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Journal of the Society of Irish Foresters

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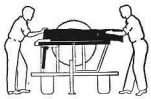

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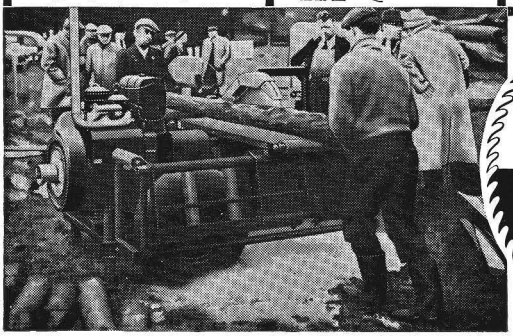
CROSS CUTTING

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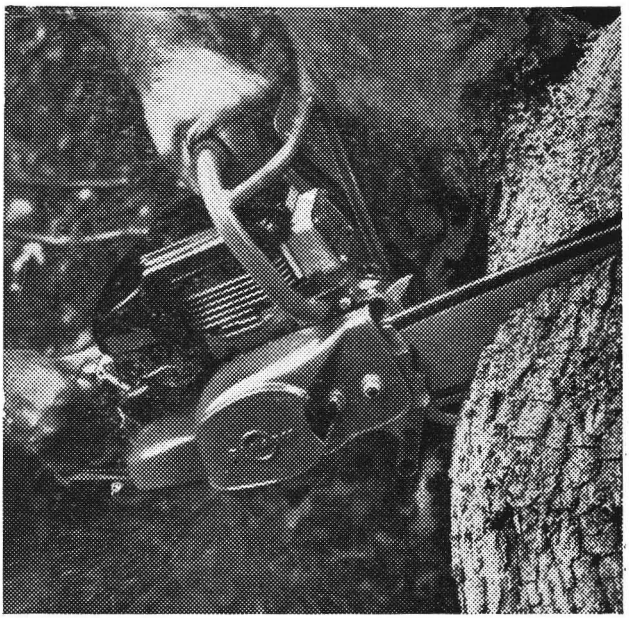

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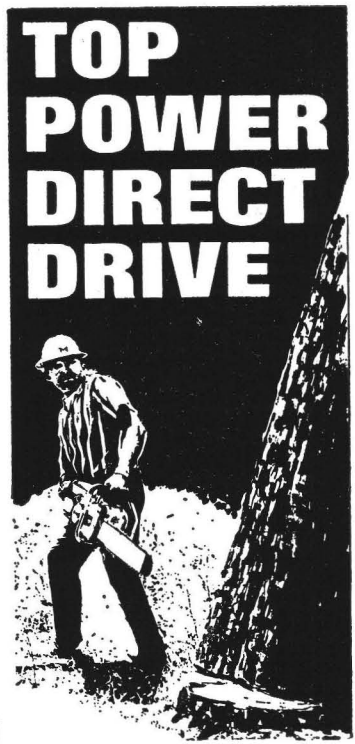


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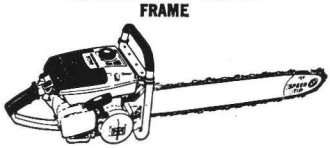

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IRISH FORESTRY

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# Potential and Economic Aspects of Forestry on Marginal and Submarginal Land

D. R. JOHNSTON

*Introduction.*

BEFORE discussing forestry on marginal land it is necessary to have a clear idea of the type of land we have in mind. I understand that we are concerned with land which has been judged to be marginal or submarginal for agriculture and which comprises, very broadly, raised bog, blanket bog and degraded heaths with varying thicknesses of peat. The bogs may have been cut for turf either by hand or by machine and there are likely to be physical and chemical problems in the shape of drainage difficulties, nutrient deficiencies, the presence of old tree stumps and the risk of wind blow. There may also be some indigenous woodlands dominated by various broadleaved species. I am going to assume that the problems of afforestation can, to a greater or lesser extent, be solved by drainage, cultivation, fertilising and the choice of suitable provenances and that tree species such as the coastal strain of lodgepole pine, Sitka spruce and Norway spruce can be made to grow, although they may only achieve a low quality class.

The problem can be regarded as a series of alternatives. First, should the land be used for production or abandoned? Secondly, if it is used should the form of land use be forestry or agriculture. Thirdly, if it is to be forestry what should be the intensity of management and what rate of interest should be used in economic calculations?

*To Cultivate or to Abandon Marginal Land.*

There is no *a priori* reason why a potential resource should be used. For example, the air contains nitrogen. If a very cheap supply of electricity is available it is profitable to fix the atmospheric nitrogen and convert it into nitrate for fertilising the soil. Without a very cheap supply of electricity such an operation would be very unprofitable and would not be considered. But even if we are not prepared to spend money in utilising the nitrogen in the air that does not mean that it is valueless. Life would be extremely hazardous in an atmosphere of pure oxygen.

Land is another resource which can sometimes be used profitably,

for example, rich arable land, and sometimes is obviously not worth investing in, for example, mountain tops. The poorest land may nevertheless have a value for recreational purposes and may possess great beauty. The point at which a resource ceases to be worth exploiting is always difficult to determine and in the case of land the difficulties are enormously complicated by man's attitude to it. Let me quote from a report on land use in Europe :

> "The problem of rational land use is urgent but is enormously complicated by tradition, prejudice, conservatism, ignorance, and sentiment."

Any country has limited resources of manpower, skill, capital and raw materials. The country as a whole and the individuals within it will be prosperous if people are able to employ themselves in highly productive work and poor, if the people have to engage in unproductive tasks. For example, the economic miracle of Italy in the 1950's was achieved by transferring people from unproductive agricultural work in the south to productive industrial work in the north. Switzerland, with limited resources, has to sell processed goods rather than raw materials, but she is prosperous because her workers are highly skilled and their work has a high hourly value. In contrast, Spain, a relatively poor country, has a very high proportion of her working population—46%, engaged in relatively unprofitable agriculture which produces only 25% of the country's wealth.

Therefore, it is important to be critical of employing manpower and capital in working a resource as inherently unprofitable as marginal or sub-marginal land. If a man can create £20 of wealth in a week in industry, but only £5 in cultivating marginal land, it may be argued that he should go into industry, and the country should import the food and wood from a country able to produce it more economically.

A government or a private investor has many opportunities for investment. I shall concern myself principally with governments which always have greater calls upon their funds than they are able to meet. Governments rarely invest purely for profit. The first calls upon revenue are for defence, public order, the judiciary and then if money is available, for education, housing, public health, roads and the development of national resources. Governments generally take a rather longer term view than individuals, but there is a limit to the time they can afford to look ahead. If a government were to plan for a century ahead it would have to divert so much of the national wealth to purposes which would benefit neither the present generation of voters nor their children or even grandchildren, that they would not stay in power for very long. Governments therefore take a medium term view and rarely undertake investments unless they are likely to produce a benefit within 30 or 40 years. As soon as the essential services have been provided a government begins to become increasingly critical of expenditure which cannot directly or indirectly show a reasonable return on the capital required.

How can the profitability of working marginal land be calculated and compared with other forms of national investment? There are several ways of estimating the return from land; one way is to consider the value of annual production, for instance, one acre may produce 60 hoppus feet of timber per annum, worth £6 or, mutton worth about £2-£3. Such estimates are valueless, however, unless they take account of the capital required to obtain the return. If it were possible to borrow money without paying interest the cost of capital could be ignored, but if such a situation were possible, capital would either be valueless or would rapidly become valueless because we would all live on borrowed capital and no one would do any work. Two methods of estimating profitability are commonly used in practice. The first is to calculate the rate of return which can be obtained from the capital invested and the second is to discount to the present day all future returns and future costs at some agreed rate of interest, and to express this as a net discounted revenue per acre or per £100 invested. As an example, let us suppose that a bank is prepared to lend money at 5%. If money is borrowed to establish a plantation the establishment costs will create an overdraft which will increase annually due to the costs of annual maintenance and protection, together with interest at 5%. When revenue is received in the first thinning, the overdraft will be reduced, but will increase between thinnings. With luck the overdraft will be extinguished by the end of the rotation and the final felling will leave a credit balance. This balance discounted back to the present day is the net discounted revenue.

