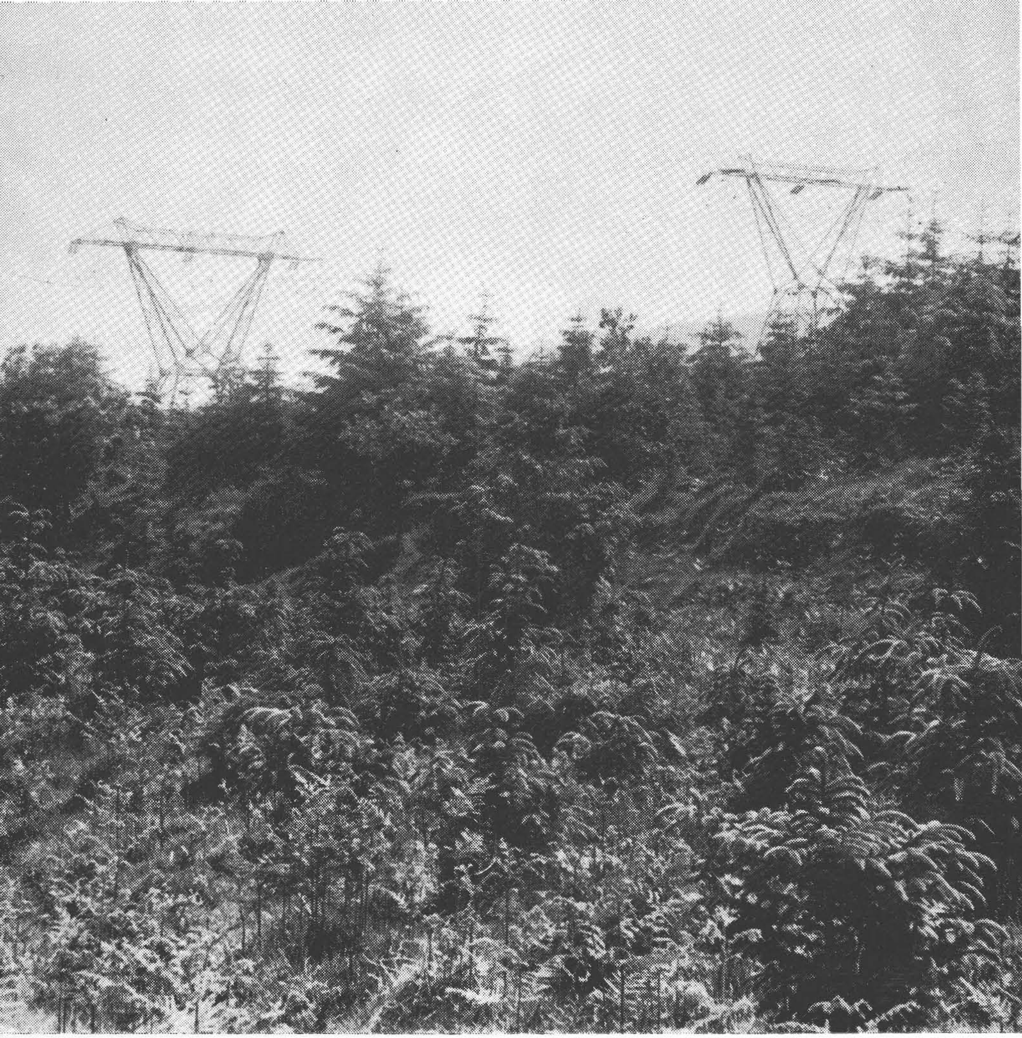

IRISH FORESTRY

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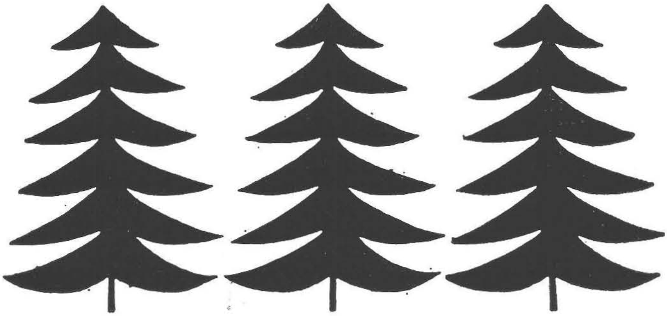

5). Yield Class determined using Yield Tables for Corsican pine (*Pinus nigra*), as recommended by Hamilton and Christie (8).*

Norway spruce (*Picea abies*). Top height 9.5 m, yield class 20 where grown in mixture with Japanese larch on 145 cm of woody fen peat in a B situation; but drops to 14th place (yield class 10 and top height 5.4 m) in the U region further north. (Fig. 2 shows the latter situation).

Western red cedar (*Thuja plicata*). Takes fourth place with top height of 7.9 m and yield class 16; penetrating 63 cm into 65 cm of woody fen and forest debris, in an A/B situation.

Sitka spruce (*Picea sitchensis*). Top height 7.7 m, yield class 16 in mixture with Japanese larch on 80 cm of woody fen peat in a B situation; Drops to 15th place with yield class 10 and top height 5.0 m in the A region further north. (Fig. 1 shows the rooting system in the latter situation).

Western hemlock (*Tsuga heterophylla*). Top height 7.7 m, yield class 14, penetrating 75 cm into woody fen peat in a B situation.

Noble silver fir (*Abies procera*). Top height 7.2 m, yield class 14. Roots penetrating 60 cm through peat of woody fen/forest debris in an A/B situation, and then a further 30 cm into the underlying mineral soil.

Scots pine (*Pinus sylvestris*). Top height 8.4 m, yield class 12. Excellent root penetration (95 cm), growing on 320 cm of peat in the U region. (Fig. 6).

Serbian spruce (*Picea omorika*). Top height 6.1 m, yield class 12 with only poor penetration (40 cm) growing on 225 cm of peat in the U region.

Hybrid larch (*Larix eurolepis*). Top height 10.4 m, yield class 10. This is a shallow-peat (A region) where on 50 cm of peat, composed solely of forest debris, its roots went down only 40 cm.

Japanese Larch (*Larix leptolepis*). Top height 10.1 m, yield class 10. Grown pure on shallow peat (75 cm) in an A situation. Feeder-roots penetrating to 95 cm (Fig. 4—Plot 7). In mixture with Norway spruce on 145 cm of woody fen peat in the B region it reached a top height of 10 and a yield class of 10. Mixed with Sitka spruce on 80 cm of woodyfen within the same B region however, it drops to last place among the oldest conifers, with yield class 8 and top height 8.5 metres.

Douglas fir (*Pseudotsuga taxifolia*). Yield class 10, top height

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*A recent paper (7) has suggested the production of Monterey pine on a height/age basis, may be much lower than this.

TABLE 1
DATA ON CONIFEROUS SPECIES PLANTED IN 1955 ON TRENCH 14, CLONSAST BOG

	Growth Data			Edaphic Characteristics			Root Data		
Plot no. and species (assessed at age 18)	Top Ht. (m)	Yield class m^3/ha/annum)	National Average yield Class[1]	Peat depth (cm)	Peat types in Profile[2]	"Natural Region" of cutover[3]	Depth to which main root mass penetrates (cm)	Max. rooting depth (cm)	Penetration into sub-peat mineral soil (cm)
(4) Grand silver fir	10.0	22	20	60	For	A/B	100	120	60
(29) Monterey pine	10.4	20	16	245	Bog/For	(U)	30	90	—
(9) Norway spruce (mixed with Japanese larch)	9.5	20	17	145	W.F.	B	15	85	—
(7) Western red cedar	7.9	16	13	65	For	A/B	15	63	—
(11) Sitka spruce (mixed with Japanese larch)	7.7	16	15	80	W.F.	B	30	80	—
(6) Western hemlock	7.7	14	19	85	W.F./For	B	20	75	—
(2) Noble silver fir	7.2	14	11	60	For/Min	B	20	75	—
(27) Scots pine	8.4	12	9	320	Bog	U	55	95	—
(31) Serbian spruce	6.1	12	—	225	Bog	U	15	40	—
(15) Hybrid larch	10.4	10	—	50	For/Min	A	10	40	—
(13) Japanese larch	10.0	10	8	75	For/Min	A	25	90	10
(9) Japanese larch (mixed with Norway spruce)	10.0	10	8	145	W.F.	B	10	50	—
(23) Douglas fir	7.7	10	13	200	W.F./Bog Transit-ion	B/U	30	45	—
(33) Norway spruce	5.4	10	16	315	Bog	U	10	55	—
(35) Sitka spruce	5.0	10	16	235	Bog	U	20	50	—
(11) Japanese larch (mixed with Sitka spruce)	8.5	8	8	80	W.F.	B	10	80	—

7.7 metres. At a transition between A (shallow) and U (untypical, deep) regions its roots went down 45 cm into 200 cm of peat; of which the top 35 cm were bog peat, then a fossil pine layer, followed by woody fen.

Contorta pine (*Pinus contorta*). No yield class estimation as yet, but showing excellent root development; through 80 cm of forest peat in an A/B situation, and a further 10 cm into the decalcified layer of the underlying mineral soil.

Discussion

On this site, considerable variation is evident in peat type, peat depth, rooting depths and timber production. Peat types vary as described earlier, with peat depths ranging between 60 and 320 cm; indicated production varies between 8 and 22 m^3/ha/annum.

1. Forest and Wildlife Service plantations.
2. Peat types in profile:
   BOG=Oligotrophic bog peat, in the present case older-sphagnum/eriophorum peat with fossil pine layer intact. Very well humified, more or less impermeable.
   WF =Woody fen peat, birchwood and non-sphagnum mosses, rather poorly humified, highly permeable.
   FOR=Peat composed solely of oak, yew and pine forest debris. Poorly humified, brittle and highly permeable.
   MIN=Mineral substratum. Here of glacial till, of Carboniferous origin.
3. The "natural regions" are those established during cutover peat surveys 1964-68 and described in Barry *et al.* (3) except that we have here an area of completely untypical deep cutover. This (U) situation is one which, if the sub-region had been cut to normal depth and developed as spread ground prior to tree planting, would have been transformed into a B/C or C area.

A regions of the cutover raised-type bog sof Ireland, following machine sod peat production, are those over convexities of the mineral floor having 30 to 60 cm of peat (or forest debris) resting directly on a mineral floor which shows a decalcified layer.

A/B situations are intermediate. Most often they are B-type profiles (see below) that have been cut unusually deep.

B regions, often on slopes of slight gradient, are characterised by the presence of 90-120 cm of undisturbed woody-fen peat resting on variable mineral soils, that may or may not show a decalcified zone.

B/C situations show mixed woody fen and reedswamp peats in profile.

C, D and E regions occur over concavities of the floor. With 120-275 cm. of reedswamp peat (character-plant *Phragmites* resting on (C) deep calcareous silt of silty clay, (D) shall marl or (E) sapropel.

U region is a term used in the present paper to denote untypical profile conditions in a particular area found to have much oligotrophic bog peat and an intact fossil pine layer, features which are normally absent from machine sod peat cutover.

Maximum rooting depths (the lowest points in profiles at which live roots were seen) vary between 40 and 120 cm.

It is noteworthy that of the first seven species in order of productivity (Table 1) six are growing in B or A/B situations, that is in woody fen or forest peats of fairly shallow or moderate depth, 60 to 145 cm. The exception is Monterey pine which, although growing in untypical oligotrophic bog peat of the U region, shows the second-greatest degree of root penetration of all the conifers on like ground (90 cm)—through to the underlying woody fen peat. Scots pine, in the same U region, has 95 cm root penetration, the maximum for any conifer in that kind of profile. Performance of the two most commonly grown and most important spruces, Norway and Sitka, seemed to depend on local profile conditions to a high degree. On typical woody-fen peat alone, of moderate depth (80-145 cm), they thrive; in the U region, where untypical undisturbed oligotrophic peat and a fossil pine layer intervened above the woody fen, growth with present treatments has been unsatisfactory.

Root development may be described, in general terms, in one of two ways (see Table 1 and Figures 1-6)—either by reference to the main roots, which provide anchorage, or to the feeder roots, "dippers" or "sinkers", which give access to soil moisture and nutrients. Many of the latter are not shown in the diagrams.

Referring first to main-root systems it is seen that grand silver fir is the outstanding tap rooter with tap and lateral roots large enough and deep enought to afford complete stability, on present showing. Several other conifers, notably noble silver fir and Scots pine are seen to be moderately deep-rooting (55-60 cm downward). Monterey pine, Sitka spruce (only when on woody fen) and Douglas fir are next-best—their main root masses penetrating 30 cm.

It could be suggested perhaps that any species whose main root-mass remains within 30 cm of the cutover surface, whether on deep or shallow peat, will be susceptible to wind-throw. This situation would be most pronounced in situations where this 30 cm level coincides with the disturbed/undisturbed peat junction. From Table 1 it would appear that all the conifers on Trench 14 whose root systems were examined, with the exception of the two silver firs and Scots pine, fall within this category. Yet when their root systems were examined more closely a significant number of sturdy developing roots were found descending at an angle of 45° or more steeply—even in Norway spruce (the classical flat-rooter) at least when growing on woody-fen (see Fig. 2). One might also recall that the trees in question were only eighteen years old at the time of the root-investigation. Further evidence for the optimistic view is perhaps provided by the absence of wind-throw so far, despite (e.g.) the gales of January 1974, in any of these quite small plots, of a mere 0.1 ha each.

