DOUGLAS FIR IN CO. WICKLOW

By T. CLEAR, B.AGR.SC.

THE "green" Douglas Fir (Pseudotsuga taxifolia) is a native of the Pacific coastal region of the United States and Canada. It grows best in the coastal region of Oregon, Washington and British Columbia, where the climate, and more particularly the rainfall, is very similar to that of the Wicklow mountains. European foresters came early to the recognition of its possibilities as a timber tree. Its remarkable growth in its native habitat and the high quality of its timber won for it a high reputation even among the coniferous giants of the "fog belt". It was introduced to Europe in 1827 but was not planted to any extent before 1850.

Early plantings were as single specimen trees and small groups in Arboreta, on avenues and in selected spots in open woodland. The results of this type of planting are to be seen in many parts of Ireland, particularly in demesnes like Powerscourt, Carton, etc.

The growth of the specimens thus planted at Kilruddery was most remarkable and by the beginning of the present century Douglas Fir was well on the way to becoming a firm favourite in the race for pride of place among the newer exotics. After seeing the giants at Powerscourt and Carton one can well understand the superoptimism that prevailed with regard to this species some 40 or 50 years ago.

Its extensive use as a forest tree coincided with the advent of State Forestry in Ireland. Much of its early planting was on old woodland sites as at Dundrum, Avondale, Camolin and was usually in mixture with larch or spruce. On private estates it was used as a filler in sparsely stocked hardwood areas, and with Abies grandis, Thuja plicata, Picea sitchensis and other of its natural associates began to give a new look to many demesne woodlands. A most remarkable example of this type of planting is to be seen at Carton and deserves the closest study by our silviculturists.

With the advent of the 1914/18 war planting practically ceased and was not renewed on any appreciable scale until 1921. The post war plantings differed in many respects from the pre-war efforts. Large areas of sheep mountain and cleared woodland, particularly in Co. Wicklow, were acquired and extensive monocultures of Douglas Fir, Sitka Spruce and other promising exotics began to make their appearance. The green Douglas Fir was used extensively in those early post-war plantings, and figured largely in the selections as at Roddenagh in Aughrim (Planted 1921-1926); at Ballyboy in Glenmalure; and at Crone and Ballyreagh in Glencree.

The site requirements of Douglas Fir were early recognised and moderately deep, light well-drained soils containing ample moisture and which were fairly well sheltered were selected for this species. These site conditions were prevalent in the early acquisitions in Co. Wicklow and in south-east Ireland generally and are asso-

ciated with lower Silurian, mica schist and the better old red sandstone rocks. Heavy bracken on bare land and a variety of ferns in old woodland were considered indicators of good Douglas ground. With the advent of more extensive planting programmes attention to the site requirements became less rigid and Douglas Fir was planted at higher elevations on exposed light "grass heath" sites where furze (Ulex europaeus and Ulex galii) and heather (Calluna vulgaris) were all too prone to become dominant when the ground was enclosed against stock. It was planted also on lowland limestone areas where frost was an important factor as was also the heavy growth of aggressive meadow grasses such as Cocksfoot.

This departure from sound selection of sites could have but one result—poor crops. These "ecological errors" were so numerous, however, that Douglas Fir came to be regarded as an unreliable species and quickly lost in popularity. The promised heavy yields did not materialise. The species was prone to flatter but to deceive—starting vigorously enough but checking in the thicket stage and producing an unwanted quota of wolves—with a pronounced sweep in the butts and very aggressive side branches. The advent of the insect Chermes Cooleyii and the leaf-cast fungus (Phaecocryptopus Gaumanii), and the frequent reports of extensive wind throw and snow break added to the general uncertainty. Adding to the long list of troubles associated with this species, the blue or Colorado Douglas Fir, a very inferior tree, was sometimes planted in mistake for the Vancouver variety. Small wonder then that Douglas Fir fell from its relatively important position among forest tree species to one of minor importance in Irish Forestry and disappeared almost completely from State nurseries. The reaction went further and a policy of replacement of unsatisfactory stands of Douglas Fir became the order of the day.