*Comparison between Forestry and other Commercial Investments.*

There are considerable difficulties in making meaningful comparisons between the profitability of forestry and industry. The average returns in Great Britain on all investment after tax between 1919 and 1963 were 6% for equities, 1% for preference shares and —1% for gilt edged securities. These yields are measured in real terms,, that is, after the effect of changes in the value of money have been eliminated. It will be seen that the fixed interest investments have suffered severely from the effects of inflation whereas neither equities nor investment in forestry would be at this disadvantage because of the (untaxed) gain in capital values. It is appropriate to consider returns net of tax since companies pass on both profits tax and, effectively, shareholders' standard rates of tax in fixing prices. If there were no taxation, product prices would be fixed at lower levels, and returns on investment would probably be at similar levels to those quoted.

The stumpage price of wood is tending to rise, relative to other commodities, at about 1½% per annum. Allowing for this rise in price forest investment on marginal land may be expected to earn something like 3% on the capital invested while on the normal run of forest land the return will be of the order of 4% to 5%. Taking into account the long history of safety in forestry a return of 4% to 5% on a long term

project represents a very reasonable Government investment. Clearly, however, investment on marginal land is a more doubtful proposition if undertaken on purely financial grounds. Unless capital were abundant and opportunities for investment limited there would need to be reasons additional to the purely financial objectives to justify expenditure on such land.

*A Comparison between Forestry and Agriculture.*

The profitability of forestry on marginal land depends primarily on four broad factors :—

(1) The volume production.

(2) The cost of production.

(3) The length of the production cycle.

(4) The price received for the product.

DIAGRAM I

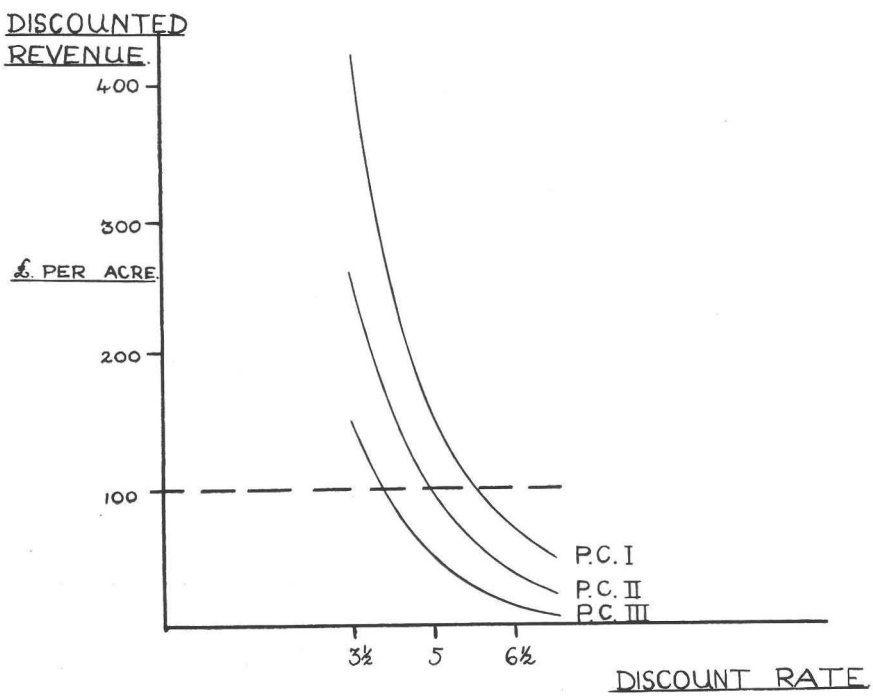


Diagram I compares the discounted revenues, for a range of quality classes, calculated at three rates of interest. [These calculated revenues incorporate the assumption that the price of wood relative to other commodities will rise at about $1\frac{1}{2}\%$ per annum.]

The very great effect of interest rate and of quality class on discounted revenue is immediately apparent. If we assume that *Pinus contorta* will achieve Q.C.II on marginal land the discounted revenue is likely to be £105 at 5% or £300 at $3\frac{1}{2}\%$ while Q.C.III will yield about £45 and £150 respectively. Without a $1\frac{1}{2}\%$ rise in the real price of timber these revenues would be very much lower.

The costs of establishment, capitalised maintenance and capitalised roading can hardly be less than £100 and will probably be more. Therefore the first conclusion must be that forestry on marginal land cannot be a profitable enterprise at normal commercial rates of interest, although it can reasonably expect to break even or to make a profit at 3% or even $3\frac{1}{2}\%$.

Agriculture is not practised intensively on marginal land. The normal pattern will be extensive sheep or cattle grazing. The carrying capacity of such land is small, and in Scotland a stocking of one ewe to three or four acres is typical. The capital requirement is small but the return per acre is also very low and a large farm of at least several hundred acres is necessary to provide a reasonable living for one family. With a very small net annual income a small change in costs or prices can mean the difference between a profit or a loss.

By contrast forestry is a capital intensive industry employing one man to 80 or 100 acres. If we assume the capital investment to be of the order of £100 per acre the amount of capital required to sustain one worker permanently will be about £8,000. This compares with less than £2,000 in marginal agriculture.

Therefore from an economic point of view marginal forestry differs in three important respects from marginal agriculture.

(a) It requires far more capital per man and per acre.

(b) Due to the long period between establishment and harvesting and to the high capital investment forestry is greatly affected by the rate of interest charged on capital.

(c) Forestry employs many more men per unit area.

Diagram II indicates in a diagrammatic form the relationship between rate of interest charged on capital and the relative profitabilities of forestry and agriculture.

In general, farming is more profitable than forestry with high interest rates while forestry is relatively more profitable with low interest rates.

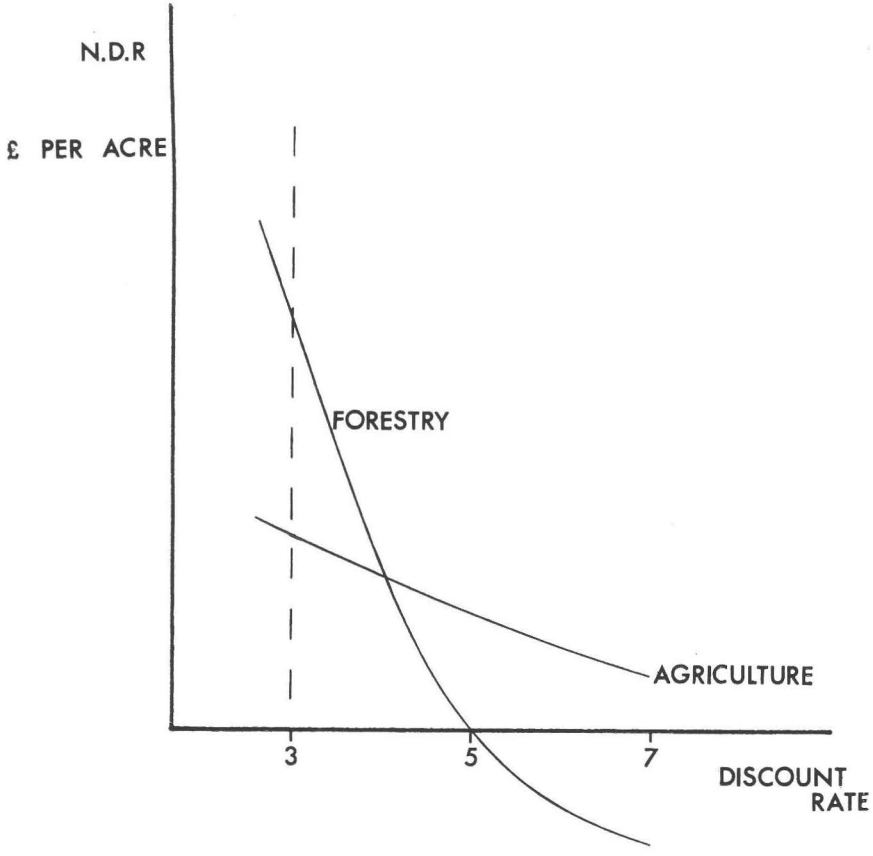
I do not know anything about agriculture in Ireland but in Great Britain there is a considerable area of marginal agricultural land which would make a loss without agricultural subsidies. If these subsidies

