

## SITKA SPRUCE IN IRISH FORESTRY

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Amongst the many conifers introduced into Ireland there is none of such economic importance as the Sitka Spruce.

The Sitka Spruce was first planted in this country about 80 years ago and the very fine specimens found here and there would indicate that it was planted mainly as an ornamental tree on estates and parklands. It may be of interest for me to mention some particulars regarding these. The tallest Sitka Spruce appears to be growing on the estate of the Duke of Abercorn at Baronscourt, Co. Tyrone. According to recent measurements it is 140 feet high and has a girth at breast-height of 12ft. 6 ins. Other fine specimens over 100 feet high are growing at Curraghmore, Powerscourt, Headfort, Clonbrock, Ballyfarnon, Glenstal, Shelton Abbey and Emo Park; from 90 to 100 feet at Killarney and Fota, and from 70 to 90 feet at Rockingham, Blandfort, Ards, Adare, Castlefreke, Kenmare and Ballyduff, Co. Kerry. All the above are individual trees and carry branches very low on the stem, with the typical swelling at the base of the stem.

Sitka Spruce was not planted as a forest tree until early in the present century, and some of the pure stands of this species which we find to-day are really the outcome of plantations where Sitka Spruce was used in mixture with Norway Spruce, European Larch, Scots Pine and *Thuia*. The Sitka Spruce, being a fast grower, soon got away from these other species and soon had more growing space than it required for full development.

Except for an experimental plot at Avondale, Co. Wicklow, which appears to have been planted about 1905 or 1906, Sitka Spruce does not appear to have been used in the form of plantations before 1909. From 1909 we find it was planted at Camolin, Dundrum, Kilrush, Knockmany, Co. Tyrone; Mountrath; Tardree, Co. Antrim, and elsewhere.

Most of these plantations were mixed, mainly with Norway Spruce, but some other species were used. Most of these earlier plantations have been felled or heavily thinned during the recent war period, and the Sitka Spruce, which had in nearly every case suppressed the Norway Spruce early in the life of the stand, had been growing under conditions resulting in rough or tapering stems, but also in the production of a very large volume per acre.

Two examples are worthy of special notice. One, and I should say it is the best, occurs in the form of several plots of pure Sitka Spruce on the Lough Eske estate in Co. Donegal. These were planted with European Larch and *Thuia*, and now after 35 years, furnish some of the finest, if not the finest, Sitka Spruce trees in Ireland.

The other was planted in 1916 on the Ballykelly State Forest, Co. Derry, on an area of about  $1\frac{1}{2}$  acres.

The plots on the Lough Eske Estate, which were planted in 1910, and which now contain individual trees 100 feet high with breast-height girths of 3ft. 6ins. to 6ft., must, I think, show the best height growth. These trees are growing now in close pure stands and, I should say from a commercial point of view, are second to none in Ireland to-day.

### Natural Habitat of the Sitka Spruce.

According to "A Handbook of Coniferae," by Dallimore and Jackson, the Sitka Spruce (sometimes called Great Tideland Spruce, Menzies Spruce, Silver Spruce, Tideland Spruce and Western Spruce), "extends further north-west than any other N. American conifer, its westerly limit being the east end of Kadiak Island. It extends through the coast region of Alaska, British Columbia, W. Washington, Oregon, southwards to N. California, rarely extending inland more than 50 miles."

It is indigenous in a great tract of country lying between the western slopes of the Coast Ranges and the Pacific Coast, where the climate resembles that of the western coast of Ireland. Perhaps the following information respecting the climate from one part of its natural range will convey a clearer picture of the rainfall conditions than the quoting of a whole mass of figures. At this particular station—on the Sitka Sound—it rains or snows for 208 days in the year. The mean annual rainfall varies throughout the natural range of the Sitka Spruce from 40 to 120 inches, being given as 88 inches for Sitka Sound. I am sure there are some places in Ireland where similar conditions occur, and the fact that the Sitka Spruce flourishes in such conditions is a point in its favour here. For comparative purposes the following figures, kindly supplied to me by the Meteorological Service, Department of Industry and Commerce, Dublin, of recorded mean annual rainfall for a number of stations in the western counties of Ireland for the period 1881 to 1915, may be of interest:—