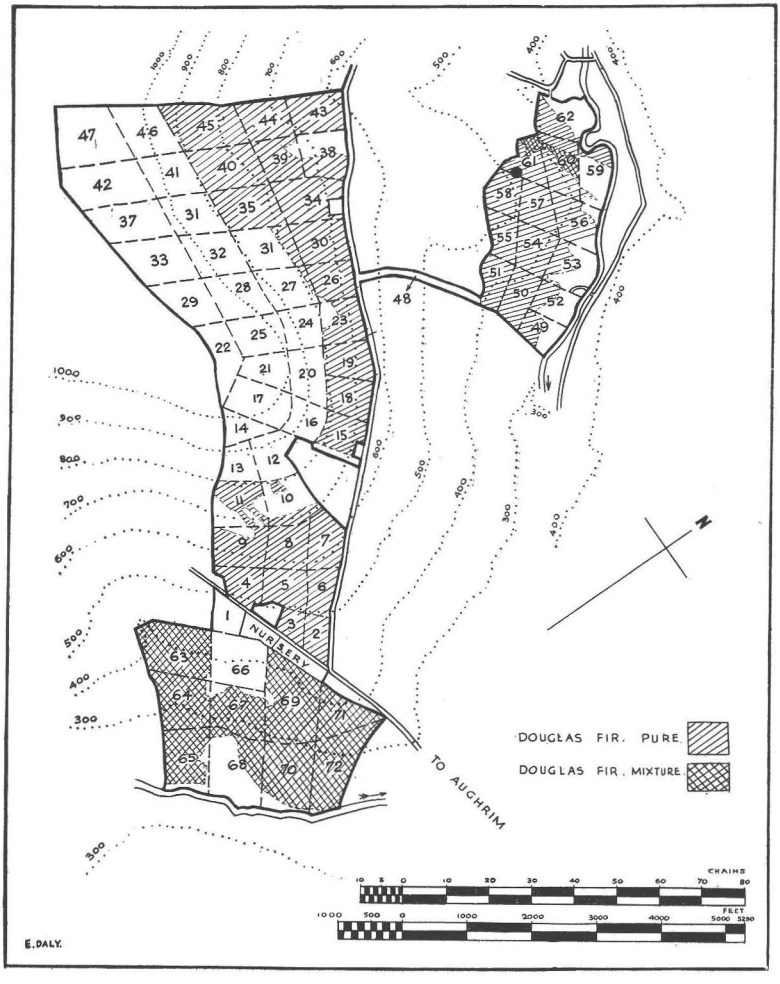
During the war the unprecedented demand for fuel enabled foresters to carry out extensive improvement cuttings of crooked and coarse dominants in young 15-20 year old stands. This work has done much to rehabilitate the Douglas Fir in County Wicklow and the great improvement apparent in these stands has led to a revival of interest in the species.

In 1948 I undertook the survey and assessment of growing stock in Roddenagh property of Aughrim forest. The area was intensively sampled using the line-plot method with 1/10th acre plots falling every 4 chains. This method of sampling provides growth statistics which could be analysed to provide information on site quality as affected by elevation and other site factors. Numerous sample trees were felled and stem analyses carried out.

In Aughrim Forest Douglas Fir figures largely in the earlier plantings. In Roddenagh and Killaduff (the properties assessed) there are over 300 acres of pure Douglas Fir aged 22-27 years covering a wide range of site qualities.

AUGHRIM FOREST

Roddenagh Property.



The area planted with Douglas Fir lies between the 450′ and 900′ contours on Roddenagh hill—and between 300′ and 400′ in Killaduff north. The soil is a relatively light shaley loam of Silurian origin only slightly podsolized, fairly deep at lower levels, but becoming shallower and lighter and more podsolized with increased elevation. Compartments 2-11 face south to south-east and are fully exposed. The contours are convex and the site could be described as a bold dry exposed ridge which is an outlier of the Wicklow range with little or no shelter from higher ground to the south.

Compartments 15, 18, 19, 23, 26, 30, 34, 35, 38, 39, 40, 43, 44, 45 face north-east to north and are fairly sheltered with the concave outline of the map contours indicating better moisture conditions, as also does the occurrence of springs and a patch of seepage in Compt. 38. Planting of Douglas Fir was taken up to 900 feet on this sheltered side. There are no records of the native vegetation of the site before planting but Irish furze seems to have dominated the dry S.E. ridge (C. 2, 3, 5, 6, 7, 8, 9, 10, 11). Bracken occurred on the moister and more sheltered notherly slope and grassheath vegetation was general above 800′.