were removed prices would rise but not sufficiently to counter balance the loss of the subsidies. On some of these areas agriculture would make a loss whatever the rate of interest whereas at low rates of interest forestry will nearly always make some profit.

*The Case for Forestry.*

It is apparent that no government is likely to invest money in marginal forestry as a purely financial investment. The case for forestry must depend upon other considerations. The traditional or sentimental

Diagram 2



idea that land should not be allowed to lie idle is insufficient to justify the considerable expense of afforestation, because 2,000 acres could be used to support one sheep farmer with a minimum of capital expenditure.

The state as well as private companies in Finland and Sweden are prepared to invest money in growing trees on which they expect to earn 3% or less. They are willing to do this because without wood they could not sustain their highly profitable wood processing industries. It may be argued that they should import their raw material and invest all their capital in building pulp mills and paper factories capable of earning 10% or more. They prefer, however, to ensure that a proportion at least of their raw material supplies are under their own control. This gives them a better bargaining position in the face of rising stumpage prices and moreover they envisage increasing difficulty in obtaining unprocessed wood. As countries become more industrialised they prefer to earn the profits of processing themselves instead of exporting it in the round for other more advanced countries to process. The Scandinavians regard paper making, for example, as one integrated process capable of earning say, 10% rather than as two independent processes, the first of which—the production of wood—earns 3%, while the second—the conversion of wood into paper—earns say 15%.

Nevertheless, the case for marginal forestry must depend very largely upon social considerations. The phenomenon of a declining rural economy is common throughout the more developed countries in the world. Ireland has some particular problems of her own. First of all the Irish population is unique in that it has declined in modern times. This is due to a complex of historical and economic factors but is primarily due to emigration and to a low marriage rate, which in turn are due to the inability of the rural economy to support an expanding population at an acceptable standard of living. Not everyone wants to or is able to emigrate from the countryside but with little local employment many people have no other alternative and the residual population tends to become culturally, socially and financially impoverished. Forestry is the enterprise, par excellence, for sustaining or expanding a rural population. It is capital intensive and most of the capital is in the form of wages which are spent locally, it employs a large number of workers per unit area, and it brings in its train wood processing industries which offer a variety of jobs for the wives, sons and daughters of the forest workers. A visible proof of this can be seen in the prosperous rural communities of Scandinavia whose economy is based to a considerable extent, on forestry.

Recreation is another important aspect of forestry. Fortunately there is still plenty of space in Ireland but as industrial populations increase there is an ever growing need for outdoor recreational facilities in the form of camping, picknicking and walking. These facilities can be a very considerable tourist attraction as many Europeans are turning more and more to camping as their traditional form of holiday. It is

important also that foresters should bear in mind the aesthetic aspect of forestry, especially in a country which depends very largely upon tourism for its foreign exchange.

Much has been written about the indirect effects of forestry and, in particular, about the beneficial influences of forestry in regulating water supplies, in preventing erosion and in providing shelter for animals. I am very sceptical about the first two benefits in our part of the world, but several examples have been reported from Wales and Scotland of the sheep and cattle population of an area increasing after an appreciable proportion of the area has been planted with trees.

I should sum up the case for forestry on marginal land as follows :

1. If there is a need to provide rural employment or to boost the rural economy forestry will probably do it more effectively than any other activity.
2. Forestry will at the same time earn a modest return on capital.
3. Forestry will provide an essential raw material which is becoming relatively more scarce and expensive and which can support profitable processing industries.
4. Forestry can be an asset to a tourist country.

If there were no need to provide rural employment or otherwise to aid the rural economy I would hesistate to invest money in the poorer marginal land, although the Scandinavians do so in order to provide raw material for their profitable wood-using industries.

*The Management of Forestry on Marginal Land.*

It is no use providing low grade employment in rural areas. Although one of the advantages of forestry is the relatively high employment per acre, it would be wrong to employ one man on 50 acres if he could be employed more profitably on 100 acres. The ways of increasing profit are to increase revenues or to decrease cost. There is a limit to the production that can be gained from one acre of poor land and foresters should examine critically the traditional methods of planting and managing forests.

Many of the costs in forestry are the same per acre on poor land as on good land but whereas good land may justify intensive management, poor land probably will not. For example, the potential discounted revenue from Q.C.I. Sitka spruce may be about £500 whereas that from Q.C.III *Pinus contorta* may be about £60. There is clearly a relatively low limit to the money that can usefully be spent on one acre if the most that can be expected in return is £60. Although some cultural operation will be necessary to get trees to grow at all, the site will not justify elaborate and expensive management techniques. In the same way one can afford to spend less per acre on fire and other protection if the standing volume is 2,000 h.ft. than if it is 6,000 h.ft.

The cost of plants, planting and weeding will often be much the

same on poor sites as on good sites. If a reduction in the number of plants saves £9 per acre and results in a decrease in discounted revenue of 5% this represents £25 in the case of Q.C.I Sitka spruce but only £3 in the case of Q.C.III *Pinus contorta.* Therefore the economy would be worth making on poor sites but no on good sites.

In the same way a more mechanical approach to thinning involving less supervision and less time spent in marking may depress production by 5%. This saving of 5% may be more than offset by potential losses in high Q.C. crops but may well exceed the potential loss in low Q.C. crops on poor land.

Another economy that may be justified on relatively wind firm but low Q.C. crops is to lengthen the thinning cycle but to remove a correspondingly greater volume at each thinning. Such an operation may possibly lead to a slight reduction in timber quality and total production but could well lead to greater profitability on poor sites.

I know little of conditions in Ireland so I must generalise by saying that the optimum intensity of management depends upon the productive potential of the site. Good land can profitably absorb a large volume of capital investment but on poor land one must invest much less and receive less in return. One would not spend as much money in polishing and mounting a piece of glass as in polishing and mounting a diamond.

A number of management decisions cannot be made intuitively but need to be supported by economic calculations, e.g. optimum rotation length, intensity of management, optimum roading intensity, optimum time at which to replace an unsatisfactory crop. All these calculations involve discounting future costs and returns and the answers will vary greatly with different interest rates. If the decision is taken to provide money for forestry, at some particular rate of interest, say $3\frac{1}{2}$%, the logical implication of that decision will only be achieved if the same rate of interest is used in economic calculations made to guide management.

# Problems of Forestry Development in Ireland

E. A. Attwood,
Rural Economy Division, An Foras Taluntais.

THERE are three main aspects of the problems of forestry development in Ireland which will be discussed with special reference to the poor land areas.