When downward penetration by the finer feeder-roots is considered grand silver fir is again the leader, with 120 cm depth at least. Scots pine is next (95 cm); Noble silver fir, Monterey pine and Japanese larch (on woody fen) are next with 90 cm. These are followed by Norway spruce, 85 cm, and then Sitka spruce, both spruces only when on woody fen—and Japanese larch, with 80 cm penetration. On the other hand, Norway and Sitka spruce in the U region of deep *bog* peat show absolute penetration of only 50-55 cm. Serbian spruce in the same region shows only 40 cm absolute penetration, with its main root-mass lying only 15 cm below the surface.

It would appear that downward root development, particularly in the spruces, is strongly affected by some factor of the peat types in profile. This factor is very likely permeability, acting directly through the easier passage that open structure affords, and indirectly through the better drainage and hence lower water tables thus provided. At any rate there is excellent correlation between rooting depth and permeability of peat-type in profile, throughout Table 1, using Dowling's scale of values (6) and especially his findings that woody fen peat was the most permeable and older-sphagnum/eriophorum the least permeable of all those peat-types he tested. Clearly, on Tr. 14 leaving out of account the necessarily shallow rooting of larch species on the morainic ridge (A region); the deepest rooting systems, and the best growth generally to date, are associated with forest-peat and woody fen profiles whereas the poorest growth is associated with the untypical cutover, oligotrophic peat-profiles of the U region.

It should be borne in mind that the initial fertiliser treatment of the conifers in question was not up to the standard now adopted. Indications are not wanting from Trench 14 today, from later experimental plantings, that P and K at planting time may be the key to still better growth in the early years, even in the rather unsatisfactory U region.

Conclusion

Research work to date on Clonsast Bog has shown that a wide range of conifers can be established on machine-cutover sod peat bog of the Central Plain. For many of the species, production rates are well in excess of the national averages, and interim results from more recent experiments on the same ground suggest that potential production from certain conifers, in particular Sitka spruce and contorta pine of coastal provenance, may well exceed that now reported.

Of the seventeen root profiles recorded, thirteen had live roots at or below 50 cm from the surface, with indications that development downward will continue.

The most striking feature in the results is the deep penetration of the underlying mineral soil by the roots of *Abies grandis* (Fig. 3). Although this may appear surprising initially it should be borne in mind that fir species in general tend to develop tap like root systems and secondly, although the mineral soil beneath is derived from limestone boulder till its upper 30 cms. is acid in reaction (pH 5.4). However, the fact remains that most of the fine and persumably feeding roots are well below this acid layer in a medium with a pH in excess of 7.

This particular subpeat mineral fossil soil shows many affinities with the Grey Brown Podzolic soils of more upland areas and is the most commonly occurring mineral soil beneath the raised bogs of the Central Plain of Ireland (4, 5). Many of these soils are known to have supported forests of oak (*Quercus*), pine (*Pinus sylvestris*), yew (*Taxus baccata*) and alder (*Alnus*) prior to being encroached upon by the developing peat some three to five thousand years ago. Evidence for this is to be found in the presence of large numbers of fossil stumps embedded in the sub-peat mineral soils.

Acknowledgements

Acknowledgement is made and grateful thanks are extended to the Forest and Wildlife Service of the Department of Lands and to Bord na Mona for the use of data from their records and for the many encouragements and kinds of assistance received in carrying out the present work. Also to Mr. T. F. Purcell, of the Forest and Wildlife Service for the assessment figures used and to Mr. A. Buckley, Research Forester, who supervised the excavations.

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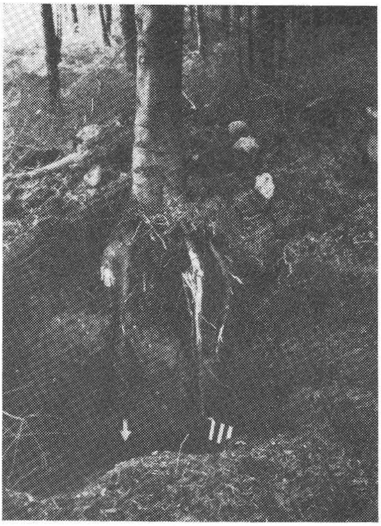

Fig. 7—Pit showing roots of ***Abies grandis***

Sitka Spruce Yield Class 500!?

ROBERT TOTTENHAM[1] AND P. M. JOYCE[2]

THE purpose of this article is to put on record the details of a small stand of Sitka spruce which is growing at a remarkable rate and to suggest some possible conclusions and their effects.

The location of the site is 110m (360 ft.) above sea level on the Eastern slopes of Slieve Callan in West Clare, some 10 miles (16 km) from the Atlantic. It is in a sheltered position and the rainfall averages 163 cm (64 in.).

The soil is a loamy gley which before planting carried a mixed sward of rushes, poor grasses, sedges and bird's foot trefoil. This for many years was used for grazing but was not relished by stock. As far as is known there had been no attempt at improving it with manure but some land drains were put in some 60 years ago. The present crop was planted on mounds at 6 ft. x 6 ft. (1.8m x 1.8) spacing in the Spring of 1961. No manurial treatment was given. In February 1971 when the top height was 29 ft. (8.8m) it was thinned by removing every alternate line of trees. This yielded 740 hoppus feet per acre (66m^3/ha). The top height in February 1974 was 42 ft. (12.8m).

In Figure 1 the Total Production for Yield Classes 120 to 280 (hoppus) has been plotted against Age. These figures were taken from the Forestry Commission Booklet No. 16 (Bradley *et al*, 1966) pp 152 to 157. Onto this has been plotted the Total Production for the stand in question for 9, 10, 11 and 13 years. As can be seen, the slope has fallen away after the 10 year figure. This is due to the 50% thinning done that year and is expected to start to 'steepen' again in the next year or two and should give a figure for total production at 15 years in the region of 4500 hoppus feet per acre 400m^3/ha). This could mean a Yield Class of 500!

There are two observations to be made:

1. If we take a price of 50p per cubic foot as an average standing price for the crop, this gives an average annual income of *£250 per acre.*

   Similar land under grass in this area without improvement would let (selling the crop standing) for *£3* and if 'reclaimed' and manured possibly *£25 per acre.*

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2. Forestry Department, University College, Dublin.

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That which is Constant is Dead

THIS applies as much to human organisations as it does to biotic organisms. The organisation, whether it be a business, a bureaucracy, or an association such as ours, if it is not changing for the better, then it is as dead as the organism which no longer metabolizes.

The Society of Irish Foresters still retains the same objective as it adopted when it was founded in 1942: "To advance and spread in Ireland a knowledge of forestry in all its aspects". Fair enough. But how often and how strenuously has this objective been examined in relation to the changing times? It may still be apt, but we need to be constantly checking on it. Is it good and is it necessary and is it really what we want to do?

Equally important is the need to examine the means by which we set about achieving our objective. Here we can apply more concrete standards. The forest walks, for example, begun in 1970, have been an obvious success, but even now we must be on our guard against complacency. The Sunday field meetings, in the early life of the Society served a definite need for education among foresters, but now that such opportunities are freely available through employers, they seem, in recent years, to have degenerated into family picnics, or polite discussion groups in which hobby-horses are aired but little real exchange of information takes place. The days are gone when going to see the horse chestnuts in flower in one's leisure time was regarded as living it up.

The newly developed concept of midweek whole-day field meetings seems a very promising development; but what changes have taken place in the annual study tour within living memory?

The pitiful attendances at many of the indoor meetings, and particularly at the Annual General Meeting, call for deep thought and investigation, as does the heroic reluctance among members to take on the offices of the Society.

We must examine ourselves constantly, and when the day comes in which we can no longer justify our existence we should, like Lewis Carroll's Baker faced with a boojum snark, "softly and suddenly vanish away,/ And never be met with again." Tours and meetings and journal and all.

Coniferous Growth and Rooting Patterns on Machine Sod-Peat Bog (Cutover) and Trench 14, Clonsast

M. L. CAREY[1] and T. A. BARRY[2]

Introduction

LARGE areas of bog are being cut over for fuel and other purposes in Ireland by Bord na Mona, the Irish Peat Development Authority. By far the greater number of bogs concerned are of the raised (*Hochmoore*) type in the Central Plain; the remainder are blanket bogs (*Terrainbedeckende Moore*) which occur mainly in the western half of the country. A total area of approximately 68,000 ha is involved in the scheme.

Clonsast, Co. Offaly (mean annual rainfall 849 mm.) is a raised-type bog 2,000 ha in extent, resting mainly on calcareous till, over carboniferous rock. Drainage began in 1936, mechanical turf-cutting in 1940. In 1955, with a view to investigation of the tree-growing potential of the cutover peat types, 3.8 ha were leased, with additions since then, to the Forestry Division (now Forest and Wildlife Service) of the Department of Lands by Bord na Mona. A 1.6 km length of Trench 14 cutover, 36m wide, comprised the original lease in 1955 (Grid Reference N. 57 21). The bog floor is 68 to 72 metres above sea level.

Trench 14 is one of the fourteen parallel main outfalls, 230 metres apart, by means of which the bog was drained. Sod peat excavators work back from each such outfall, widening the cut-over strips or fields annually, at first spreading the sod peat for air drying on the bog-top; later on the cutover itself, so that ground for land-use trials can be allocated only at the expense of output during the fuel-production life of the bog.

Mechanical sod peat extraction entails the removal of peat to a depth of 4.5 m (maximum) from the cutting face. The top 45 cm or so of this is "stripping", consisting mainly of young sphagnum

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moss peat and other vegetable debris from the bog surface. It is placed on the cutover surface. The quantity and nature of undisturbed peat left behind, beneath the stripping layer, vary considerably in accordance with variations in the original (pre-drainage) depths of peat from point to point, which in turn are closely allied to irregularities in the configuration of the bog floor, (1).

In 1936, prior to drainage, peat depths along the 1.6 km of Trench 14 now under consideration varied between 8.5 m and 3.6 m. On present showing, peat residues left behind, undisturbed, beneath the stripping layer on the same ground (immediately following fuel-peat extraction) will vary between 30 cm and 275 cm.

In 1955, it was found possible to subdivide the trench-length used for planting into three well defined regions running from south to north (2). These are listed below with additional data from more recent surveys.

(i) Plots 1—12*. 550 metres of trench length typical of average mechanical-cutover conditions. Moderate depths of peat left behind, 60 cm to 120 cm consisting of fossil forest debris, or woody fen, sometimes overlying mixed woody fen and reed swamp plants, resting on mineral soil that usually had a decalcified layer at its surface.

(ii) Plots 13—22. 400 metres of trench length typical of cutover conditions over morainic ridges and eskers. Undisturbed peat residues very shallow, 30 cm to 60 cm consisting of forest debris only, resting on mineral soil with a well-defined decalcified zone at the surface.

(iii) Plots 23—38. 650 metres of trench length of untypical deep cutover, the profile beneath the stripping layer consisting of 30 cm to 60 cm or more of older-sphagnum/eriophorum bog peat, a thick layer of large fossil pine (*Pinus sylvestris*) *in situ,* then sometimes another 30 cm of acid bog—or forest-peat, then some fen peat. Total depths of undisturbed peat 240 cm to 335 cm, over mineral soil of clay or silty clay texture showing no decalcification.

With reference to region (iii) above, this "untypical" deep cutover region is so named here on account of the presence within it of a thick layer of oligotrophic bog peat and of the pine layer, undisturbed. Normally on Bord na Mona spread grounds no such timber-layer is left *in situ,* nor is there any appreciable amount

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*Plot numbers for the various species appear on Table 1.

of acid peat, undisturbed. In fact, in the 1964-68 cutover peat surveys, less than 3% of the 8,000 ha covered were of this kind, and then only on parts of two bogs that probably have been cut more deeply since then.

Typically, deep sod-peat cutover following mechanical harvesting shows 150 cm to 270 cm *of fen peat only*, undisturbed, beneath the stripping layer. At Clonsast Trench 14, north end, however, a local basin caused an acute drainage difficulty which could not be overcome until a new outfall had been blasted through a bedrock uplift, clear of the plantation line, in the late fifties.

Following levelling, the area was pit-planted with various species and mixtures, one half of the area being fertilized with ground rock phosphate. Details, and early results, have been published (9). Results to date from this and later planting show that a wide range of species can be successfully established on sod peat cutover, and for several species production figures are well in excess of the national average (16 m^3/ha/annum for Sitka spruce in Ireland—see Table 1). In view of these high production figures, and some concern regarding the stability of plantations on peat, it was decided in 1972 to carry out a preliminary investigation into the rooting behaviour of the more important species.

Methods

Due to the time-consuming nature of root excavation it was necessary to restrict the sample to two carefully selected trees per plot. Pairs of adjacent dominant or co-dominant trees were therefore selected in fertilized plots. The excavation procedure involved the digging of a pit 3 m long by 2 m wide, beside the trees, so that one side of the pit approximately bisected the root systems. Excavation was done manually using spade, shovel, saw and penknife. The pit was deepened to at least 20 cm below the level of the general root system. Roots were cut off flush with the sides of the pit once their general pathways had been recorded.

To facilitate accurate sketching of the root systems a sheet of 500 gauge P.V.C. polythene was pressed closely to the side of the trench next to the trees being studied. Root distribution was then traced in on this using quick-drying felt pens. The boundaries between the various horizons in the profiles were traced in a similar manner. The sketches were worked up indoors with the aid of field notes. (See Figures 1-6).