Planting commenced in the season 1921-22 and was carefully supervised and thoroughly done. The planting stock was (2—1—1) 4 years old transplants and the spacing was 6′ × 6′. Growth was rapid from the start as judged by a stem analysis of average dominants. Ring width was about 4 rings to the inch up to 1930 when there is striking evidence of check in some parts of the plantation. For 3 or 4 years rings of 1/16″ occurred followed by an improvement to 1/8″ which was maintained up to 1937 when a further check occurred giving rings of 1/32″ for 3 years. This check was general over the whole area of Roddenagh Hill. There was an improvement in 1940 to 1/16″ which increased to 1/8″ in 1942 and to 3/16″ in 1944. Then growth fell off gradually until in 1947 ring width was again 1/16″. This succession of check followed by release is even more striking on the co-dominants while the sub-dominants have been in full check since about 1940.

The first check appears to have been caused by excessive competition from furze the cleaning of which was neglected for some years. This check was most pronounced on dry ridges and at the higher elevations. A heavy cleaning carried out in 1933 or 1934 was in the nature of a thinning in its silvicultural affect—many trees had been suppressed and the furze was well up into the canopy according to the officers-in-charge at the time. The second check in 1937 could be accounted for as being normal and due to root competition indicating that thinning should have been carried out in 1935 or 1936 i.e. 13 or 14 years after planting. The check was so severe, however, that one is inclined to the belief that leaf shedding must also have been excessive about this time. Stands of Douglas Fir about 15 to 18 years old are often condemned because of general stagnation by excessive loss of foliage. It

is interesting to observe that this condition prevailed in Aughrim for some years. The general improvement which set in in 1939 or 1940 coincided with brashing operations as evidence of the sawn branch stubs reveals. The assessors attributed the improved growth to a thinning which was presumed to have occurred about this time. However, there was no record of a thinning having been carried out in 1939 and the officers in charge state that the stands only received a brashing. It appears, therefore, that brashing has given a pronounced stimulus to the crop. I am convinced that the mulching effect of the branch litter so improved the moisture conditions as to offset the effects of root competition and disease. The improvement in increment got a further boost in 1942 when a thinning of dominants was carried out.

The crop is now vigorous and healthy and with thinning, increment can be satisfactorily maintained. The trees have doubled in timber volume in the last 5 years. Extensive growth studies reveal annual increments varying from 8% to 15%. For example in Compartment 3 the average dominant increased from 3.62 cu. ft. (U.B.) true volume to 6.07 cu. ft. (U.B.) true volume and the average co-dominant increased from 1.6 cu. ft. to 2.9 cu. ft. over 5 years.

In compartment 4 the average dominant increased from 5.5 cu. ft. to 7.10 cu. ft. and the co-dominant or sub-dominant from 1.28 to 1. 62 cu. ft. in five years.

Compartment 3 seems to have been cleaned and thinned earlier than C.4 since the early (1930) check is not in evidence and the stocking is now lower. This as well as the fact that C.3 enjoys a lower elevation, accounts for the better current increment.

The following statistics are based on an analysis of 34 plots of 1/10th acre covering the south-eastern end of Roddenagh Hill (C.2-11). In all cases calculations for Mean Annual Increment include a figure for thinnings which was obtained from the records of the forest.

Age of Crop 27 years :

Average No. of trees over 3" Q.G.B.H. per acre	475.
Mean area per tree	0.152 sq. ft.
Mean volume (Hoppus measure O.B.) per tree down to 3" diameter ...	3 cu. ft.
Mean volume per acre	1,425 cu. ft.
Mean annual increment	60 cu. ft. per ac. per an.
Current annual increment (estimated)	90 cu. ft. per ac. per an.

Current growth is more rapid at lower elevations as the following statistics show.

Compartment 3. Elevation (450′—500′) :

Average No. of trees	420 per acre.
Volume per tree	3.2 cu. ft.
Average volume per acre	1,660 cu. ft.
Mean height	42′.
Mean crown length	20′.
Current annual height growth	1½′.
Mean annual increment	81 cu. ft. per ac.
Current annual increment based on last 5 years growth	150 cu. ft. per ac.
Current increment %	13%.

Compartment 4. Elevation (500′—550′) :

Average No. of trees per acre	472.
Volume per tree	3.55 cu. ft.
Average volume per acre	1,685 cu. ft.
Mean crown length	21′.
Mean height	43′.
Current annual height growth	1¼′.
Mean annual increment	80 cu. ft. per ac.
Current annual increment	94 cu. ft. per ac.