The first is the question of the criteria by which we should judge forestry policy, both at national and regional level; it is usual to distinguish five different criteria—the financial (or purely economic), the creation of employment, import-saving, the generating of economic growth and finally the recreational and tourist opportunities. The second is the problem of deciding the optimum use of particular pieces of land for agriculture or for forestry; and the opportunities for the integration of these so as to benefit each other. The third point is the actual rate of development of forestry in the western counties of Ireland in recent years and its effects as a stimulant to economic growth in that area.

Taking first the question of the criteria for determining national and regional forestry policy, there is a very wide variety of standards by which developments can be assessed. Even if we take purely economic criteria, and ask "does the forestry pay", the views and answers are complex. Normally when faced with the problem of assessing a long term capital project economists think in terms of either the internal rate of return or the present value of the investment. The internal rate of return is the net earnings on capital in terms of all revenues minus all costs, all investments being discounted at this internal rate over whatever time period involved. The second—the present day value, in forestry economics often called the discounted net revenue—is the absolute value of all revenues less all costs, discounted back at the appropriate discount rate. There remains the very large problem of deciding what is the appropriate rate to use and this may create many problems which cannot be relieved by any simple method.

Most forestry economists and applied economists working in other spheres where long term investment is involved, have advocated the 'present value' criterion. The problem of deciding what is the appropriate rate at which to discount costs and revenues is partially solved by presenting the results at a number of different interest rates. This problem is of critical importance in the viability of very long term undertakings, such as growing trees.

On the other hand, the internal rate of return does give a specific answer, and this type of exercise (such as was done for the forestry section of "Economic Development") at least leaves a fairly clear cut answer to the basic questions. Even here, however, there are difficulties.

In a recent paper it is argued that the internal rate of return is only relevant if time preference and social discounts are constant over the whole time period involved.[1] The point here is relevant in that we are investing money to-day in forestry which will not be realised as a consumable product for probably another 30 to 40 years. Even allowing for the changing value of money, it is by no means obvious that in the year 2004 the utility of the return will be equal to that which it could be realised to-day. This is very much a value judgement, but Turvey goes on to say that judgements by economists are better than those by non-economists because the economists are experienced in systematic thinking about this type of problem. The difficulty remains that if you get a number of economists on the same problem they will often give widely differing answers.

There are, in the real world of economic policy, other economic issues which are clearly important. The contribution of forestry to import saving is one obvious case; in 1962 imports of non-manufactured wood products (but including plywood, fibre, etc.) were over £5½m., and to this must be added £7½ m. of paper and paper manufactures. The present investment of around £3m. net on the forestry programme will obviously not replace much of this in the immediate future, but there will be many years during which the import saving effect of forestry will be of direct benefit in the national balance of payment. The Second Programme for Economic Expansion clearly envisages that by 1970 there will be a substantial deficit on the balance of international payments and by then the contribution of forestry will be of very considerable importance.

Another important issue is employment and this is something more than just a social benefit. In recent years the employment directly in forestry has been 4,600-4,800 men, which is a little over 0.5 per cent. of the total male labour force. The counting of heads is not an adequate assessment, for much of the employment is created in areas where the alternative employment opportunities are poor.

There is finally need to have regard to the extent to which the multiplier effects is involved—or what Professor Ryan calls 'linkage'—in the investment in forestry [2]. As much of the current total expenditure goes on wages, the 'backward linkage' in creating other industries to supply its need is very small. On the other hand the forward linkage effects would appear to be much better; the recent recommendation in the Report on the Paper and Paperboard Industry by the C.I.O. on the setting up of a new mill might be quoted as an example.

The non-economic criteria which must be examined has recently been emphasised in Britain in a paper read by Michael Dower in which he expressed the view that "forestry, and particularly mixed and hardwood forestry should be increasingly used to transform some of our drabber and poorer farmland" and puts in a plea for more liberal term of reference for the Forestry Commission in its buying of additional land for afforestation [3].

The second main aspect of forestry development is the translation of these general criteria into practical decisions as to the optimum use of individual pieces of land, and the way in which forestry and agricultural developments benefit one another. Here the problems of actually estimating the returns per acre from farming and from forestry are almost as complex, and as full of uncertainties, as they are for the total national planting programme. The use of the internal rate of return criteria makes the problems of actually computing the answers less arduous; the effect of employment generation and of recreational and social advantages can be more precisely defined, but that of the effects on general economic growth generation has to be left out at this stage.

The real problem is to extract and project the data needed to such an exercise. This is of course already widely recognised; in a paper read recently in Dublin it was said that "It may well be that in the long term the inclusion of rather good quality land in the forestry estate will be justified by comparative studies of forest and agricultural relations". (4) Unless this type of analysis is done then many of the conclusions about forestry's contributions to the economic development of a particular region, or to the economy as a whole, will be more than a statement of hope rather than one of fact. Of course the task of getting the necessary data and making all the calculations involved is bound to be difficult; the fact that the information at present is not readily available is a strong reason for beginning now to get the necessary data together rather than a cause for delaying further. If we are to except that the national forestry effort is an economic business then it is necessary to begin to draw up fully budgeted accounts, not just in terms of day to day receipts and expenditure, but in terms of detailed estimates of return and profitability of the activities as a whole, and in the individual parts. It must be remembered that the investment of £3m. annually represents a large business effort and the same criteria should be adopted in the case of other businesses with long term periods of capital investment and amortisation. There seem to be a generally prevailing view that such an exercise would prove to be advantageous to the cause of forestry development and the necessary resources should be devoted to its prosecution.

In any examination, part of the data should be orientated towards putting figures on the inter-relationships between forestry and agriculture. In recent years it has become common practice to talk of the "integration" of the two forms of land use, as if this will in itself solve the problem of competition for the available land. In a recent paper, Dr. William Davies, Director of the Grassland Research Centre in Britain, said that "there has been much heated discussion as to the place of the forester on the hills of Wales and Scotland. There is clearly a place for both forest and grassland, and I for one would be very happy to see the escarpments and boulder strewn lands under forest. To achieve a sensible and practicable plan of development

demands co-operation between those interested in forestry and in grassland development". Mr. James McDonald, Deputy Director General Forestry Commission, Edinburgh, comments that "it isn't clear why the nimble forester should be confined to steep slopes and the land strewn with boulders while the presumably stiff-jointed sheep and shepherds should have the run of the smooth and gentle slopes".(5) He also goes on to point out the difficulties which arise due to a lack of precise knowledge, and this seems to be the real kernel of the issue.

In the whole question of multiple or alternative land use policy, the lack of data is the biggest stumbling block. How much can be got from work already being undertaken, and how much new work needs to be done cannot be readily assessed. I can only enter a plea on the strongest possible terms for the field to be cultivated; as often is the case it would look as though the task would fall first on the busiest people, but someone without a multiplicity of other duties could start to analyse the information which could be extracted from the existing records.

This brings me to the third major aspect—that is the present position and rate of progress of afforestation in western counties (which for this purpose consists of Connaught plus Kerry, Clare and Donegal). These counties account for 43.3 per cent. of the total area of the State, but until 1959/60 the area planted annually was under 40 per cent of the total planting. In the last few years the rise in the rate of planting in the West has increased so that the percentage of planting is approximately the same as the percentage of the total land area in these eight counties.

However, the actual area planted in these western counties has shown a very slight decline in the last couple of years, and it appears unlikely that this will be reversed in the immediate future. There are clear reasons why the planting in any area cannot be maintained on a precise line or trend, but even allowing for this it would appear that just at present the difficulties in acquiring suitable land for afforestation are somewhat greater in these Western counties. How much this is of a temporary character is difficult to say; part of it must no doubt come from alternative developments in land use and the increased competition which results.