Results

Data on the species investigated are presented in Table 1, and

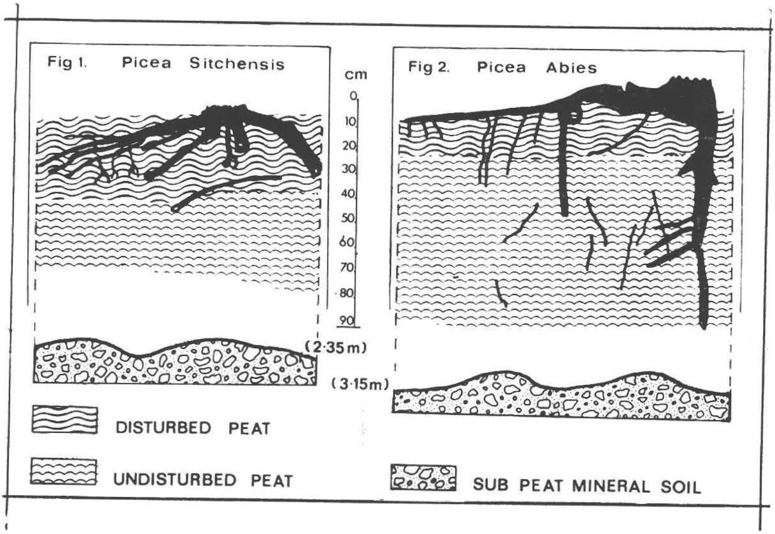
Fig 1. Picea Sitchensis
Fig 2. Picea Abies
cm
0
10
20
30
40
50
60
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80
90
(2·35m)
(3·15m)
DISTURBED PEAT
UNDISTURBED PEAT
SUB PEAT MINERAL SOIL

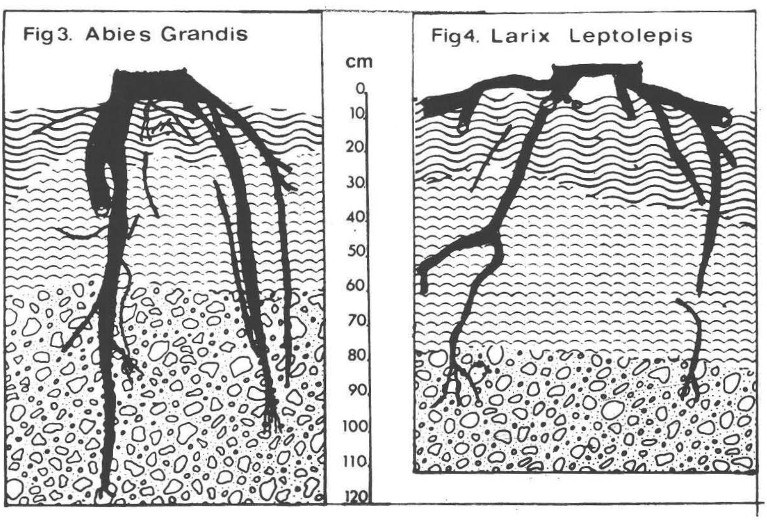
Fig3. Abies Grandis
Fig4. Larix Leptolepis
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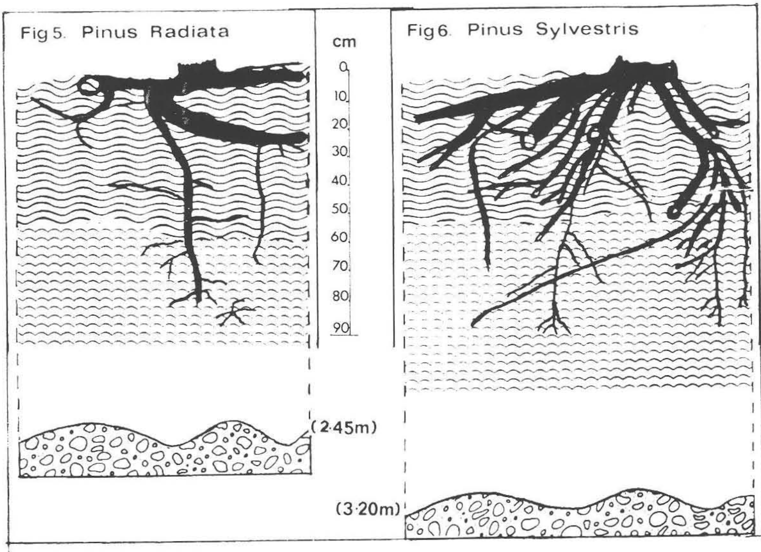
120

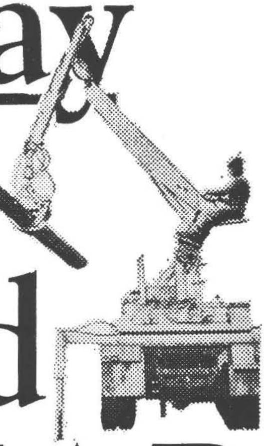


the root-development records of some of them are shown in Figs. 1-6. Yield class was determined using Forestry Commission Management Tables (8).

The growth and root penetration of thirteen conifers were as follows, all aged eighteen years, except contorta pine which was nine years old, having been added later in the replanting of certain plots which had failed.

Grand silver fir (*Abies grandis*): The most productive conifer with a top height of 10 metres and a yield class (metric) of 22. Root-penetration 120 cm through 60 cm of birchwood peat in an A/B situation (see Table 1, Note 3), and then into 60 cm of compact mineral soil at first decalcified—pH 5.4 and then calcareous —pH 7.3 (Figs. 3 and 7). The lower 25 cm of the root system, which includes most of the fine feeding roots is in fact embedded in this calcareous layer.

Monterey pine (*Pinus radiata*). Top height 10.4 m, yield class 20 in a U situation. Roots penetrating 90 cm in a profile of 245 cm peat-depth, including 60 to 70 cm of undisturbed older-sphangum/eriophorum peat and an intact fossil pine layer (Fig.



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COVER: This 220 KV line from the new power station at Turlough Hill required the clearing of a 60 m swath through a Wicklow forest.

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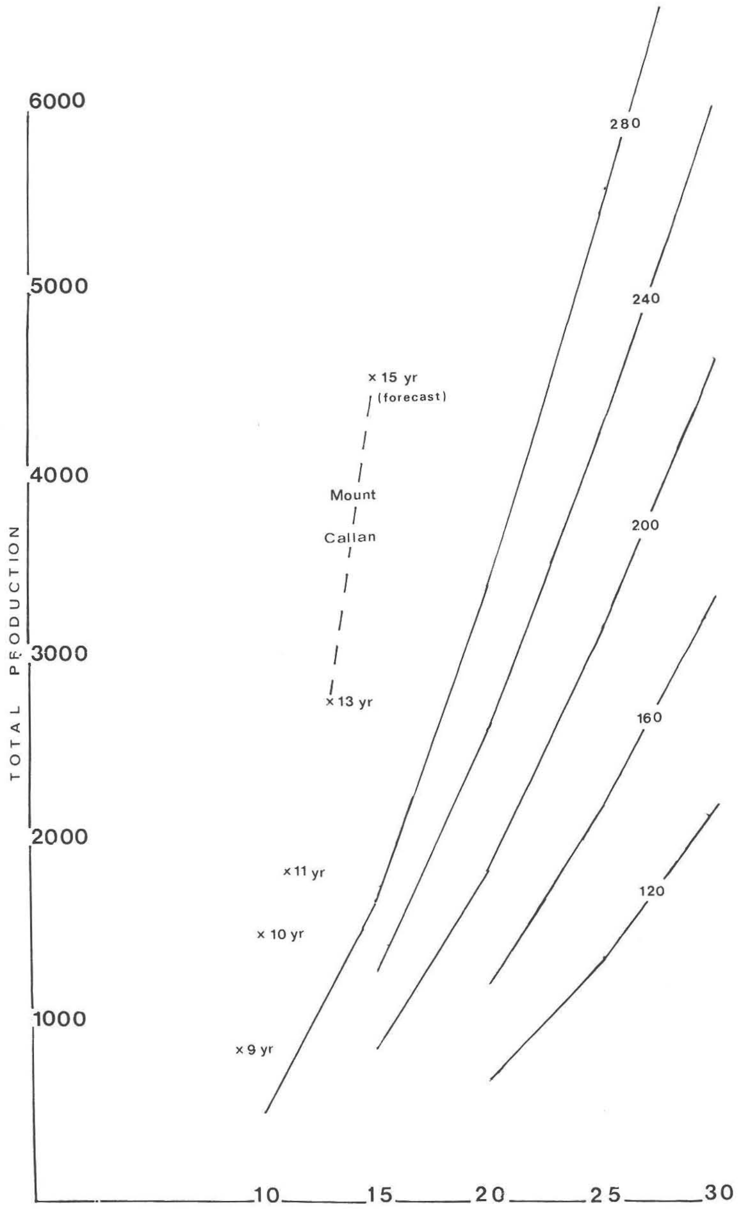

Figure 1: Total production (Hoppus feet per acre) for yield classes 120-280 (B.F.C.) and past and projected total production for Slieve Callan stand.

Given the same support that Agriculture is getting: Sitka spruce on the better lands would be a very real answer to the problems of the West.

2. There must be crops of Sitka spruce in this country potentially yielding greater than 280 hoppus feet per acre ($25m^3/ha$) per annum, the maximum in the Forestry Commission Booklet No. 17 (Bradley, 1967). If these crops are being thinned at the rate given for Y.C. 280 (70% of the Yield Class per annum), the dangers of wind damage will progressively increase due to overstocking during the life of the crop. There is, therefore, a very urgent need for producing tables for and recognising the fact that there are yield classes well in excess of 280.

R. T.

In May 1974 I had the opportunity to measure a 1/20 acre (.02 ha) sample plot in the above mentioned stand. Data for this plot are given in the Table 1.

TABLE I—DATA FROM SAMPLE PLOT

QGBH (inches	No. of stems	
3	—	
¼	1	MEAN QGBH = 5½ inches
½	—	MEAN HEIGHT = 40 feet
¾	1	MEAN VOLUME = 4.02 hoppus ft.
4	1	
¼	1	
½	1	VOLUME PER PLOT = 116 hoppus ft.
¾	2	VOLUME PER ACRE = 2,320 hoppus ft.
5	3	
¼	4	
½	4	
¾	4	TOP HEIGHT = 42 feet
6	—	
¼	2	NOTE: Mean volume was obtained from Forest
½	1	Record No. 10, (Hummel *et al.*, 1951)
¾	2	
7	2	

The two important crop characters are top height and volume per acre. the top height of 42 feet at 13 years is 50 per cent greater than that of the highest tabulated yield class for Sitka spruce at this age. Since the highest tabulated yield class is 280 (hoppus) it might reasonably be assumed that the yield class for the plot exceeds 400 and might possibly approach 500. The total volume production to date tends to support this. If volume per acre is added to the volume removed in thinnings it gives a cumulative volume of approximately 3000 hoppus feet per acre. The mean annual increment is therefore 230 hoppus feet and the crop, at 13 years of age, is presumably not yet half way through a rotation of maximum mean annual increment!

It is interesting to compare this remarkable growth rate with the performance of exotic pines in South Africa. Marsh (1957) gives a yield chart for *Pinus patula* which shows a total volume per acre of approximately 4000 cu. feet (3140 hoppus feet = 280m/^{3}ha) at 13 years. Is it possible that yield tables applicable to South African conditions might be suitable for Sitka spruce in Ireland? Be that as it may, the above growth rate has major implications for land use on much of the land in the West.

P. M. J.

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Early Growth of Sitka Spruce on Gleyed Soils in Northern Ireland

P. S. SAVILL[1] AND D. A. DICKSON[2]

1. *Introduction*

UNTIL the late 1960s practically all forest nutrition research in Northern Ireland dealt with the problems of Sitka spruce planted on oligotrophic peats. There were few experiments on other soil types. The fact that gleys were neglected for so long indicates that nutritional problems were not so great on them as on deep peats. But, high elevation gleyed forest soils of basaltic or carboniferous origins amount to about 40 per cent of the forest area. They are therefore important. The aim of this paper is to discuss the results of the few existing experiments on gleyed soils.

2. *Classification of Gleyed Soils in Northern Ireland*

The classification of mineral soils used in the forest soil survey at present being carried out in Northern Ireland is similar to that used by the British Forestry Commission (Pyatt, 1970). Two major kinds of gleys are recognised: non-peaty and peaty gleys. Non pleaty gleys are mineral gleys with up to 5 cm of peat on the surface and peaty gleys have an upper horizon of peat between 5 and 50 cm in depth. In this paper no further sub-division of these soils has been recognised.

3. *Fertilizing Practice on Gleyed Soils in Northern Ireland*

Fertilizing practice on all upland gleyed soils has changed considerably over the past 20 years. During the 1950s and early 1960s it consisted of giving each plant a handful of basic slag at planting. Since then coarse rock phosphate (CRP) has been applied, broadcast, at the rate of 500 kg/ha at the time of planting on most sites and more recently as much as 750 kg/ha has been applied to the poorest sites.

Fertilizing practice on gleys unlike the situation on deep peat (Dickson and Savill 1974) was based upon only limited experi-

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mentation, and more recent work indicated that on some sites application rates were unnecessarily high. This was not too important when the cost of fertilizing at planting was only a small fraction of the total establishment cost, but the price of rock phosphate quadrupled between 1972 and 1975 and the elimination of any wasteful use is now economically highly desirable.

