence of oak mildew was explained thus: "Oak likes wind: perhaps mildew does not like wind."

Reluctantly we left the forest, stopping to have our last meal on Danish soil at a beautiful restaurant on the shores of the Baltic. Farewells were made to our Danish hosts; our excellent Danish driver raced his bus against time over the Smaal Belt Bridge and on into Esbjerg and here we boarded the boat for home.

M. C.