At the same time the very great demographic changes which have been going on over the past decade must have an important repercussion on land ownership, and the pattern of changes in land ownership. The changes in population have been substantial. In seven of the eight counties of Connaught and Ulster the number of farmers' sons and daughters has gone down by over 40 per cent. in 10 years.

It is these changes in the population in the western counties that make it appear that the ultimate amount of land available for forestry is likely to become more than proportionately important in the western counties. This is not a question of social forestry—it is a question of

whether the opportunities for changing land use patterns are likely to be greater when the social structure itself is going through a period of major change.

There will obviously be important problems to be tackled in afforesting the poorer lands of the west. One of the dangers in discussing farming in these western counties is that of over-generalisation; this seems also to be a potential danger in discussing forestry policy. The western counties in fact include a very wide range of soil, exposure, climate and topography; the area is by no means all steep hills rising straight out to the Atlantic, or blanket-bogs stretching to the Leinster boundary. This brings us back to the need for much more information on the relative production potentials and costs of development in the different areas, and for as much investigation as possible into the problems in areas where no firm expectations can be projected.

If we accept the need to develop the economy of the west as part of a national programme, and look to both forestry and agriculture to stimulate employment and productivity per person in the rural areas, it should be possible to extend still further the contribution made by *both* these industries to the economy of the area. The income derived in the form of wages to forest workers in the eight counties with which we are concerned amounted to 0.5 per cent. of the total income earned in the region in 1960, compared with almost 50 per cent. in the case of agriculture. How far forestry can be extended without losing sight of the objective of an economically justifiable forestry programme integrated with its primarily agricultural environment is of basic concern. In view of the willingness of the government to give special consideration to the Western areas in the development of industrial production, the claims to similar treatment for developing the land-using industries must be regarded as of considerable importance.

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(1) Turvey, R., March, 1963. "Present value versus the Internal rate of return —an essay in the theory of the Third Best". *"Economic Journal"*. Vol. LXXIII No. 209.

(2) W. J. L. Ryan, 1963. "Investment Criteria in Ireland". *Journal of the Statistical and Social Inquiry Society of Ireland,* Vol. XX.

(3) Published in *"The Observer"*, 15th March, 1964.

(4) H. J. Gray, December, 1963. "The Economics of Irish Forestry". *Statistical and Social Inquiry Society of Ireland.*

(5) "National Resources in Scotland". *Scottish Council (Development and Industry)* 1961.

# The Pattern of Annual Growth in Basal Area of Sitka spruce, Norway spruce and Pinus contorta, in Ireland.

By NIALL O MUIRGHEASA

SINCE the forester does not reap his harvest of timber each autumn as the farmer reaps his corn or as the market gardener gathers his apple crop, the significance of the growing season *per se* may tend for him, to be less clearly identified than it might be.

The bursting of the bud and leaf-fall are obvious enough and accepted as an earnest of progress, but in the important matter of the volume increment which is yielded annually by each acre of forest, these are but indirect indicators of what is happening.

It is in the field of forest mensuration perhaps that the need for more precise data as to growth commencement and cessation as well as to the pattern of volume increment throughout the growing season, is most clearly recognised. This is particularly so where sampling survey estimates of standing volume derived from numerous plot measurements taken at different times during the growing season must be adjusted to provide estimates of volume at a particular date.

While it is recognised that basal area growth is not necessarily simultaneous with sectional area growth at other levels along the stem and that in consequence it may not be fully representative of the annual pattern of volume increment it is notwithstanding, conventionally a critical factor in volume estimation. By implication therefore it is accepted as a satisfactory guide to the current position during the transition of the growing season.

In the course of a volume sampling survey of some 71,500 acres of State forests carried out in 1960 by the Assessment Section of the Forestry Division, the need for data as to the annual cycle of basal area growth of our principal conifers became apparent.

In the Spring of 1961 a study of the matter was initiated. The species chosen for investigation were Sitka and Norway spruce and *Pinus contorta;* these being of predominating importance in managed plantations in Ireland. The 1960 survey had indicated that of the total current volume increment of State plantations of conifers having measurable volume, 69% was then being contributed by these three species—37% by the Sitka spruce, 24% by the Norway spruce and 8% by the *Pinus contorta.* Even though Scots pine contributed 12% of the total increment and rated third, to the fourth position held by the *Pinus contorta,* the marked decline in its use in the planting programmes of recent times served to tilt the balance favouring the inclusion of the *Pinus contorta.*

The prime object of the investigation was to obtain a graph of the accumulating percentage growth over the growing season for these

species, as representative of our conifer crops generally. In doing so it was also hoped to obtain some information as to whether such factors as region, species, age, quality class, or the position of the tree crown in the canopy, were of practical significance in the volume increment cycle.

The factor of elevation, though suspected of being of greater significance than most if not all of the above-mentioned ones was excluded because of difficulties related to the availability of the species concerned, in their respective sub-groupings over a worthwhile elevation range.

The five factors chosen were taken at three levels as follows:—

I. *SPECIES:* 1. Sitka spruce;
2. Norway spruce;
3. *Pinus contorta;*

II. *REGION:* 1. North-West;
2. Midlands;
3. South-West;

III. *AGE:* 1. Crops aged 13-17 years;
2. „ „ 22-25 „
3. „ „ 26-40 „

IV. *QUALITY CLASS:*—

Sitka spruce 1. Qual. Class II and over;
2. „ „ III;
3. „ „ IV and under;

Norway spruce 1. Qual. Class I and over;
2. „ „ II;
3. „ „ III and under;

*Pinus contorta* 1. Qual. Class I and over;
2. „ „ II;
3. „ „ III and under;

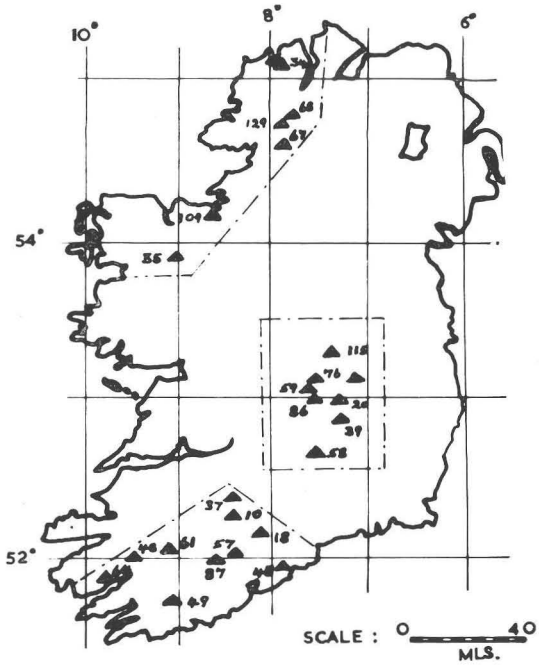
(*Pinus contorta* rated by Scots pine Tables;)

V. *POSITION IN THE CANOPY:*— 1. Dominants;
2. Co-dominants;
3. Sub-dominants.

*Species:* No attempt was made to segregate the spruces into their respective provenances, but in the case of the *Pinus contorta* the study was largely confined to the more important coastal strain.