- Co. Mayo, Delphi Lodge—99.00 inches.
- Co. Kerry—Gap of Dunloe—94.00 inches.
- Co. Galway, Ballynahinch—61.00 inches.
- Co. Sligo, Markree—43.53 inches.
- Co. Cork, Roche's Point—41.88 inches.
- Co. Donegal, Malin Head—39.60 inches.

In its natural habitat Sitka Spruce grows to 160—180 feet, and occasionally to 200 feet, with a trunk girth of 24 feet to 36 feet or more above the buttressed base, but ordinarily 100—125 feet high, with a trunk 9—18 feet in girth.

Exposed trees such as we have—those mentioned above—are broadly spreading and pyramid-shaped, but those grown in pure stands, close together, have fine clean timber, gradually tapering and free of branches for 40 feet and sometimes 80 feet.

In parts of Alaska, where the Sitka Spruce is found up to 3,000 feet above sea-level, the tree gets smaller after it passes 1,000 feet above sea-level, those found at the 3,000 feet mark being nothing more than shrubs.

The tree was first discovered by Archibald Menzies, the distinguished traveller, after whom it was first named by Lindley. It was not introduced into cultivation until 1831 in Britain, and at a much later date in Ireland.

Professor Sheldon in his book, "The Forest Wealth of Oregon," calls it the largest tree in the State, and says it is distinctly a moisture-loving tree, and in an extensive coast belt is an ideal lumber tree.

In California it grows on rich alluvial plains, at the mouths of rivers or on low valleys facing the ocean, where it is found associated with *Sequoia* and *Abies grandis*, and this may be said to be a region where there is perennial moisture in the air and a rainfall of 50 inches and upwards.

Sargent says its growth is rapid, the leading shoots on young trees in Puget Sound being from 3 to 4 feet.

### Nursery Treatment.

Sitka Spruce seed is small (about 200,000 to a lb.) and exceptionally fine digging and raking and breaking of the soil is necessary. Sown usually at the rate of 1 lb. to 40 yards of 4 foot bed and lightly covered. A mixture of leaf mould through the fine soil is an excellent cover. A light mould soil is recommended for Sitka Spruce and shelter from sharp winds is desirable. The seed is sown in April or May, and in some nurseries it would be wise to cover the seed with sand, as the seeds are so small that they often dry out, resulting in complete failure. Sand as a dressing is also necessary to diminish danger from damping off and frost lift. The latter seems to be the greatest worry for the nurseryman, but this can be corrected by proper drainage of the seed bed.

Lined out at two years, the seedlings should be given ample space for development above and below ground, and it is usual to line them out 10 inches between lines and 3 inches between plants.

Sir John Stirling-Maxwell on his estate in Inverness-shire, Scotland, has used Sitka Spruce in his system of employing "flying nurseries," in which the seedlings are first planted out in turfs clustered closely together and after a year or two moved to their permanent position along with the turfs on the adjoining moorland. These flying nurseries need not be very extensive and each one should not contain more plants than will stock  $1\frac{1}{2}$  to 2 acres at a spacing of 5 feet by 5 feet. Sir John carried out extensive experiments on moorlands and incidentally says in his booklet—Loch Ossian Plantations, 1929—"of all trees we have tried Sitka promises the best return." He says that it is very much less subject to frost damage than at lower elevations and that one merit peculiar to Sitka is the ease with which it can be transplanted when grown on turfs.

### Subsequent Cultivation.

Although Sitka Spruce loves a wet climate it loves a wet soil even more and soon becomes unsightly and loses its foliage in dry localities. No conifer except the Douglas Fir grows so rapidly where it has suitable conditions, and in some parts of Ireland it is growing where it would be hard to get any other conifers to live. Owing to great resistance to wind, Sitka Spruce, where conditions are favourable, is eminently suited for bleak mountain slopes and it does well near the sea.