Compartment 5. Elevation (450′—500′) :

Volume per acre	1,220.
Mean height	40′.
Crown length	18′.
Current annual height growth	1¼′.
Volume per tree	2.7 cu. ft.
Mean annual increment	60 cu.ft.
Current annual increment	92 cu. ft.

Compartment 7. Elevation (650′) :

Mean annual increment	55 cu. ft.
Volume per acre	1,300 cu. ft.
Mean height	36′.

Compartment 8. Elevation (650′) :

Mean annual increment	52 cu. ft.
Volume per acre	1,140 cu. ft.
Mean height	36′.

In Compartment 10 and 11 (700′—800′) the Douglas Fir has largely failed. The better remnants of the stand remain and the yields of 800 to 850 cu. ft. per acre after 27 years (30 cu. ft. M.A.I.) speak for themselves. These Compartments have been beaten up with J.L. which promises very well on this site.

Compartments 15, 18 19 and 23 are somewhat better sheltered than Compartments 2-11 but the elevation is 650′-800′. The contours indicate excessive drainage and drought is likely to be an important factor. Irish furze played an important role here in checking growth especially in Compartment 23, where partial failure has resulted, necessitating replanting with Japanese Larch.

The "dry ridge" is a most unsuitable site for Douglas Fir and competition from native vegetation is excessive on such sites. Nevertheless Douglas Fir has not done too badly as can be seen by the following results to date.

Compartment 15. Elevation (700′) :

Age	26 years.
Average No. of trees per acre	430.
Average volume per tree	2.5 cu. ft.
Average volume per acre	1,080 cu. ft.
Mean annual increment	41.5 cu. ft.
Mean height	40′.

Compartment 18. Elevation (700′) :

Average No. of trees per acre	415.
Average volume per acre	1,245 cu. ft.
Mean annual increment	57 cu. ft. per ac.
Mean height	36′.

Compartment 19. Elevation (700′) :

Average No. of trees per acre	400.
Average volume per acre	1,100 cu. ft.
Mean annual increment	50 cu. ft.
Mean height	36′.

Conditions in Compartments 34, 35, 38, 39, 40, 43, 44, 45 are much more favourable. As can be seen by the contour lines this portion of the area is "cupped" and sheltered (the concave contours indicating better moisture conditions and shelter) with better soil depth. The native vegetation was likely to have been bracken rather than furze.

The improvement in rate of growth is quite remarkable considering the stand here is 3 years younger.

Compartment 30. Elevation (700′) :

Age of crop	23 years.
Average No. of stems per acre	567.
Volume per acre	1,200 cu. ft.
Mean annual increment	62 cu. ft.
Current annual increment	101 cu. ft.
Mean height	38′.

Compartment 34. Elevation (700′) :

Average No. of stems per acre	676.
Volume per acre	1,200 cu. ft.
Mean annual increment	83 cu. ft.
Current annual increment	155 cu. ft.
Current annual increment %	14%.
Mean height	36′.

Compartment 35. Elevation (750′) :

Average No. of stems per acre	643.
Volume per acre	1,150 cu. ft.
Mean annual increment	75 cu. ft.
Current annual increment	116 cu. ft.
Current annual increment %	12%.
Mean height	33′.

Compartment 40. Elevation (850′) :

Mean annual increment	70 cu. ft.
Mean height	30′.

Compartment 43. Elevation (650′) :

Mean annual increment	79 cu. ft.
Mean height	38′.

Compartment 44. Elevation (750′) :

Mean annual increment	66.5 cu. ft.
Mean height	40′.

Compartment 45. Elevation (850′) :

Mean annual increment	57 cu. ft.
Mean height	36′.

These last three Compartments are on the edge of the plantation and subject to exposure.

In KILLADUFF NORTH the Douglas lies between 350′ and 500′ and while the area is sheltered the ground is rocky and the soil rather shallow in places.

Growth has been very satisfactory as can be seen by the M.A.I. figures.

This area was only 22 years planted on the date of assessment and as one would expect, the current annual increment is very much higher than the Mean.

GROWTH STATISTICS.