*Region:* The regions chosen were as indicated on the map at Table I. Due to a shortage of suitable material it was found necessary to extend these—particularly region 3—over a wider territory than might have been wished. However, in the light of meteorological data supplemented by general experience of them, the regions so chosen were accepted as providing a satisfactory range of climatic conditions. The

## TABLE I.
## THE DISTRIBUTION OF THE FORESTS FROM WHICH READINGS WERE OBTAINED




| No. | Forest | Map No. | No. Sites | No. Trees 1961 | No. Trees 1962-63 |
|---|---|---|---|---|---|
| 1 | Ards | 34 | 5 | 7 | 28 |
| 2 | Stranorlar | 68 | 11 | 9 | 36 |
| 3 | Ballybofey | 129 | 6 | 6 | 24 |
| 4 | Pettigo | 67 | 1 | 1 | 4 |
| 5 | Collooney | 109 | 1 | 1 | 4 |
| 6 | Foxford | 35 | 3 | 3 | 12 |
| 7 | Emo | 33 | 9 | 9 | 36 |
| 8 | Portlaoise | 20 | 2 | 2 | 8 |
| 9 | Durrow | 39 | 3 | 2 | 8 |
| 10 | Urlingford | 58 | 1 | 1 | 4 |
| 11 | Kinnitty | 59 | 3 | 4 | 16 |
| 12 | Clonaslee | 76 | 2 | 2 | 8 |
| 13 | Ossory | 86 | 6 | 6 | 24 |
| 14 | Tullamore | 115 | 1 | 1 | 4 |
| 15 | Kenmare | 64 | 5 | 5 | 20 |
| 16 | Killarney | 48 | 2 | 2 | 8 |
| 17 | Macroom | 61 | 4 | 4 | 16 |
| 18 | Dunmanway | 49 | 1 | 1 | 4 |
| 19 | Ballyhoura | 10 | 5 | 6 | 24 |
| 20 | Kilfinane | 37 | 2 | 2 | 8 |
| 21 | Banteer | 87 | 1 | 1 | 4 |
| 22 | Killavullen | 57 | 3 | 2 | 8 |
| 23 | Kilworth | 18 | 4 | 2 | 8 |
| 24 | Killeagh | 45 | 2 | 2 | 8 |
| | Totals | | 83 | 83 | 332 |

Midland region, it was expected, would provide more contrast with the North and South than they would with each other, and to accentuate this preference was given to trees growing at lower elevations in that region.

*Age Classes:* The range of age classes had perforce to be confined to what was generally available, and the limiting factor in this case was *Pinus contorta.*

*Quality Classes:* The scarcity of Sitka spruce quality class I and some categories of Norway spruce limited the range under this head.

Quality Class assessments were in all cases made in accordance with the British Forestry Commission Yield Tables.

*The Selection Procedure.*

The initial plan involved the selection of twenty-seven trees in each region. Those chosen were required generally to be normal in form, etc., and to have a minimum breast height diameter of three inches or more. They were selected so as to ensure that of the total in each region nine stems belonged to each of the three sub-categories, of the main categories, of Species, Age Class, etc. In 1961 a total of eighty-one trees were thus chosen.

Since Region was one of the five main factors concerned, three centres were chosen as focal points around which the trees were to be located, and with the minimum of scatter. The centres were Ballybofey (Region I), Emo (Region 2), and Kenmare (Region 3). Prior to the actual selection, tabulated lists of census data arranged by forest and in order of proximity to the centre or focal point of the region concerned in each case, were obtained. The lists indicated the stands where trees of the various categories might be found. Normally at each forest listed a number of possible stands occurred and the order in which they were visited was decided by random selection; likewise within the chosen stands the actual sites at which trees were to be selected were decided upon in advance by random means.

In cases where stands were found on inspection, not to include trees of the particular category sought, the next stand in random order was visited. This process was continued until all the necessary trees were located.

*The Method of Recording Growth.*

The method adopted was that described by Liming in 1957. It involved the use of aluminium dendrometers or girth-bands with part overlap and incorporating a vernier scale with the aid of which girth increases of 0.01 inch or more could be read. Prior to placing the band on a tree, the breast-height girth was measured accurately with a steel girthing tape, the stem bark having first been cleared of moss, ivy, loose bark or any abnormal protrusions of dead bark where such occurred. The girth-band (made to measure at the tree site) was then

placed on the stem at breast height; the necessary tension required to keep the band taut being provided by a stainless steel spring, having a modulus of elasticity of from 2 to 4 inches per lb. load.

When in position on the stem (which was duly numbered for identification purposes), the reading on the band scale was recorded. Each week during the growing season further readings were taken by

Girth-band in position on a *Pinus contorta* stem at Kenmare Forest, Co. Kerry.

local forest staff and forwarded to Assessment Section. There the weekly girth change for each tree was converted to a basal area change (true measure). These basal area changes were totalled in their respective groupings e.g. taking all 27 readings for each of the respective regions (irrespective of the species etc., concerned), for the three species (irrespective of the regions etc., concerned) and so on. The mean weekly values were then derived from these totals and plotted on squared paper. As the season progressed growth-trend curves were drawn.

*Selection of Additional Trees in 1962 and 1963.*

During the 961-63 seasons, readings were taken each week as described. In view of losses of data through damage to trees and/or to bands in 1961, and also for the purpose of increasing the sample

size, the number of banded trees was quadrupled at the beginning of the 1962 season. At each of the original sites three additional trees of the same category as the first, and within 10% of it in basal area were chosen. This measure did not upset the previous routine in any way except that the basal area increases of the single trees as used in 1961 were replaced in 1962 and after by values representing the means derived from the group of four trees at each site.

*Winter Readings.* Following the cessation of growth each year the bands were left in position on the trees and readings were taken at monthly intervals. These showed that while the majority of the stems did not vary in basal area during the winter, some increased slightly and some decreased. Between the end of October 1963 and the end of February 1964 for example, 84% of the 324 bands did not vary in their readings. Of those which did, 13% indicated an average girth increase of but 0.015 inches and 3% showed a mean contraction of 0.02 inches in girth. Such changes were not considered of practical significance in the context of the study.

*The Basal Area Growth Trends.*

At Table II the mean basal area growth per tree per week, for each of the sub-categories has been graphed; the three years being treated separately as well as on a combined basis.

In 1961 and 1962 band readings were not commenced until the beginning of May and in consequence some of the initial growth data were lost. While this is a matter for regret the general validity of the overall estimate of the growth-pattern now presented is not considered to have been significantly impaired. In 1963 and 1964 when readings were commenced at the beginning of April and March respectively, the growth which had taken place by the end of April was but 6% approximately, of the season's total in each case. In plotting the average growth-trend graphs for 1961 and 1962 extrapolations suggestive of similar growth levels have been made covering the month of April and part of March in each case. These extrapolations appear as broken lines.