Sitka Spruce with turf planting may be said to have opened up a new era for forestry in Ireland. On poorer moorland soils the volume of timber produced by Sitka far exceeds that which Norway Spruce will produce on land of this type. At low elevations on old woodland and on fertile soils Norway Spruce produces heavy stands of timber, but on higher, more exposed and less fertile types of land, Sitka Spruce is to be recommended and has already proved itself a better tree, especially when grown in pure stands. Norway Spruce will thrive on soils hardly moist enough for Sitka Spruce, but, I may add, that on such soils many other species can be grown. As long as there is sufficient moisture in the soil Sitka is very accommodating, but it will not thrive on water-logged soil or on one deprived of air by a tight peat skin. It will not grow well on dry peat as indicated by heather, but will grow on grass-covered peaty soils. Where it is planted on soils covered with grass and heather it will often do quite well for a time, but it is safer not to take a chance with Sitka on such ground.

Where there is any doubt about excessive moisture in the soil it is advisable to plant Sitka on turfs. It is much cheaper than carrying out extensive drainage. Sitka Spruce, being a shallow rooter, thrives well when planted on turfs and it is remarkable the difference it makes when the trees are planted deeply in pits, as the roots usually die or the plants remain in a state of check, living on their own vitality until a new root system develops from the collar. This is, in my opinion, the cause of very uneven height-growth in many young Sitka plantations.

In cultivation Sitka Spruce suffers from frost damage and may remain in a state of check for a number of years, until, as examples show, the plants get above the frost line and growth becomes normal. In an area planted in 1935 near Dunmanway, for example, growth has been so badly checked by frost that after ten years the largest trees are not yet more than 9 feet high. Similar cases have occurred elsewhere.

In cases where frost hollows are recognised or even suspected, Grey Alder should be planted two to three years before the ground is stocked with Sitka Spruce. I do not consider the planting of Alder at the same time as the Spruce any immediate advantage, and in nearly every case the Sitka Spruce are damaged beyond recovery before the Alder provide the all important cover.

Another feature of the Sitka Spruce which causes many foresters to dislike it is the blowing out of the half-ripened shoots and the formation of double leaders. I do not consider this any just reason for

any person to denounce it as a poor forest tree. I have observed this on Sitka, but I think that only a small percentage of the trees suffer and it is not likely to cause permanent damage to the crop. I have heard it said that trees grown from seed of Queen Charlotte Island origin are less subject to damage from the breaking of leading shoots and less from frost damage.

Sitka Spruce also suffers from attacks by an aphid, but so far no permanent damage appears to have been noted in this country. If large blocks of Sitka are broken up with belts of other conifers or hardwoods where the soil and situation suit, there is not likely to be any danger of the spread of this pest.

Height growth is normally from 2 to 2½ feet per annum, but many instances have been noted where growth has been 3 feet and even 4 feet yearly. I have never observed Sitka produce a second annual growth.

It has, I am sure, been noted that I favour the formation of pure Sitka Spruce stands, but I am aware that certain mixtures have been tried. It is claimed that a mixture of hardwoods lets in the light and checks the formation of raw humus, lessens the danger of wind-throw and may be a protection against frost. Such a mixture requires attention however. Part of a plantation laid down in Killeshandra State Forest in 1932 on an area of old woodland suffered because of the presence of too many alder birch and other shoots, and it was only when the Sitka Spruce were freed by the removal of some of these that they showed anything like normal progress. In an adjoining compartment, where the trees were planted on unwooded ground, the Sitka Spruce made excellent growth and are now nearing the thinning stage.

I am indebted to Mr. M. O'Beirne for information about another interesting mixture of Sitka Spruce and Japanese Larch which was planted in 1904 at Avondale. The Larch outgrew and suppressed the Spruce and after twenty years the former were almost all removed. The Sitka Spruce made a remarkable recovery and showed normal growth and increment. One would never think that the Sitka had ever been suppressed to judge by the present appearance of the plot.