Compt.	Age	No. of stems over 3" Q.G.B.H.O.B. per acre	Av. Volume per tree cu. ft.	Vol. per acre cu. ft.	M.A.I. (including thinnings) cu. ft.
49	22	600	2.30	1,380	58
50	,,	620	2.30	1,430	95
51	,,	610	3.10	1,890	95
52	,,	620	3.40	2,110	96
53	,,	620	2.60	1,610	74
54	,,	535	3.40	1,820	90
55	,,	510	3.24	1,650	85
56	,,	580	3.10	1,800	92
57	,,	705	2.30	1,620	82
58	,,	465	3.10	1,440	71
59	,,	540	2.85	1,540	69
60	,,	510	2.85	1,450	66
61	,,	612	2.00	1,224	50
62	,,	590	2.90	1,710	78

In this property Douglas Fir has failed on the wet flats—which adjoin the river. There seepage areas were water-logged and carried molinia and tufted Aira grasses before planting.

Douglas fir in mixture.

In Roddenagh Wood—an area very similar to the Killaduff North property—namely old woodland—350-450′ elevation fully sheltered, with the soil moderately deep and moist and free rooting—Douglas Fir was planted in mixture with Japanese Larch 50% of each at 6′ × 6′. The Douglas has been practically eliminated by suppression and the remnant can be maintained only by the deliberate sacrifice of the more vigorous Japanese Larch.

Growth Statistics :	Japanese Larch	Douglas Fir
Age of crop	25 years	25 years.
Volume per acre Q.B.O.B. ...	1,720 cu. ft.	530 cu. ft.
Stems over 3" Q.G.B.H. per ac.	360.	211.
Mean Q.G.	5¼".	4½".
Heights of dominants	47′.	52′.

There were many sub-dominant Douglas Fir—with heights around 40′.

It is still possible in this stand to produce a final crop largely composed of Douglas Fir but it involves a sacrifice of the main increment producer—the Japanese Larch. On the point of quality of final produce there is much to recommend a pro-Douglas Fir policy. In this connection the following experience may be of some interest. The freshly cut samples taken for stem analyses (discs 2″ thick cut off at 5′, 15′ etc.) were stored in sacks for some days before being collected for examination. When examined the Japanese Larch sections were found to be covered with a dense mat of fungus mycelium and the wood was deeply stained and almost black in colour right through. The Douglas Fir showed little or no trace of discoloration and were as bright and clear as when cut.

CONCLUSIONS.

The main conclusions that one is tempted to draw from the results of this assessment might be listed as follows:

(a) Douglas Fir even under fairly suitable conditions is not likely to be a very heavy yielder on the foothills of County Wicklow.

(b) It is, however, much superior in growth rate to the normal alternative selections, European Larch and Scots Pine.

(c) It is inferior in height growth to Japanese Larch in the early stages, at least, but promises to give a much better quality timber: further the evidence from stem analysis would indicate that while the Douglas Fir increment is well maintained between the 20 and 30 years that of Japanese Larch tends to fall off.

(d) Douglas Fir is extremely sensitive to drought and to root competition. An aggressive vegetation like Ulex Gallii on dry exposed sites can bring the crop into complete check. This condition is aggravated by the disease Phaecocryptopus Gaumanii which delays canopy formation.

(e) Douglas Fir shows good powers of recoverey from disease and check, and is much superior to Scots Pine in this respect.

(f) There are indications that the cleaning of furze and other competitive vegetation must on no account be neglected.

(g) The brashing of the crop appears to have a most invigorating effect and at a critical stage, and this may help to put this operation in a new and more favourable light.

(h) Early thinning (starting at the 15th year after planting) and the reduction of numbers to between 400-500 stems by the 25th year seems to be very necessary if increment is to be maintained.

(i) The fact that co-dominates and sub-dominants show very little response to crown thinning would seem to indicate that a heavy low thinning might be more suitable than crown thinning.

Since carrying out this survey at Aughrim, further assessments have been concluded at Glenmalure in central Co. Wicklow and at Glencree in North Central Wicklow in 20 to 30 years old stands and at Kilruddery (near Bray) in 30-40 years old stands.

The results have helped to confirm the general impression that Douglas Fir in heavily thinned stands improves enormously between the 20th and 40th year: that it gives promise of good yields on sites up to 700′ on northern slopes especially on deep loamy soils: and that it appears to throw off the effects of Phaecocryptopus Gaumanii and to enter into a period of very vigorous growth, after heavy thinning.

Final yields may be very much heavier at Aughrim and other centres in Wicklow than present returns indicate. The very serious check which was experienced between the 10th and the 20th year did much to depress yields and comparison with British Forestry Commission yield tables would be likely to show that Wicklow stands in a very unfavourable light. It is interesting to note, however, that American and Continental tables for Douglas Fir give yields comparable with those recorded here.