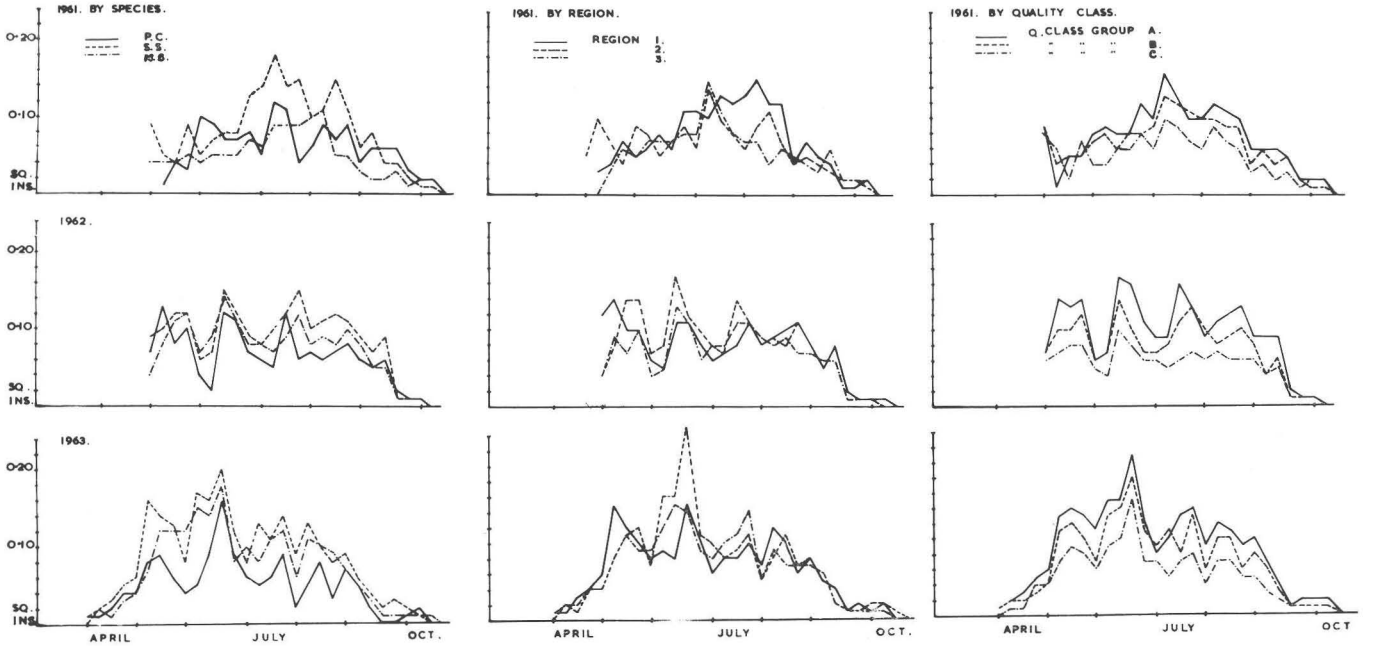
The high initial readings shown on some of the 1961 graphs are as received, but since they were considered to have arisen through faulty band-adjustments or possibly through simple recording errors rather than through basal area growth, they have been rejected and in the calculations have been replaced by values more in keeping with the general trends.

*Growth-Trends of the Sub-Categories.*

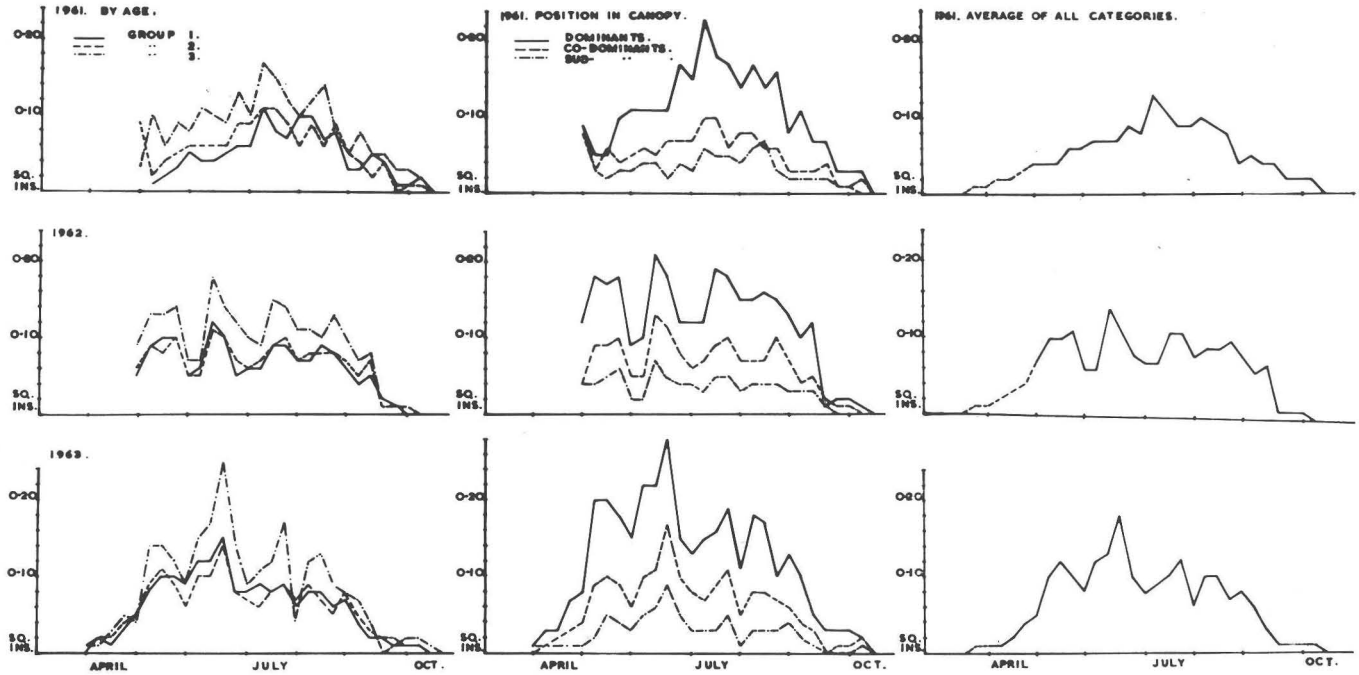
The mean increment for all of the trees has been averaging 6% approximately. As between the individual categories e.g. the dominants, co-dominants etc., there has been wide variation in absolute growth, as might be expected, but their growth-trends on the other hand show a

# TABLE II

WEEKLY AVERAGE GROWTH IN BASAL AREA (TRUE MEASURE) BY SPECIES, REGION ETC., FOR 1961 - 1963.



## TABLE II CONTD.



generally good correspondence. The following are the correlation coefficients calculated for a selection of paired sub-categories for the years 1962 and 1963 :—

| *Sub-Category* | *Correlation coefficient* | |
|---|---|---|
| | *1962* | *1963* |
| Quality Classes A & B ... ... | 0.95 | 0.96 |
| „ „ A & C ... ... | 0.95 | 0.95 |
| Regions 1 & 2 ... ... ... | 0.78 | 0.75 |
| „ 1 & 3 ... ... ... | 0.83 | 0.77 |
| Species P.C. & S.S. ... ... | 0.84 | 0.80 |
| „ P.C. & N.S. ... ... | 0.77 | 0.79 |
| Age Groups 1 & 2 ... ... | 0.95 | 0.94 |
| „ „ 1 & 3 ... ... | 0.95 | 0.95 |
| Position in the Canopy— | | |
| Dominants & Co-dominants | 0.94 | 0.97 |
| „ Sub- „ | 0.90 | 0.90 |

Pending a more searching analysis of more extensive data, these results indicate that while the factors of locality and species may be of some material significance, quality class, age class and position in the canopy are not of practical importance in this context.

*The Mean Percentage Growth Curve.*

Despite the sometimes dramatic fluctuations in weekly growth rates which may be taken generally as reflecting prevailing weather conditions, the mean percentage growth curve for the season emerges as a much more regular trend. At Table III this curve may be seen. By means of it, it is possible to read the approximate percentage of the total annual growth which is likely to have taken place by a particular date. The range of variation from this average, by the individual yearly curves for the three years concerned, is also indicated. As further data become available changes in this curve in greater or lesser degree must be expected. It is noteworthy, however, that provisional calculations for the 1964 season indicate a curve which falls almost entirely within the confines of the already indicated range.

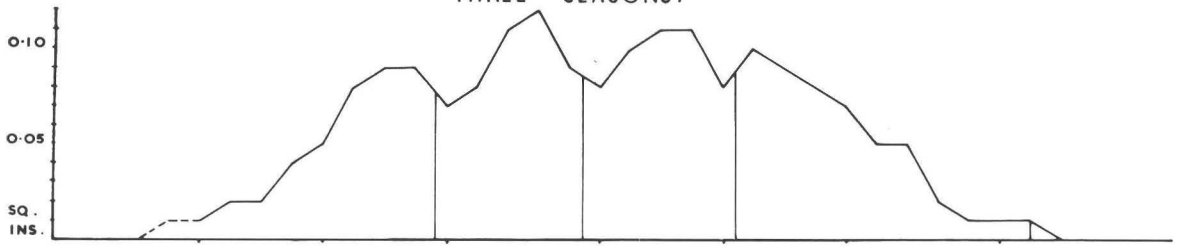
The dates at which the quarter, half etc., stages of total seasonal growth are reached have been indicated on Table III. The corresponding dates suggested by the 1964 curve agree with these, to within a week, in all cases.