At Pettigo State Forest in Co. Donegal there is now one of the most extensive tracts of young Sitka Spruce plantations on difficult moorland soil, consisting of a deep water-logged peat, mostly between the 400 and 700 foot contour lines above sea-level. The vegetation was mainly *Molinia* on the planted areas, with occasional rushes and bog myrtle. Planting was begun in 1937 and was exclusively carried out on turfs at a spacing of 4½ feet by 4½ feet. The tallest of the Sitka Spruce are now about 20 feet high, but height growth is not uniform and some years must elapse before the stands will reach thicket stage.

### Thinning.

In the ordinary course, thinning of Sitka stands should commence when the trees are 25 feet high and should be continued at intervals of three years. In well-stocked pure stands the trees are free of side branches, but it may be necessary to do some brashing of the lower branches a year or two before the stand is due for thinning.

In pure stands the number of trees per acre will vary from 1,200 to 1,700 according to the original spacing when the stand is ready for thinning. When the stand has reached maturity there will probably seldom be more than 250 trees per acre. In other words, 80% to 85% of the trees will have disappeared before the end of the rotation, which I would put at about 55 years of age. In addition a certain number will already have been lost during the first 15 years or so of the life of the stand owing to natural deaths. The majority of these trees, however, in a well-managed plantation are deliberately cut out. Neglect to carry out thinning at the proper time causes permanent injury to the crop and may lead to severe damage from wind-throw.

The grade of thinning suitable for Sitka Spruce is, I suggest, one in which many of the weaker dominants are removed as well as whips injurious wolf trees and any suppressed or sub-dominant trees not required for ground cover.

**Yield.**

I have endeavoured to collect some particulars of yield and rate of growth from some stands of Sitka Spruce in Ireland, and I have specially to thank the following for kindly supplying the figures quoted and for giving permission to publish them:—Mr. Scott McD. Swan, Lough Eske; the Forestry Division of Northern Ireland and the Forestry Division of the Department of Lands, Eire.

The first figures refer to the plot of pure Sitka Spruce planted at Ballykelly in 1916 on a fairly deep peat over heavy clay in a sheltered position at an altitude of 100 feet.

This plot has had four thinnings and in addition special poles have been removed for urgent war purposes. The fellings were heavier than normal owing to danger from wind-throw due to the clear-felling of an adjoining area. A sample plot of a tenth of an acre, recently measured, gave the following figures:—

		1939	1945
Number of Stems per Acre	.. ..	540	300
Total Height of Sample Tree	.. ..	63 ft.	78½ ft.
Timber Height to 3 ins. diameter	.. ..	48 "	60 "
Q. G. at Half Height	.. ..	5½ ins.	6 ins.
Volume per Acre (U.B.)	.. ..	4540 cu. ft.	4163 cu. ft.

The second lot of figures refers to a plot at Knockmany, Co. Tyrone, felled in 1939. At 20 years of age there were 1440 stems per acre, with a total height of 41 feet, a timber height to 3 inches diameter of 26 feet, a Q.G. at half height of 3½ inches, and an under-bark volume per acre of 4320 cubic feet.

Three individual trees planted at Knockmany in 1914 now measure as follows:—

Age	Total Height	Timber Height	Q.G. b.h.	Q.G. Half Height	Volume Q.G u.b.
32	91ft.	80ft.	13½in.	10½in.	56.6 cu ft.
32	88ft.	76ft.	12½in.	10in.	48.3 cu. ft.
32	92ft.	80ft.	13½in.	10½in.	54.0 cu. ft.

Measurements of three individual trees on the Lough Eske estate, Co. Donegal, believed to have been planted in 1910, are as follows:—

Age	Total Ht.	Q.G. b.h.
35	100ft.	10½in.
35	86ft.	18 in.
35	95ft.	19 in.

One of the trees on this estate yielded 74 cubic feet Q.G. of first-class timber up to a diameter of 6 inches, and thinnings from an adjoining plantation yielded an average of 26 cubic feet per tree.