4. *Problems of Tree Growth on Gleyed Soils*

The forest soil survey has indicated that growth of Sitka spruce on gleys is far from uniform on areas of apparenly uniform soil. In a study carried out in Lisnaskea Forest, Adams *et al* (1970) found that yield classes on non-peaty gleys ranged from 10-24 with a mean value of 17.5 and on peaty gleys from 9-23 with a mean of 16.9. The present classification of gleyed soils is therefore of limited use to forest management since the two groups embrace a range of conditions so wide that the growth of Sitka spruce can vary from its best to almost its poorest. It was clearly desirable to determine which soil factors most influence the growth of the trees and to find a method of subdividing the categories of gleyed soils so that difference in growth potential can be predicted before planting in order that fertilizers and other treatments can be applied in the most beneficial and economical way.

Some indications as to which factors might be influencing tree growth were provided by Adams *et al* who studied the relationships between various physical and chemical soil properties, tree growth and foliar nutrient levels. No obvious subdivision of value for management purposes could be identified from the physical or chemical characteristics of the soil by the analytical methods used but it was shown that poor growth is associated with low foliar nutrient status, particularly of P and N, and an accumulation of organic matter. It was suggested that further approaches to the problem could either be through raising the nutrient status of crops by the additions of fertilizers, or by attempting to increase the rate of organic matter decomposition by drainage and/or liming.

All these approaches have been followed up but the one which appears to be the most promising, at least in the short term, is the improvement of the nutrient status by the addition of fertilizers.

5. *Lisnaskea Experiment 8/69—Effects of Fertilizers on Growth of 8-10 Year Old Sitka Spruce Crops*

The direct approach of increasing the nutrient status of the

TABLE 1
LISNASKEA 8/69 TREATMENTS APPLIED IN SPRING OF 1969

Symbol	Treatment
P0	No P applied
P1	625 kg/ha CRP (80 kg/ha P)
P2	1250 kg/ha CRP (160 kg/ha P)
N0	No N applied
N1	312 kg/ha urea (145 kg/ha N)
N2	624 kg/ha urea (290 kg/ha N)
K0	No K applied
K1	312 kg/ha KCl (155 kg/ha K)

Note: All trees received a handful of slag when planted.

crop by addition of fertilizers was tried at Lisnaskea in 1969. The aim of the experiment is to investigate the responses of crops to different fertilizer treatments with and without drainage. It is laid out as a complete factorial experiment over a representative range of soils and conditions of growth in Lisnaskea Forest, Co. Fermanagh.

Four applications of each of the fertilizer treatments shown in Table 1 were laid out in each of High YC and Low YC areas. Because of practical difficulties, heights of only the five trees of greatest diameter were measured in each of the High YC plots. In the Low YC's 24 trees per plot were measured.

5.1. *Results*

5.1.1. *Effect of applied phosphate on growth and foliar nutrient concentrations*

In the Low YC plots at Lisnaskea growth has been significantly better in the presence of applied CRP each year since 1968 (Table 2). Even the PO plots received a handful of basic slag at the time of planting, so differences between the P0 and P1 treatments might have been greater if this had not been done. As it is however the increase over the five-years in terms of total growth represents a difference of about one yield class when the PO anl P2 treatments are compared.

TABLE 2

LISNASKEA 8/69 EFFECT OF APPLIED PHOSPHATE ON GROWTH MEAN HEIGHT (cm) AND FOLIAR P CONCENTRATION—(% DRY MATTER)

	Low YC Plots					High YC Plots				
Year	P0	P1	P2	Mean	SEm	P0	P1	P2	Mean	SEm
Growth 1969	31	29	29	30	0.8 NS	51	51	49	50	0.9 NS
1970	37	39	41	39	0.8 **	65	65	66	65	1.5 NS
1971	39	44	49	44	2.5 ***	(44)	(35)	(39)	(39)	3.0 NS
1972	46	56	60	54	1.5 ***	80	78	77	78	1.8 NS
1973	41	49	53	48	1.3 ***	54	54	55	54	1.4 NS
Growth 69–73	185	222	234	213	5.5 ***	288	286	287	287	6.0 NS
Foliar P 1973	0.13	0.18	0.22	0.17	0.007**	0.18	0.23	0.23	0.21	0.007**
					Diameter 1973	8.8	8.9	8.8	8.9	0.19 NS

The effect of phosphate applied in 1969 on foliar P concentrations in 1973 in the Low YC plots is marked, as shown in Table 2. At the PO level it is just above the "critical" concentration of 0.12 per cent dry matter (Van Goor 1970) while at the two higher levels it is well above this concenration. By contrast, in the high yield classes. applied phosphate has had no significant effect upon growth at any time or on foliar P concentrations in 1973. Foliar P concentrations were much higher in the untreated plots in the High YC's than in the Low YC's.

The experiment occupies almost 12 ha of forest. In such a large area it was impossible to achieve the desired degree of crop uniformity within each block. In the Low YC series yield classes ranged from 8-18, wi:h a mean value of 14. In the High YC plots they ranged from 14-24 with a mean of 18.

This variation provided an opportunity to study the relationships between the response of individual yield classes in terms of height

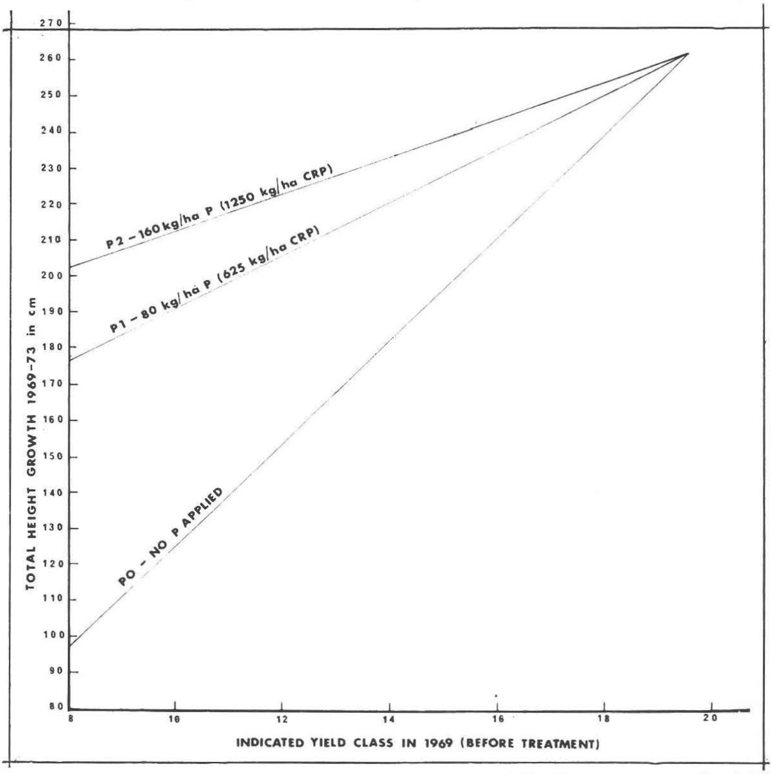

Fig. 1—Lisnaskea 8/69. Relationships between 1969-73 growth, and yield class, at each level of applied phosphate.

TABLE 3
LISNASKEA 8/69 EFFECT OF APPLIED NITROGEN ON GROWTH MEAN HEIGHT (cm) AND FOLIAR N CONCENTRATION (% DRY MATTER)

Year	Low YC Plots N0	N1	N2	Mean	SEm	High YC Plots N0	N1	N2	Mean	SEm
Growth 1969	30	30	29	30	0.8 NS	50	50	50	50	0.9 NS
1970	39	40	38	39	0.9 NS	62	66	68	65	1.5 *
1971	42	45	45	44	2.5 NS	(38)	(43)	(37)	(39)	3.0 NS
1972	51	55	56	54	1.5 *	74	81	80	78	1.8 *
1973	46	48	50	48	1.3 NS	56	54	53	54	1.4 NS
Growth 69–73	206	214	220	213	5.4 NS	283	292	285	287	6.0 NS
Foliar N 1973	1.49	1.51	1.48	1.50	0.035 NS	1.51	1.59	1.58	1.56	0.035 NS
					Diameter 1973	8.5	9.0	9.1	8.9	0.114 **

growth, 1969-1973, to different rates of applied phosphate. The results for the Low YC plots only are illustrated in Figure 1.

The three regression lines show that responses to applied CRP are greatest on the poorest sites and become less marked as the yield class increases. At YC 20 (which involved extrapolating one yield class), the three regression lines converge, indicating that there is no advantage in applying phosphate to crops growing at this rate or more. It should be noted however that none of correlation coefficients was very high though all were significant. (They were PO = 0.68***, P1 = 0.43***, P2 = 0.32*).

The calculated regressions for the High YC plots did not differ significantly from each other.

5.1.2. *Effect of applied nitrogen on growth and foliar nutrient concentrations*

Applied nitrogen slightly, but not significantly, increased overall height growth in crops of both yield classes (Table 3). In both cases the effect of nitrogen was significant in 1972 (and in 1970 as well in the High YC plots). In the High YC plots mean breast height diameter in 1973 was significantly increased by applied nitrogen.

The fact that responses to nitrogen were small is not surprising since, as indicated by foliar N levels in 1973, nitrogen was not limiting growth. It was well above the "critical" concentration of 1 per cent dry matter in all nitrogen treatments shown in Table 3 and was well above 1 per cent in every individual plot.

5.1.3. *Effect of applied potash on growth and foliar nutrient concentrations*

Applied potash had no effect at all upon growth (Table 4). As in the case of nitrogen, this is not surprising since average foliar K levels were well above the "critical" 0.4 per cent dry matter. Out of all the plots sampled, only seven had concentrations below 0.5 per cent and of these only one was as low as 0.4 per cent.

In both the High and the Low YC plots it was found that applied phosphate significantly increased the uptake of K by the trees. Where no phosphate had been applied, the mean foliar K concentration was 0.59 per cent; at the P1 level it was 0.62 per cent and at the highest level of applied phosphate it was 0.66 per cent.

TABLE 4

LISNASKEA 8/69 EFFECT OF APPLIED POTASSIUM ON GROWTH MEAN HEIGHT (cm) AND FOLIAR K CONCENTRATION (% DRY MATTER)

	Low YC Plots				High YC Plots			
	K0	K1	Mean	SEm	K0	K1	Mean	SEm
Growth 1969	30	29	30	0.6 NS	51	50	50	0.7 NS
1970	39	39	39	0.7 NS	66	65	65	1.2 NS
1971	43	45	44	2.0 NS	(40)	(39)	(39)	2.4 NS
1972	53	55	54	1.2 NS	79	77	78	1.4 NS
1973	48	48	48	1.0 NS	54	55	54	1.1 NS
Growth 69–73	210	216	213	4.4 NS	288	287	287	4.8 NS
Foliar K 1973	0.62	0.63	0.63	0.017 NS	0.61	0.64	0.63	0.017 NS
				Diameter 1973	8.9	8.8	8.9	0.09 NS

6. *Proposed classification of gleys*

The results of this experiment have shown that on some gleyed soils, where growth is relatively poor, substantial improvements can be obtained by the application of phosphate. On other soils, which are apparently similar in terms of soil chemical and physical properties, but on which growth is good, no improvement can be obtained from applied phosphate. Within the relatively small area of Lisnaskea forest climatic differences are obviously small and are not the main cause of growth differences.

The experiment did not show the rate of phosphate which should be applied to achieve optimum growth on the poorer sites, nor has it been possible to show whether as good growth could have been obtained on the better yield class sites in the absence of any applied phosphate since all plots at Lisnaskea received a handful of basic slag at the time of planting. However it is clear that on these better sites additional applied phosphate is wasted

There is therefore a need to find a way of predicting tree performance on gleys. Although the methods used by Adams *et al* (1970) proved unsuitable for this, tree growth is obviously being influenced by soil conditions and some other index of soil potential for tree growth must be found.

In practical terms it is more common to assess the potential of a site in terms of the native vegetation that grows on it rather than by describing the characteristics of the soil (Anderson 1950). This method is used successfully for deep peats in Northern Ireland (Dickson and Savill 1974) and a similar approach was tried for the gleyed soils.

Several areas in Lisnaskea Forest were visited including all the block involved in experiment 8/69 and as far as possible the vegetation growing on open ground adjoining them was described and related to the yield class of the crops. It was found that both peaty and non peaty gleys of similar yield classes had essentially the same ground vegetation. For the purposes of a classification based on vegetation the two soil types are not distinguishable. However the distinction is worth maintaining since other factors, such as stability, may vary with basic soil type.

The survey showed that changes in growth rates of Sitka Spruce were related to changes in the proportions of the most common constituents of the vegetation. On practically all sites almost all the following plants could be found:-

Calluna vulgaris
Molinia caerulea

Descampsia flexuosa
Juncus effusus
Deschampsia caespitosa
Holcus lanatus)
Anthoxanthum odoratum) Soft grasses
Agrostis spp)
Poa spp)

However the fertility of the site in relation to the growth of Sitka spruce could be recognised by the proportion of each of these species in the vegetation. Thus at the poorest extreme *Calluna* predominates but as conditions improve slightly *Molinia, Deschampsia flexuosa* and *Juncus articulatus* become relatively more common. At the other extreme the site is dominated by *Juncus effusus,* soft grasses and *Deschampsia caespitosa.* There is a continuous variation between the two extremes. The previous history of the area also has a marked effect on the vegetation of any one site. For example, it is commonly observed that the vegetation in old fields, particularly those which are near houses or ruins, tends to be of a more eutrophic kind than on unenclosed land.

All the high yield class sites were on enclosed land of this kind, although some of the poorer sites were enclosed too. The greater fertility of old fields is probably caused by the fact that they were cultivated and manured by farmers and, over many years, the P status has been built up. Abrupt changes in vegetation can frequently be seen along boundaries from one field to the next or from a field to open ground.