The third lot of figures refers to a plot of about one acre in compt. 57 of Dundrum State Forest, planted in 1909. This was originally mixed with other species and has been thinned from time to time. The last two thinnings were heavy ones made in July and November, 1944, whereby 156 trees were removed, with a volume of 2,420 cubic feet, Q.G. There are now 210 stems left, which are estimated to contain 3,500 cubic feet, Q.G.u.b. So that the total volume at thirty-five years of age was approximately 5,920 cubic feet, not taking earlier thinnings into account. The mean total height is 70 feet, and the mean Q.G. at breast height, 8 inches. These trees are in a somewhat exposed position and have often lost their leaders. Another area of 14 acres at Dundrum, planted in 1914 and thinned three times, is now 30 years old, and is estimated to contain 420 trees per acre, with a mean total height of 67 feet and a mean Q.G. of 7 inches.

The fourth set of figures refers to an area planted in the Kilrush State Forest, Co. Clare, in 1913, a small part of which is still standing, in which the trees have an average height at 32 years of age of 60 feet, and a mean Q.G. of 9 inches, with an estimated volume of approximately 6,500 cubic feet Q.G.u.b. per acre. Another area of 4½ acres at this forest, planted in 1913, contains 425 trees per acre and is of the same mean height and girth, with an estimated volume per acre of 7,000 cubic feet, Q.G. Kilrush Forest is generally very exposed to the Atlantic gales and there has been repeated loss of leaders in these stands, so that many of the trees are rough and coarse and not very straight.

Mr. H. A. Booth in a short article in a recent issue of the Quarterly Journal of Forestry gives some very interesting figures and information

about two plantations of Sitka Spruce which he had come across in England.

These were both about 35 years old and contained 1,150 poles with an u.b. volume of 3,929 cubic feet, and 1,100 poles with a volume of 3,817 cubic feet per acre, respectively.

He makes a comparison with the figures shown in the Forestry Commission yield tables for quality Class IV., which gives 545 stems per acres with a volume of 3,750 cubic feet at 35 years. He points out that while there is a close relation in respect of volume, there is a very great difference in the number of stems per acre, and concludes that the plantations were under-thinned and that the result should certainly have been better if proper thinning had been carried out. He places the value of the contents of the crop per acre at approximately £110, and that for material merely of pitwood sizes! With proper thinning a crop of this kind might be expected to produce trees of much larger size and better timber quality.

### The Timber and its Uses.

Now we come to the timber and its uses.

The following description of the properties of Sitka Spruce timber is based on a paper by Mr. James Kay, published in Vol. XXXIV. of the Transactions of the Royal Scottish Arboricultural Society.

The wood varies in colour from white to light brown; it is soft, light and easily worked, but tough and very strong for its weight. It is even grained and long fibred, flexible and does not split or warp. Being odourless and tasteless, strong and light, it is suitable for cooage and packing cases.

For structural work where great strength is required it is not so suitable as Douglas Fir, but it is used for framing and shelving. It is very good for panelling, office fittings and furniture; it is suitable for interior finish; takes paint and glue well, is easy to nail and does not split.

When cut into thin boards its quality makes it suitable for piano sound boards, organ pipes and stringed instruments, and it is a very good pulp wood.

Spruce makes, it is claimed, the very best type of paper, and it is on account of this latter quality that it has been so strongly advocated for use in the afforesting of the waste lands of Ireland.

In conclusion, I would like to say that I think the Sitka Spruce has not always been fully appreciated in this country. I submit that its performance has been good, but a tree, like a person, a place, or any other thing, can hardly do anything right if people are prejudiced against it.

I hope the Sitka Spruce will get more consideration in the future and that from the mistakes we have made in the past, we shall learn, not at the expense of other species, to give it a chance to make a place for itself in Irish Forestry. I should like to thank all those friends and members who have helped me by furnishing details and items of information respecting individual trees and stands, which I have made use of in preparing this paper.

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