Preliminary surveys in many forests in Northern Ireland have indicated that the relationship between the growth of Sitka spruce and vegetation on gleyed soils is likely to be similar to that at Lisnaskea.

For practical purposes it is necessary to provide some fairly arbitrary classification of vegetation as a basis for fertilizer prescriptions and the one shown in Table 5 is proposed as being suitable for most gleyed soils.

7. *Belmore Experiment 1/56—Effect o fFertilizers on growth of Sitka Spruce from time of Planting*

If the classification shown in Table 5 is to be of practical use, one would expect crops on eutrophic sites scarcely to respond at all to applied phosphate. Those on mesotrophic sites should give a maximum response to moderate rates of phosphate and those on

TABLE 5
CLASSIFICATION OF GLEYED SOILS

	Characteristic species of vegetation*		
Nutrient class	Botanical name	Local name	Other features
Oligotrophic	Calluna vulgaris Molinia caerulea Deschampsia flexuosa Juncus articulatus	Heather Purple moor grass Wavy hair grass Sprit or jointed rush	Normally unenclosed land. Poorer parts on typical marginal farms.
Mesotrophic	Deschampsia flexuosa Juncus articulatus Juncus effusus Calluna vulgaris Polytrichum spp	Wavy hair grass Sprit or jointed rush Soft rush Heather Mosses generally abundant	Occasionally enclosed land. Usually poorer fields adjoining unenclosed area. Unlikely ever to have received farmyard manure.
Eutrophic	Juncus effusus** Holcus lanatus Agrostis spp Anthoxanthum odoratum Deschampsia caespitosa	Soft rush Yorkshire fog Bent grasses Sweet vernal grass Tufted hair grass Mosses not abundant	Normally enclosed land. Usually best fields convenient to farm buildings. Frequently given farmyard manure in past.

*Species are listed according to their relative abundance in the native vegetation.
**Rushes may be absent from locally well drained areas.

oligotrophic sites to high rates. Only one (unreplicated) experiment is old enough to give any indication as to the medium-term responses of Sitka spruce on gleys from the time of planting. It is used here to confirm the validity of the classification proposed in Table 5.

The experiment is at Belmore Forest, Co. Fermanagh, at an elevation of about 300m. The soil is a non-peaty gley. At the time of planting in 1956 the ground vegetation consisted largely of *Juncus articulatus, Juncus effusus, Eriophorum angustifolium,* and *Molinia caerulea.* According to the classification in Table 5 this is a mesotrophic site.

Earlier experience had shown that Sitka spruce growth on similar sites was disappointing.

As a result, the range of fertilizer treatments shown in Table 6 was applied to see if any would improve growth.

7.1. *Effect of treatment on growth and foliar nutrient concentrations*

Table 6 shows clearly that growth in all the plots which received some phosphorous was better than in the untreated plot. Growth in the plots which received basic slag only was best, and on average it was 50 per cent better than in the untreated plot.

At the other extreme, applied calcium and possibly nitrogen depress growth. The depressing effect of lime is consistent with the early results of liming experiments on peats (Dickson 1972). Fertilizer nitrogen applied at the time of planting on peats often depresses growth too, though it becomes essential in later years (McConaghy 1962, Dickson and Savill 1974).

The annual mean heights since 1957 of the two plots which were treated with slag only are shown in Figure 2 and compared with the untreated conrol plot. It will be seen that there has been very little difference in growth between the two treated plots at any time since planting, indicating that on this site 250 kg/ha basic slag is as good as 500 kg/ha. The increase in height as a result of applying slag indicates an improvement in predicted yield class, which has been consistent since planting from YC12 to YC20.

Determinations of foliar N, P and K levels at intervals since planting (Table 7) have shown that in the slagged plots N and K levels were normally above the "critical" concentrations of 1 and 0.4 per cent dry matter respectively (Leyton, 1958, Van Goor, 1970). By contrast foliar P concentrations in the untreated plot have always been below the "critical" level of about 0.12 per cent; in the slagged plots P levels have always been higher than in the

TABLE 6
BELMORE 1/56 TREATMENTS APPLIED IN SPRING OF 1956

kg/ha element				Applied as (fertiliser)	kg/ha fertiliser	Mean height at end of 1971 (cm)
N	P	K	Ca			
	22.5			Basic slag	250	670
	45			Basic slag	500	663
	22.5			Basic slag	250	574
			2000	Ground limestone	5000	
26				Ammonium sulphate	125	
7.5	22.5			Bone meal	250	554
	45			Basic slag	500	
		62.5		Muriate of potash	125	
	22.5			Basic slag	250	529
			1785	Burned lime	2500	
10	14	17		Special potato manure	250	516
26				Ammonium sulphate	125	
				Nil		442
			1785	Burned lime	2500	359
			2000	Ground limestone	5000	343
26				Ammonium sulphate	125	
52			38	Nitrochalk	250	228
		62.5		Muriate of potash	125	

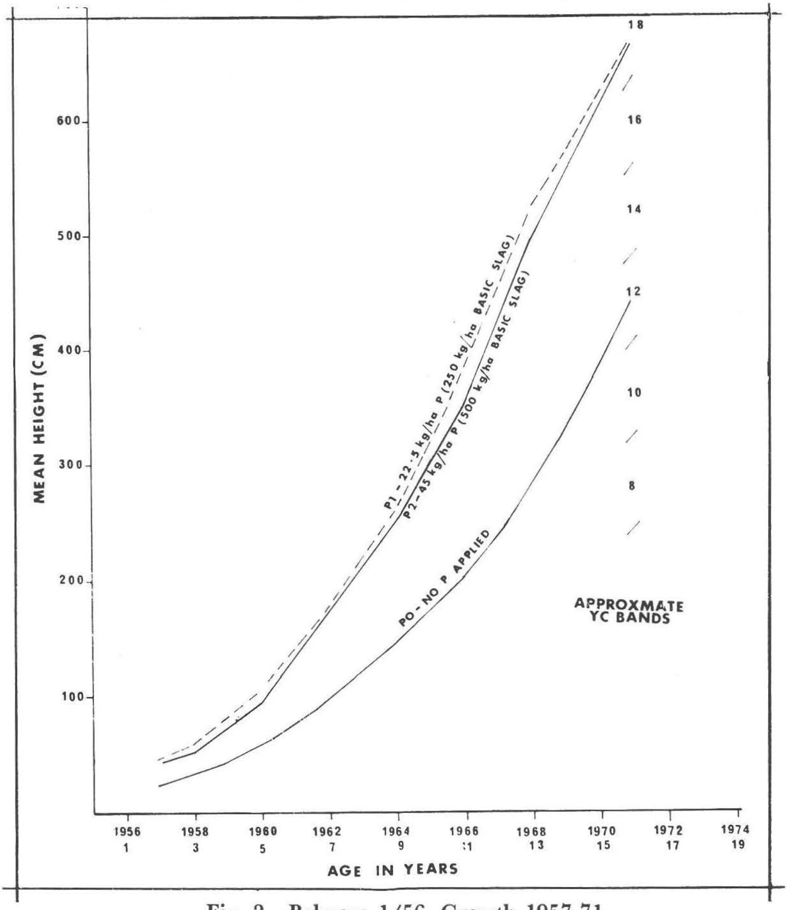

Fig. 2—Belmore 1/56. Growth 1957-71.

untreated plot though in two seasons concentrations were just below the "critical" level.

It seems therefore that on this site growth is limited by a deficiency of available phosphorus which can be corrected by applying a moderate rate of basic slag.

8. *Discussion*

The Belmore experiment has confirmed that the classification in Table 5 is valid, at least as far as this mesotrophic site is concerned, since no advantage to growth is indicated by applying basic slag at rates exceeding 250 kg/ha (about 22 kg/ha P) at this stage in the rotation. However, in an attempt to make general recommendations for management purposes, there must at this stage inevitably be some uncertainties, for example the Lisnaskea experi-

TABLE 7
BELMORE 1/56 FOLIAR N P AND K CONCENTRATIONS EXPRESSED AS PERCENTAGE DRY MATTER

Treatment	Foliar N P and K concentrations in winters of								
	1963			1964			1965		
	N	P	K	N	P	K	N	P	K
P0 Nil	1.24	0.08	0.54	–	0.10	0.53	1.32	0.12	0.50
P1 250 kg/ha slag	1.33	0.10	0.64	–	0.14	0.49	1.47	0.14	0.53
P2 500 kg/ha slag	1.45	0.11	0.43	–	0.13	0.53	1.44	0.13	0.54
	1966			1967			1973		
Treatment	N	P	K	N	P	K	N	P	K
P0 Nil	1.24	0.09	0.48	1.29	0.08	0.42	1.46	0.12	0.50
P1 250 kg/ha slag	1.40	0.11	0.48	1.57	0.14	0.50	1.89	0.21	0.63
P2 500 kg/ha slag	1.33	0.11	0.54	1.61	0.12	0.48	1.89	0.19	0.69

ment indicated increasing responses to increasing rates of applied CRP, but in this case the phosphate was not applied until about 9 years after planting and at the time of writing they had only been growing for five seasons since treatment. It seems likely though that the current application rate of CRP at 500 kg/ha (65 kg/ha P) will be adequate for the poorest, oligotrophic gleys, from the time of planting. On the more fertile mesotrophic gleys like the Belmore site, 250 kg/ha CRP (32 kg/ha P) should be adequate. On the best eutrophic sites, it is probable that growth will be perfectly satisfactory in the absence of any applied phosphate but this is also uncertain. An experiment on a eutrophic gley a Kesh Forest indicates that growth immediately after planting, in plots which received no phosphate at planting is as good as that in the plots which received rates up to 105 kg/ha P.

The results of the Belmore and Lisnaskea experiments have given no indication that it is worth applying potash or nitrogen at an early stage though it is worth noting that at Lisnaskea small but significant responses to applied nitrogen were found. It is not suggested that nitrogenous fertilizers should be used so early in the crop rotation but later results of this trial may indicate that later applications could have beneficial effects.

9. *Acknowledgements*

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The Influence of Fertilisers Upon Microbial Activity in Peat

I. SUPERPHOSPHATE AND GROUND MINERAL PHOSPHATE[1]

J. J. GARDINER[2] and M. J. GEOGHEGAN[3]

Introduction

GROWTH of forest trees on many of the peat types occurring in Ireland is extremely slow due to the nutritional poverty of the peats, but the addition of phosphate improves the rate of growth. In addition to this growth response to phosphate, foliar analyses have shown that uptake of nitrogen by trees from peat treated with Ground Mineral Phosphate (G.N.A.P.) is much higher than that from untreated peat.

This increase in foliar nitrogen concentration has been attributed to an increase in availability of mineral nitrogen in the peat following phosphate application. It has been suggested (McEvoy, 1954; Atterson and Binns, 1968; O'Carroll, 1972) that the calcium in the G.N.A.P. (rock phosphate) stimulates the microbial population resulting in increased mineralisation of organic nitrogenous complexes. However, O'Hare (1967) could not measure any growth response in trees following application of calcium carbonate to peat. In fact growth decreases following liming have been reported (e.g. Dickson, 1972).

The purpose of the experiments reported here was to measure the effects of superphosphate and G.N.A.P. upon microbial activity in peat, and its influence on some of the chemical properties of the peat.

Experiments

The peat used was cut-over raised bog peat remaining after the milled peat method of harvesting was collected from Bay 21, Lullymore, Co. Kildare (Grid ref. N70.26). The final harvesting from this bay was in 1965 and the remaining peat has been exposed and undisturbed since that time. It is a layered non-sphagnum-moss peat of average pH 4.5. The peat was homogenised by sieving before addition of the fertilisers.

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1. Part II: *Calcium and Nitrogen* wll be published in Vol. 32, No. 2.
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G.N.A.P. and superphosphate were added separately to the homogenised cut-over peat at rates of 0 (P_0), 625 (P_1), 1250 (P_2) and 2500 (P_3) kilograms of fertiliser per hectare. No attempt was made to add equivalent amounts of the elements. These rates were calculated from bulk density measurements. The treated peat samples were incubated in pots in the laboratory and the moisture content was maintained at field level (82% wet weight) for the duration of the experiment. The mean temperature in the laboratory during this period was 20.5°C$\pm$4.5°C.

Microbial activity was assessed by measuring oxygen uptake, ammonical (NH_4—N), and nitrate ($N0_3$—N) nitrogen and pH were determined at intervals over a period of 70 days. Oxygen (0_2) uptake by the peat was measured using the electrolytic macrorespirometer of Birch and Friend (1956) as modified by Balis (1973). (Fig. 1). NH_4—N and $N0_3$—N were extracted by shaking with 1N—K_2 $S0_4$ and estimated by the microdiffusion method of Bremner and Shaw (1958). pH was mesured on a peat paste (peat: water, 1:2) using a glass electrode. The bacterial and fungal populations were estimated by the plate dilution method on the 70th day.

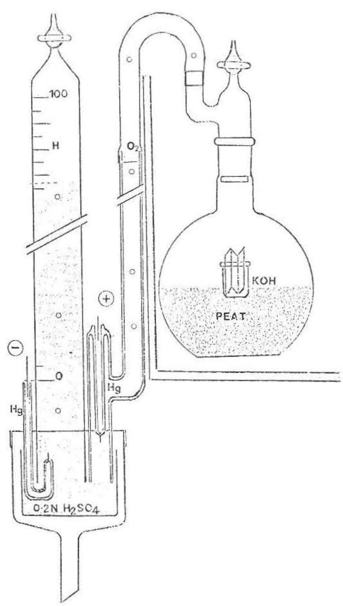

Figure 1. The macrorespirometer used for measuring oxygen uptake.

TABLE 1

INFLUENCE OF PHOSPHATE TREATMENT ON pH OF PEAT

Superphosphate	Time (Days)						Mean
	1	7	14	28	52	70	
P_0	4.40	4.35	4.35	4.40	4.35	4.35	4.37
P_1	3.90	3.90	3.90	3.90	3.90	3.95	3.91
P_2	3.80	3.80	3.85	3.90	3.95	3.95	3.88
P_3	3.70	3.75	3.75	3.80	3.80	3.80	3.77
Means	3.95	3.95	3.96	4.00	4.00	4.01	
G.N.A.P.							
P_0	4.35	4.35	4.35	4.35	4.40	4.40	4.37
P_1	4.30	4.25	4.25	4.25	4.30	4.30	4.27
P_2	4.30	4.25	4.25	4.25	4.30	4.35	4.28
P_3	4.25	4.20	4.20	4.20	4.25	4.40	4.25
Means	4.30	4.26	4.26	4.26	4.312	4.362	

L.S.D. (5% level) Superphosphate 0.03 G.N.A.P. 0.02

Results

1. *Effect of Treatment on pH of Peat*

Immediately following mixing of the peat and fertilisers, slight decreases in pH were found in all of the peat samples (Table 1). This drop in pH was more noticeable after 7 days incubation. However, the pH of the G.N.A.P. treated peat samples reverted to near its original level towards the end of the experimental period.

This initial decrease in pH was rather surprising in view of the amount of calcium which the fertilisers contain (Sauchelli, 1956), although the differences in effect between the fertilisers can be explained by differences in calcium content. However, Carolan (1959) has shown that the effect of G.N.A.P. on pH varies in different peats and he cites similar reports from Russian workers. With lowmoor peat—G.N.A.P. mixtures he found an increase in pH at first, followed by a decrease; transitional peat—G.N.A.P. mixtures showed a steady decrease in pH.

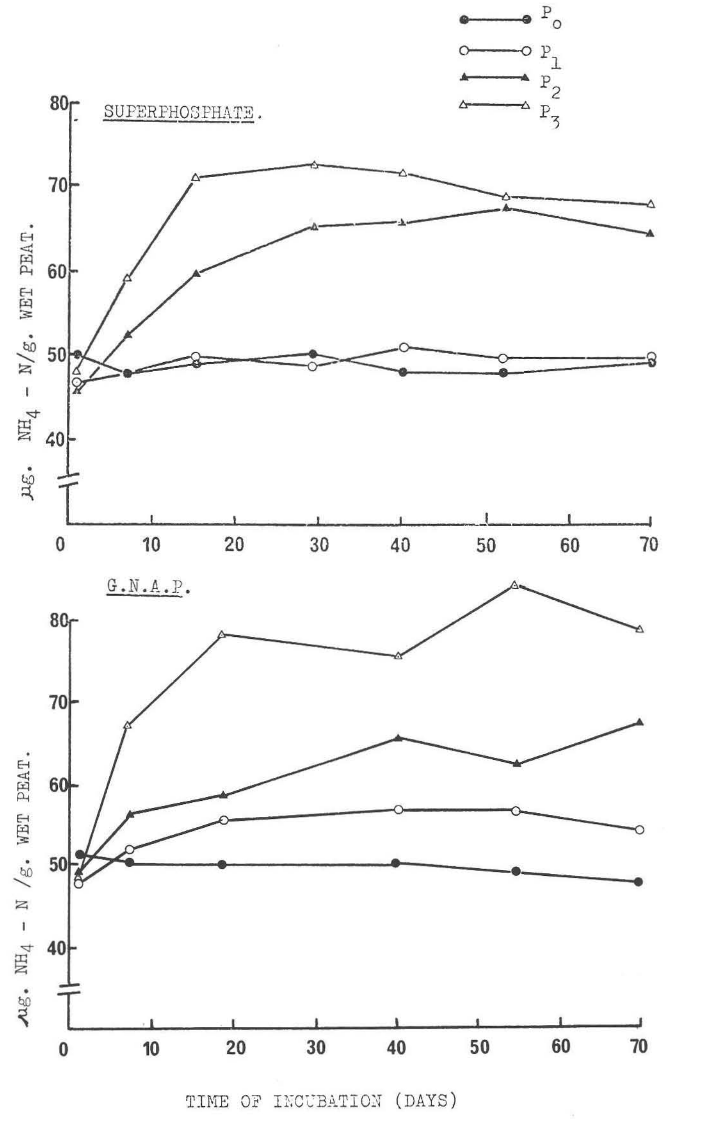

Figure 2. Influence of phosphate treatment on concentration of NH4-N in peat.

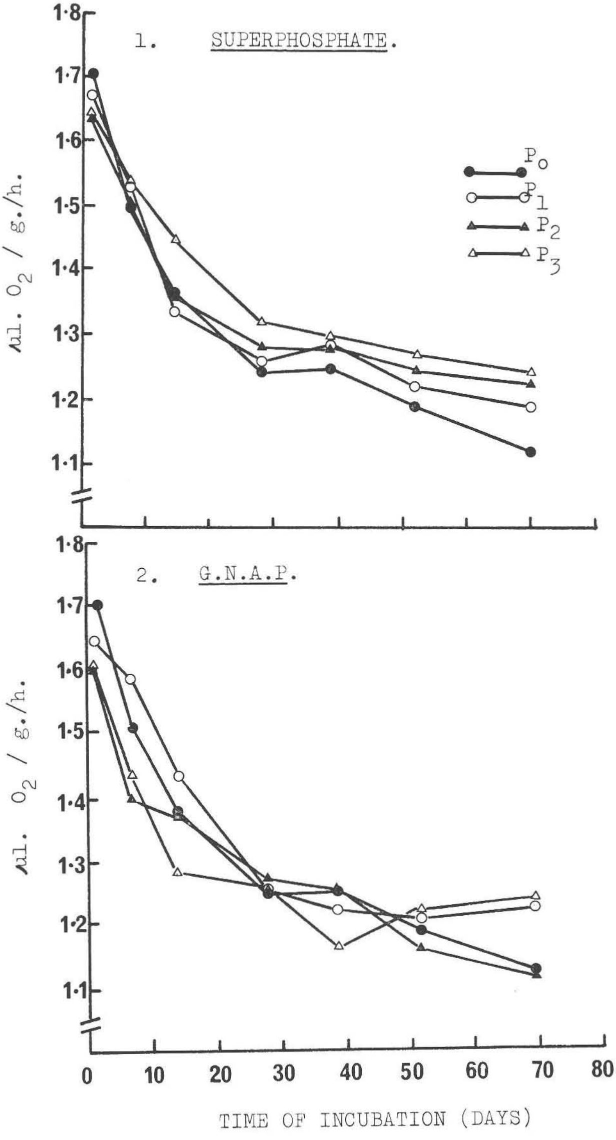

Figure 3. Influence of phosphate treatment on the rate of oxygen uptake in peat.

2. *Effect of Treatment on Nitrogen Content of Peat*

(a) Ammoniacal Nitrogen

The NH_4—N content of the peat increased significantly following the addition of both fertilisers, at all levels of application with the exception of the lowest level of superphosphate (Fig. 2). The highest concentrations of NH_4—N occurred in both instances with the largest application of fertilisers. The increases in the mineral nitrogen concentration of the P_2 and P_3 were significant at the 1% level.

(b) Nitrate Nitrogen

The NO_3—N content of the peat samples remained constant throughout the experiment and ranged from 3–7 micrograms/gram of wet peat.

3. *Effect of Treatment on Oxygen Utilisation of Peat*

The rate of O_2 uptake by all treated peat samples (including control) decreased steadily over the first 30 days of incubation, thereafter the rate of decrease tended to level off. This is illustrated in Fig. 3. Rate of uptake ranged from 1.7 to 1.1 microlitres of oxygen/gram/hour at the beginning and end of the incubation period.

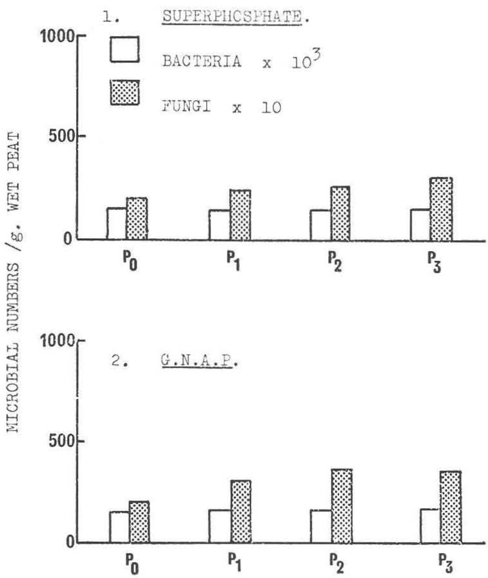

Figure 4. Influence of phosphate treatment on microbial numbers in peat.

This decrease was probably due to the fact that the respiration rate was already unusually high following aeration during sampling and homogenisation. Jackman (1960) has found that some of the oxygen uptake by disturbed soil may be non-biological and attributable to autoxidation of lignin. From about the 30th day of incubation onwards small differences in the rate of respiration of the peat samples were found, but these were not statistically significant. The numbers of bacteria counted at the end of the period, were not influenced in any way by either fertiliser at any level of application (Fig. 4). Small increases in fungal numbers in the peat were found at the 70th day, but the variation between fungal counts within treatments was usually greater than the differences between treatments.

Discussion

The application of different rates of superphosphate and G.N.A.P. separately at various levels has led to an increase in concentration of NH_4—N in the peat. Furthermore, the biggest increases in mineral nitrogen were found at the highest levels of fertiliser application. This may account for the finding by O'Carroll (1972) that the smaller the application of G.N.A.P. the shorter the period during which growth accelation of Sitka spruce is maintained. Despite the effect of superphosphate upon the availability of mineral nitrogen shown here, application of superphosphate has been found to be less effective than G.N.A.P. in improving tree growth on peat. (O'Carroll 1972, and personal communication.) This may be due to the lowering of the pH of the substrate by the former (Table 1). Benzian (1965) has shown that for nursery plants at least optimum uptake of nitrogen by Sitka spruce and Lodgepole pine occurs close to pH 4.5 and drops off steeply below pH 4.0. The final pH levels found in the superphosphate treated peats in these experiments were as low as 3.8.

The results indicate that the addition of G.N.A.P. to peat produced an increase in the concentration of NH_4—N in the peat, yet no increase in microbial numbers or activity (0_2 uptake) has been observed. These facts indicate that the reactions involved in the release of the additional NH_4—N are chemical and not biological. Neither is there any evidence that there is an increase in microbial activity following the addition of superphosphate. Indeed, Williams (1972) has reported that the addition of triple-superphosphate to pine-humus, apart from stimulating mineral nitrogen production, had no effect upon microbial activity measured as $C0_2$ production.

From the above it may be concluded that the addition of soluble or insoluble phosphatic fertilisers to cut-over peat does not stimulate microbial activity and has no priming effect upon the microbial population. This is contrary to the findings of Zottl (1963) who reported that basic slag stimulated microbial activity and nitrogen mineralisation in peat. However, it should be noted that in his case the phosphate was added with lime. In addition, Dickson and Savill (1974) have shown that a second application of G.N.A.P. to crops growing on peat has only a small and short-lived effect upon foliar nitrogen concentration. Also, since it appears that there is no "priming effect", the nitrogen supply to trees growing on peat can only be maintained by either promoting recycling of nutrients from the peat or by direct application of nitrogenous fertilisers.

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Trees, Woods and Literature—12

EPITAPH ON A FIR-TREE

She grew ninety years through sombre winter,
Rhododendron summer of midges and rain,
In a beechwood scarred by the auctioneer,

Til a March evening, the garden work done,
It seemed her long life had been completed,
No further growth, no gaiety could remain.

At a wedding breakfast bridesmaids planted
With trowel and gloves this imported fir.
How soon, measured by trees, the party ended.

Arbour and crinoline have gone under
The laurel, gazebos under the yews:
Wood for wood, we have little to compare.

We think no more of granite steps and pews,
Or an officer patched with a crude trepan
Who fought in Rangoon for these quiet acres.

Axes and saws now convert the evergreen
Imperial shadows into deal boards,
And let the sun enter our house again.

Quickly we'll spend the rings that she hoarded
In her gross girth. The evening is ours.
Those delicate girls who earthed her up are faded.

Except for daffodils, the ground is bare:
We two are left. They walked through pergolas
And planted well, so that we might do better.

From *Sailing to an Island* by Richard Murphy. Reprinted by permission of the publisher, Messrs. Faber and Faber Ltd.

Richard Murphy was born in Galway in 1927. He won the AE Memorial award in 1951. For some years he ran a fishing boat on the west coast, the subject of his poem *The Last Galway Hooker*. He also wrote a long poem *The Cleggan Disaster* about an event in October 1927 when 25 fishermen from Cleggan and Inishbofin were drowned as a result of a sudden storm. He lives in Cleggan.

Notes and News

By

Wood Kerne

NEW TREATMENT FOR PARAQUAT POISONING

SCIENTISTS at ICI's Central Toxicology Laboratory have taken a step forward in the search to find a successful treatment for paraquat poisoning.

A series of experiments with rats has demonstrated that if the concentration of paraquat in the blood is drastically reduced by suitable treatment the lungs no longer accumulate enough paraquat to cause lethal damage. All the animals used in the experiments survived, even though treatment was not started until four hours after the paraquat had been given.

Another series of experiments showed that the same treatment. started ten hours after a lethal dose of paraquat had been given, saved 80% of the animals.

These experiments give good grounds for hope because human lung is known to react to paraquat in much the same way as rat lung.

Details of the suggested new treatment have been widely circulated to doctors, hospitals and poisons centres in Ireland and overseas.

This achievement marks the culmination of many years work within ICI to find a treatment—and an antidote—for paraquat poisoning, a search which began when the significance of the paraquat accidents was first appreciated. An essential first step in the search, however, was to understand the mechanism whereby paraquat enters the lung. Until that was fully understood it was difficult, if not impossible, to devise an effective treatment.

Despite the absence of a specific antidote, many victims of paraquat have been successfully treated. Even before the latest treatment, there had been a considerable advance in the methods of treatment. The recovery rate among cases of accidental poisoning by paraquat is continually improving.

Other work currently in progress in ICI involves compounds which, it is hoped, will slow down or prevent altogether the accumulation of paraquat in the lungs.

From *Gramoxone in Perspective, Fitting facts into an Irish Picture*, published by Plant Protection Division, ICI (Ireland) Ltd.

WEALTH TAX 1975

Submission to the Minister for Lands by the Society of Irish Foresters:

The Society of Irish Foresters would like to express to the Minister the concern of its members in relation to the proposed Wealth Tax Bill 1975 and the effect it will have on Private Forestry.

Owing to its long term nature Private Forestry has always, in the past, been the subject of special consideration in every aspect of taxation—Income Tax, the former Death Duties and even in the recent Capital Gains Tax proposals, and in each case growing timber has always been distinguished from the land on which it grows.

Presumably successive Governments have considered Private Forestry to be desirable and the State since its foundation has given grants, advice and tax concessions to this end.

The Wealth Tax Bill in its present form allows no such concessions and unless some special provision is made, as in the case of the other taxes, economically damaging consequences must ensue as the effect of a 1% annual levy on the value of growing timber can only mean its systematic expropriation.

It is submitted that:

(a) Growing timber should be added to the list of exemptions in Clause 7 (1).

(b) Growing timber should be specifically excluded from Woodland defined in Clause 10 (4) but added to the list of items brought in for the purpose of defining a "Farmer" in Clause 10 (4) (a) with livestock and bloodstock.

As many of our members manage their woodlands through the medium of Discretionary Trusts, non Trading Companies, as well as Trading Companies it is the opinion of the Society that these should qualify in the same way they do in the bloodstock industry and be subject to the same advantages in terms of arriving at Taxable Wealth for tax purposes.

The Society whose principal object is the promotion of Forestry in all its aspects views with anxiety any form of legislation which might threaten this object and requests the Minister to have these proposed amendments incorporated in the Bill.

THE HOME GROWN TIMBER MERCHANTS' ASSOCIATION

The Minister for Lands Mr. T. Fitzpatrick, T.D., was Principal guest at the annual dinner of the Home Grown Timber Merchants' Association held on 15th February 1975 at the Clarence Hotel, Dublin.

Mr. Malachy Sharkey, President of the Home Grown Timber Merchants' Association, in the course of his address said that "the Home Grown Timber trade was presently going through a very critical period mainly due to shortage or indeed complete absence of markets. Many sawmills are either working on short time or with reduced staff and some have completely closed.

While the timber industry is in recession all across Europe, the weaker home grown timber trade in Ireland has been practically suffocated by the imported timber mountain which has built up over the past 18 months.

The traditionally weak image of Irish timber has seriously aggravated its present day marketing position and prospects. While Irish grown timber, the produce of modern scientifically planned and managed forests, is generally as good as, and sometimes better than the varied grades of imported timber, the Irish product has not yet outlived its war-time reputation. Irish timber is too often wrongly regarded as an old fashioned rustic product, mishandled in badly equipped and badly managed ramshakle mills, despite the very marked progress made by most mills in sawing skills and techniques, modern equipment, drying programmes and heavy stock carrying, which ensure a good supply service to the consumer.

Irish sawn timber must on merit demand a firm standing in the market place. Imported timber is costing approximately £25,000,000 per annum while at the same time increased supplies of good quality sawn timber coming from our own forests cannot be sold. It is obvious that a major promotional and marketing job must be urgently pursued to redress the ridiculous position where vast quantities of timber are brought from the ends of the earth while our own good quality home-grown spruce is practically ignored.

While most Irish grown timber is inherently as high in general quality as imported timber the approach to processing and presentation must be standardised. This particularly applies to the moisture content of home grown timber. Neither will the poor image of the home product be changed until *all* sawmills conform to international standards. In this respect one must visualise a system of timber grading and branding in the future with classification of sawmills related to their production performance—somewhat along the lines of the grading of hotels. Sawmills producing building timber, whether on a local or national scale, would require official certification to be associated with quality branding of the finished sawn product. In this way product confidence would be established amongst architects and builders and Irish timber could compete on equal terms with imported timber—even to the extent of carrying a certifying brand on the end of the timber—preferably in red—so important to Irish architects.

The alternative is an ever increasing deficit bill for imported timber while the produce of our own valuable forests stagnates on our hillsides. We can ill afford such waste of one of our principal native resources."

SINCEREST FLATTERY

We are pleased to observe that the Timber Growers' Association is taking a leaf out of our book, and is sponsoring open days "down in the woods" this summer, in privately owned woodlands. The T.G.O. has 1,700 members with 200,000 ha of woodland in England and Wales.

BIBLICAL FORESTS

The Forest and Wildlife Service, in its display at the Royal Dublin Society Spring Show, had the following biblical quotation: "For every beast of the forest is mine, and the cattle upon a thousand hills. I know all the fowls of the mountains: and the wild beasts of the field are mine" (Ps. 50:10, 11). Clearly the F.W.S. believes in adopting from the outset a strong negotiating position, a habit acquired doubtless in its dealings with staff associations.

We were stimulated into a search for further forestry references in the Bible. For example:

> I will plant in the wilderness the cedar, the shittah tree, and the myrtle, and the oil tree; I will set in the desert the

fir tree and the pine, and the box tree together (Is. 41 : 19).

The voice thereof shall go like a serpent; for they shall march with an army, and come against her with axes, as hewers of wood. They shall cut down her forest, saith the Lord, though it cannot be searched; because they are more than the grasshoppers, and are innumerable (Je. 46: 22, 23).

As when a man goeth into the wood with his neighbour to hew wood, and his hand fetcheth a stroke with the axe to cut down the tree, and the head slippeth from the helve, and lighteth upon his neighbour, that he die; he shall flee into one of those cities, and live (Deut. 19: 5).

The exercise is so fascinating that we may return to it in our next issue. Order your copy now!

WORLD INCREASE IN FOREST FIRES

FAO, the UN Food and Agriculture Organisation has reported that forest fires have increased at a serious rate in recent years in both developing and developed regions of the world. The increase in developing countries is probably due to population increases and the need for arable land; the increase in the Mediterranean region and in California is ascribed to increased use of the forest by local residents and tourists. Some areas are burned deliberately to decrease temporarily their tourist value in the hope of gaining permission for buildings or other facilities.

These increases have prompted FAO and the UN Environment Programme to initiate a programme aimed at increased research, education and cooperation in the prediction, detection and control of forest fires.

QUERY

Do kangaroos have hoppus feet?

MURPHY'S LAWS

1. In any field of scientific endeavour, anything that can go wrong will go wrong.
2. Left to themselves, things always go from bad to worse.
3. If it is possible for several things to go wrong, the one that will do most damage is the one that will go wrong first.
4. Nature always sides with the hidden flaw.

5. Mother Nature is a bitch.
6. If everything seems to be going well, you have obviously overlooked something.

(Collected from American academics by Diarmuid McAree)

COOLE AGAIN

We will not be allowed to forget either our past misdeeds or our present responsibilities with regard to Coole Park, now part of Gort State Forest, Co. Galway. Following the comment quoted in our last issue (p. 178) the magazine *Books and Bookmen* (March 1975) begins a review with the following sentence: "The Coole Edition of Lady Gregory's writings pursues its monumental course, no doubt with some sense of reparation for the regrettable destruction of her home, and perhaps also some shame for the now indecipherable state of her famous autograph tree."

TREE SEED WORKERS

A computerised World Directory of Tree Seed Workers is being compiled on behalf of the International Union of Forest Research Organisations (IUFRO) Working Party S2.01.06 (Seed Problems). The Directory will include all aspects of seed ontogeny, origin, technology and health. In addition to being a source of addresses and a mailing list for meetings it will serve as a general manpower source and a register of expertise to advise on or investigate specific tree seed problems.

The Directory will list all tree seed workers, whether they are involved on a research level or industrial-operational level, in all nations of the world.

Individuals who wish to be listed but who have not received a questionnaire should contact Dr. D. G. W. Edwards, Canadian Forestry Service, 506 West Burnside Road, Victoria, B.C. V8Z IM5, Canada.

Book Reviews

OBSERVERS BOOK OF TREES. H. L. Edlin. 75p.

The Observer book series covers a wide range of topics from natural history to sport. The present publication is a revised and updated version of an earlier edition on trees. It is broadly divisible into three sections. The first deals with the concept of tree growth which is expanded further to deal with the forest from primeval time up to present day forestry. Brief mention is also made of Ireland's affoestation programme. The second section, by far the largest, deals with the broadleaved species. It covers the major tree and shrub species to be found in Britain and Ireland in some detail. Among the topics covered for each species are its most likely habitat and if it is non indigenous, some interesting information on the derivation of its common name, and when it was first introduced into Britain. This is followed by a description of the twig in winter, its leaf formation and flowering habit. The final portion describes the wood and the bark type of the tree. Each species description is accompanied by a colour plate showing the leaf form, fruits, the twig in winter and the whole-tree form in winter and summer. Individual tree bark form is shown in half tone photographs.

The final section dealing with the conifers follows the same format as that for the broadleaved species. A very simple and brief method of grouping conifers is outlined in the opening section. There follows a description of the more common conifers to be found in everyday forestry in Britain and Ireland. Experiences in Ireland with contorta pine find a special mention. In addition to the morphological description of each species and its flowering habit statistics on its height and girth growth are also give . As for the hardwood species a colour plate accompanies each description showing details of branchlet, flower and the whole tree form.

As a general treatise on trees the book achieves its aims. As its main market is likely to be the amateur naturalist its handy size allows it to be carried readily into the field. It is a pity that the layout was not better planned and followed the same order for each species. The black and white photographs in the introductory section give the impression that forestry is somewhat behind the times. Updating in this section would be in tone with the improvements in the rest of the book compared with the earlier edition. The descriptions and plates for each species are however not sufficiently detailed for the discerning dendrologist. As an introduction to forestry and trees it more than serves its purpose for the young naturalist. In addition it is well within his or her financial reach.

J. O'DRISCOLL

WORK STUDY IN FORESTRY. W. O. Wittering. Forestry Commission Bulletin No. 47, H.M.S.O. £1.00.

The Bulletin consists of nineteen papers prepared for a two week international seminar on work study in forestry. The seminar was organised by the British Forestry Commission for the joint FAO/ECE/ILO Committee in Forest Working Techniques, and training of forest workers, held in July 1971.

During the first week while the course was resident at Wymondham College, Norfolk, instruction concentrated on the theory and practice of work study and participants were given an insight into the entire process from method study via work measurement, culminating in the establishment of time standards and piece rate payments.

The course transferred to Newtown Rigg College, Cumberland, for the second week, and here the instruction encompassed the problems associated with the development and testing of forest machinery, and a glimpse at the future of mechanical harvesting.

The Editor's claim that the Bulletin is intended to be a Forestry Work Study bible is valid in that it contains much basic work study theory, and propounds the concepts and practices which are common to Work Study in most situations. Generally this is a very matter-of-fact, down-to-earth bulletin. The examples which amplify some of the text enhance the readability of the lectures, and help to make them more interesting.

Not alone is the Bulletin of value to work study practitioners, but it has also quite a lot to offer to forest managers in the fields of planning, organisation, machinery and harvesting, and helps both management and work study to appreciate each other's problems.

Work study will only be of real value to the enterprise when harmonious relations exist between Work Study and Managers, Workers and Union Officials. Respect and understanding for the rights and feelings of others will help to create the right atmosphere for success. It is most important that the work study man knows his job thoroughly and earns the respect of both managers and workers for fair dealing. This respect has to be earned and doesn't normally come overnight. The above points were mentioned in a few of the lectures, but I would like to see a paper on Human Relations in Work Study as it is the rock on which so many good work study ideas founder.

Mr. Troup in his introduction set the theme for the seminar by outlining how work study has developed and is used in the British Forestry Commission. Their choice of techniques may not be the best, but nevertheless they have worked reasonably well in practice. The results achieved by Work Study, Management, Research, Training and Workers has raised total productivity in the Commission by 6% compound annually in the period 1960-70, and this rate is likely to be maintained for some years. Over the same period costs have been held constant in real terms despite the fact that 60% of the workers are over 40 years (recent comparable figures for Irish Forestry is 73% over 40 years). The Commission has the same problem regarding run-down of staff as we have. The principle of "last in—first out" does not allow the retention of the most efficient workers. From 1954 to 1971 the worker staff fell from 13,620 to 6,900 which is in line with the drop in this country.

Some of the papers are of particular intreest to our forest managers as we are becoming involved in harvesting. Items such as developments in harvesting, machinery costing and testing, and safe working methods are well covered. The booklet contains a vast amount of useful information in its 99 pages and I feel that its purchase at £1 would be money well spent by any forest manager.

P. P. O'GRADY

FUNGI THAT DECAY PONDEROSA PINE. Robert L. Gilbertson. The University of Arizona Press. 197 pp., illustrated. £4.00.

SOME forest mycologists, I think, have a pathological fear of fungal taxonomy. Unfortunately so, because the precise identification of a pathogen is a necessary prerequisite in the formulation of a disease control programme. Gilbertson's manual, however, should help to counteract and remedy this general aversion. A more popular title for his book would read "Basidiomycete taxonomy made easy". The spoonfuls of antidote helping the medicine go down are administered in the form of concise diagnostic descriptions of the various Basidiomycete fungi interspersed with clear line drawings of their microscopic characters.

With the aid of the manual's excellent analytical keys and checklists one can precisely recognise over 220 species of wood-decaying fungi known to occur on ponderosa pine over its entire range. The manual includes a wealth of information about the ecological significance of these fungi and their decay relationships. A comprehensive glossary is appended for those of us who have gone rusty on mycological terminology.

Classification of the Basidiomycetes into families and genera is still in a state of flux as a result of efforts to establish a system based on phylogenetic relationships. Gilbertson, however, has combined current systems of nomenclature in his key rather than strictly adhering to the old Friesian families and genera. This results in the use of nomenclature that may be somewhat unfamiliar to forest pathologists but the changes were inevitable and are already well established in the literature for most orders of the Hymenomycetes.

Although the manual specifically relates to decay fungi of Ponderosa Pine it will also provide a very useful tool for identifying Basidiomycetes on other timber, particularly other conifers. The book is highly recommended to any specialist working with the Basidiomycetes. It is guaranteed to make those long hours spent working with the microscope a lot more interesting and rewarding.

DIARMUID McAREE

ONE MAN TREE FELLING—BY POWER SAW. C. H. Kerr, N.D.F. Forestry Booklet No. 4. (n.p.).

Although this booklet was originally printed for use within the Forestry Division, Department of Agriculture, Northern Ireland, it is worthy of much wider circulation, and would, I feel sure, be welcomed by all those engaged in or responsible for felling Sitka Spruce with power saws, either in the State Forest Service or in the private sector.

It is a booklet of great practical value which deals with the safety rules to be observed; the tools to be used and the method to be employed in felling trees of various sizes from first thinnings to final fellings. It could be used to advantage in training workers in proper chain saw technique.

The importance of employing the proper felling technique in all situations cannot be over emphasized, and the author rightly states in the introduction that "although the actual felling operation takes a relatively short period of time compared with other work, it is of vital importance for the subsequent working process. Therefore it should be carefully planned and accurately performed."

The chain saw is an inherently dangerous machine, and the operator should exercise great care at all times when using it. The booklet lists 18 safety rules which operators should observe. Two of these relate to the clothing to be worn, and the protective equipment to be used by the operator, and 16 of them relate specifically to the handling of the chain saw. The observance of these rules should reduce significantly the accident risks associated with using a chain saw.

Since there are many variable factors, there can be no standard or best felling method according to the booklet. Some of these factors are given as site conditions, size of tree, and crown density. The execution of the felling job having regard to these factors is described in some detail and the reader is taken through the various methods to be used in felling (1) Large trees, (2) Large thinnings in an overstocked stand, (3) Leaning trees, (4) Diseased trees, (5) First and second thinnings.

A major contributing factor to the economic extraction of timber is the proper presentation of the material and this proper presentation is to a large degree dependent on precise directional felling. Accordingly the description of "root spur" or "buttress" removal, of the cutting of directional sink or "mouth", and of the felling cut deserve careful study. The author lists four characteristics of a good felling method and these are worthy of note.

They do include however this sentence: "It is best for the thick butt of the trunk to lie in the direction of extraction".

This is questionable as there are situations where it may be best that the top of the tree lies in the direction of extraction.

The felling methods described in the booklet are illustrated by excellent drawings and good quality photographs.

It is a booklet which can be recommended to those involved in the business of timber harvesting.

B. A. MOLONEY

OTHER PUBLICATIONS RECEIVED

Forestry Commission Research and Development Papers (unpriced).

No. 108. *Tree Growth on the South Wales Coalfield*. G. J. Mayhead, K. Broad and P. Marsh.

No. 109. *Fertiliser effects on the Growth and Composition of Sitka and Norway Spruce Nursery Transplants and on the Composition of a Podzol Profile after 15 years' Cropping.* Blanche Benzian, J. Bolton and J. K. Coulter.

No. 110. *Initial Spacing in Relation to Establishment and Early Growth of Conifer Plantations.* A. J. Low.

Society Affairs

HONOURARY MEMBERSHIP FOR D. M. CRAIG

The following motion from Council was put to the general meeting on 14 February 1975: *That Mr. Duncan Craig be elected an honourary member of the Society.*

In introducing the motion to the meeting Mr. O. V. Mooney, President, said that it arose from the last Annual General Meeting, where it had been strongly supported.

The citation was as follows: Mr. Craig was Honourary Auditor of the Society from its foundation in 1942, until his retirement in 1973. During his thirty-one years he gave generous and efficient service and particularly in the formative years his support and wise advice was a significant contribution to the well-being and survival of the Society.

Commenting further Mr. Mooney said that the citation, while fully accurate, might be somewhat economical and would bear a little elaboration for those who were not familiar with the part that Mr. Craig had played in the affairs of the Society.

"For justification of honourary membership (he continued) our Constitution requires 'notable services to the advancement of forestry or persons who may be deemed to be worthy of such recognition for any other reason consistent with the object of the Society.'

"If to keep alive the Society and nurture it during its delicate infancy is consistent with the object, then, for this reason alone, although there are others, Duncan Craig's contribution deserves our highest honour. But I think the first reason might be thrown in too—i.e. the advancement of forestry, because, with a small group of foresters he supported and contributed to a policy which enabled the Society to survive. During the early years of the Society's life he instilled into the basic management of our affairs an orthodox and conservative approach to our financial business which guided us safely through times when there was more enthusiasm than money or members, to the happy situation we have in 1975 when we have a comfortable credit balance and the highest membership ever. A quiet unassuming man of few words and great integrity, he nevertheless spoke with decisiveness and authority as custodian of our financial welfare from beside the presidential chair at our Council Meetings of those times, and guided us with his wisdom in many other aspects of our work too.

"I suppose there were not many of those who served on the Council of those days, when he was so very much more involved in our affairs than of recent times, who ever fully realised that the Society had the services of a top class professional accountant without charge. As a fully qualified accountant he gave his services to us for nothing, together with, for a period, secretarial services and the use of his boardroom for nominal fees. All this must have been a big financial help to the Society at the time, even though perhaps we may not have fully appreciated it then. With hindsight, in the present, we have now made our appraisal of his contribution over thirty one years to the affairs and management of the Society that we propose the motion this evening."

The motion was passed with acclamation.

OUTDOOR MEETING

West Fermanagh

A whole-day meeting, organised by the Northern Region, was held on Wednesday, 30 April 1975. The day began in Belmore Forest on the question of fertilisation of gleyed soils, led by Dr. D. A. Dickson. This was followed by a demonstration of helicopter fertilising of young plantations in Ballintempo Forest, led by Mr. T. Wilson.

The afternoon was devoted to a visit to Florencecourt Estate, where Messrs. J. C. L. Phillips and W. J. Wright led a discussion on planned development of a new forest park.

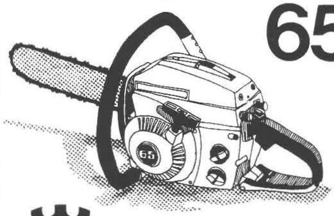
INDOOR MEETINGS

Decomposition of Peat

On 24 January 1975, in the R.D.S. Science Room, Dr. John J. Gardiner, Forestry Department, University College, Dublin, gave a paper entitled "The Influence of Fertilisers on the Microbial Decomposition of Peat." The revised text of the paper is printed elsewhere in this issue.

Land Use Before the Peat

Mr. Seamus Caulfield, Archaeology Department, University College, Dublin, delivered a lecture in Dublin entitled "Forest Clearance and Land Use before the Peat." This lecture, fully illustrated with stides, was a detailed description and discussion of the excavations at Belderg, Co Mayo, demonstrated by Mr. Caulfield to the 1974 annual study tour, which demonstrated human habitation and agricultural development in north west Mayo about five thousand years ago, before the development of the blanket bog cover. It is hoped that it will be possible to publish the text of this lecture later.



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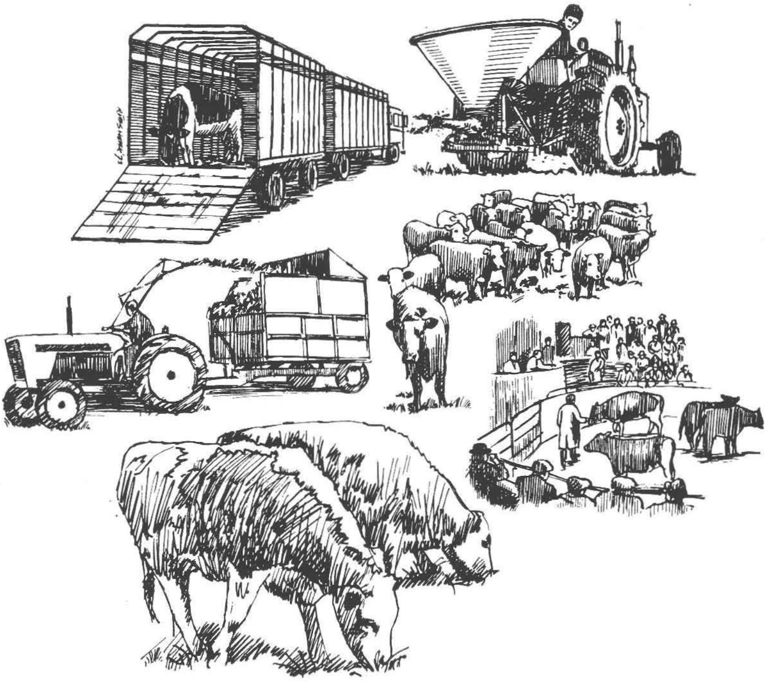

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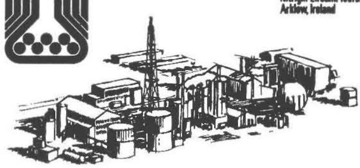

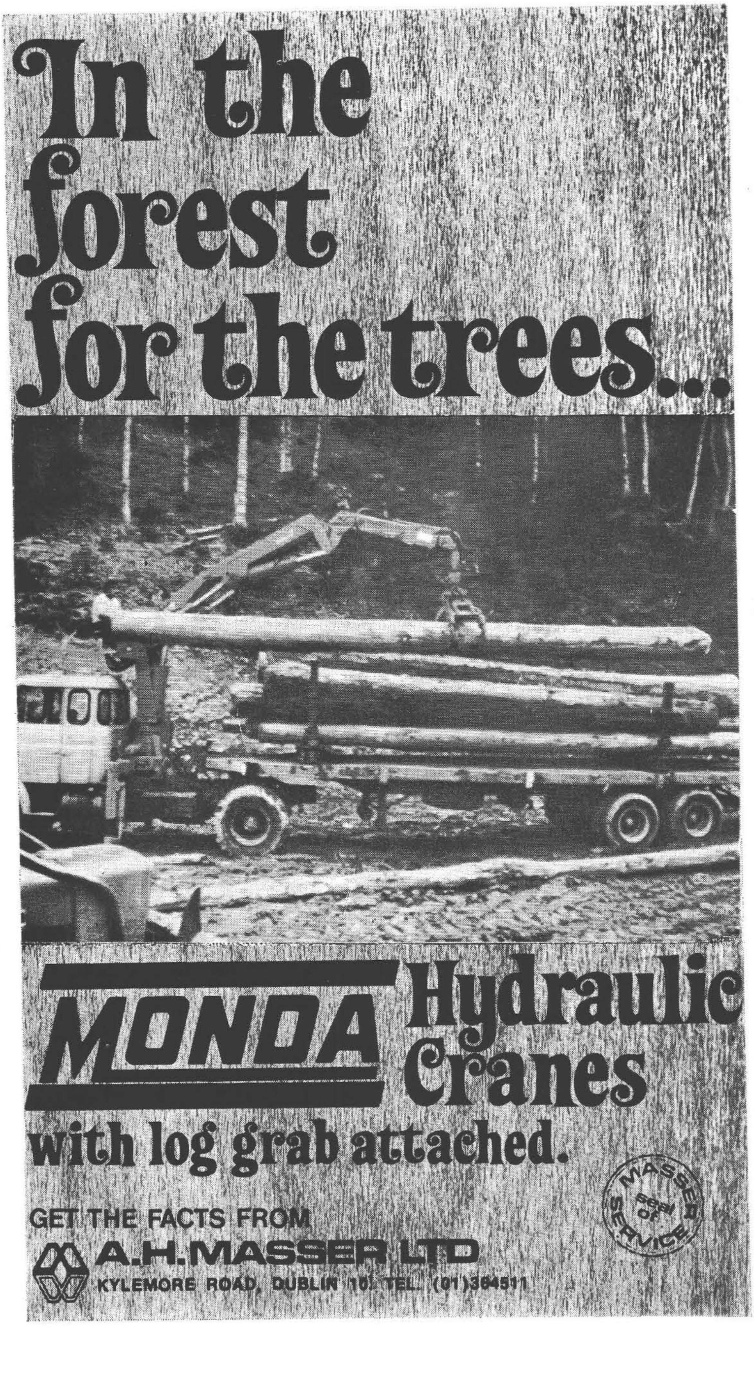
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