*Summary.*

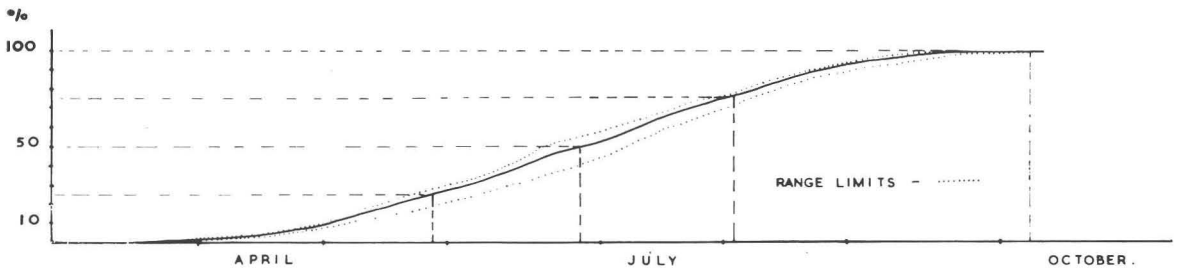
1. The pattern of the basal area growth of Sitka spruce, Norway spruce and *Pinus contorta* in Ireland during the 1961-1963 seasons is shown.
2. The implications or region, species, quality class, age class and the position of the tree crown in the forest canopy are also dealt with.

TABLE III.

MEAN BASAL AREA GROWTH-PATTERN FOR ALL CATEGORIES FOR THE THREE SEASONS.




PERCENTAGE GROWTH CURVE FOR THE 1961-1963 SEASONS.



*Acknowledgments.*

The co-operation of the Foresters-in-Charge at the forests concerned, and of the staff of the Assessment Section, who have, between them, being doing the routine work involved in this project is gratefully acknowledged.

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# An Insight into Arterial Drainage

J. D. KAVANAGH, B.E.

WHEN we see an Office of Public Works (O.P.W.) Land Rover pulling up beside a bridge and two engineers and probably four labourers alighting we are witnessing the beginning of Survey Field Operations and the natural question which springs to the mind of the observer is—

"When will they do the river?" "do" referring more specifically to drainage works.

Before we try to answer that question we must take a quick flash-back to history.

Until 1842 drainage works were mostly on a do-it-yourself basis, but in 1842 the first important land drainage Act was passed. Under this Act the O.P.W. surveyed and prepared small schemes on behalf of riparian owners. Much good work was done—e.g. from the very middle of the famine (1847) to 1852 saw 40,000 impoverished souls improve over a quarter of a million acres.

The effectiveness of this Act died out in the late 1850's and we had the Arterial Drainage Act of 1863 to succeed it. This left the responsibility for the schemes in the hands of the landed proprietors with O.P.W. having a consultative capacity generally.

Again much good work was done—over 130,000 acres were improved under this Act. However, with the rapid rise of tenant ownership, after the Land Acts of 1881 and subsequent years, drainage saw a period of entire stagnation. This was bad in every way, for with no new schemes coming, and lapsed maintenance on the ones which had been done, we had very severe deterioration throughout the land. The advent of Native Government resulted in the passing of the 1924 Drainage Maintenance Act which helped to repair the damage to former schemes. This was rapidly followed by the 1925 Arterial Drainage Act which resulted in a large number of new schemes. We haven't time to examine the weaknesses of this legislation—but a special Government Commission in 1938-40 examined all aspects of drainage and produced a report which was the basis of the 1945 Arterial Drainage Act.

This differed from all the previous Acts in four important ways.

(1) In future all Arterial Drainage Works would be carried out by O.P.W. on the basis of entire catchments and entire catchments only.

(2) Construction costs would be met entirely from State funds.

(3) Maintenance would be undertaken in future by O.P.W.

(4) Cost of maintenance would come from County Councils concerned, as a county-at-large charge.

The whole concept of drainage was thus changed. Previously all schemes were to provide relief on lands immediately affected by making

improvements on perhaps a couple of miles of channel. Finance had been more of a problem in the old days, when it was all pick and shovel work, and rock had to be taken out by lighting large fires on it, and cracking it with water, followed by the wedge and feathers. There had often been a tendency to do drainage made easy—by leaving out the parts that were difficult. And whilst we must pay respect to those stone-masons who built monuments to their craftsmanship, we could truly say that the bad old days were surely gone.

From 1945 the scene has changed. We do not consider a couple of hundred acres here and another couple of hundred there. Now we take the catchment as a whole. Firstly, we examine the entire catchment area which is drained into a river basin. This is done by the valuers section of O.P.W., a group of dedicated young men, who not only mark on their 6″ O.S. Maps (6″ to One Mile Ordnance Survey Maps) the extent of the land which will benefit from drainage but also carefully evaluate the actual potential improvement. Gone are the days when we could merely say that so many thousand acres were improved; to-day we can estimate the actual extent of the improvement. When all the damaged land in a catchment has been marked, it is up to the engineering staff to survey the channels required to drain this land and to prepare a scheme, estimate the cost and examine the economics of the various rivers and streams. And so the picture that finally emerges is this:—Here is a Catchment—it has an area of C,000 acres, it has A,000 acres of damaged land, B,000 of which can be improved to the O.P.W. present standards for a cost of £D,000. That is the final stage of a proposed scheme—to achieve it the engineering staff have to start the ball rolling in their examination of the problem. This is where we came in, with our pair of engineers leaving their Land Rover.

By this time they have gone some distance up the river and we'll have a look at what they are doing.

The first fellow, aided by his pair of workmen, is "pegging and barring". He is driving pegs into the bank of the river at regular intervals, ensuring at the same time that these pegs are not a hazard to man or beast. He knows exactly where to place the pegs because he has a "legged" 6″ map with him, i.e. a map with markings, or "leggings" as they are called, giving the position of the various cross-sections which will be taken. These cross-sections are marked at 100 yard intervals on major rivers and extended to 200 yard intervals on small streams. As the position of each cross-section has been previously marked on the map by scaling, the engineer needs only to locate the position by pacing or "legging" from the nearest identifiable fence. This system replaced the old laborious one of chaining and whilst it seems a small point, in fact, it makes for many times faster and much more accurate work. Now let's see what this "barring" is all about! The workmen are driving a hexagonal steel bar into the bed of the stream and, as the engineer watches its progress and inspects the materials adhering to the bar when withdrawn, he decides the

classification of the types of material to be found in the bed strata. The types of material occurring in the banks are evident to the eye. The frequency of this barring varies somewhat, according to the engineer's assessment of the geological situation, but frequently where the leggings are 100 yards apart the barrings may be at 25 yard intervals.

In the event of rock or heavy boulders occurring this will understandably be reduced to barrings every 5 yards. On wide rivers both sides are barred simultaneously, whilst on small streams with 200 yard "leggings" barring at 50 yard intervals is adequate. Unless he hits rock or other impenetrable stratum, the engineer makes sure that the bar is driven to below what he considers to be the probable new design bed level. In the case of small streams, usually four feet is adequate, except near swampy terrain where an extra couple of feet are advisable. For small rivers six feet might be a popular choice, for major rivers perhaps eight feet, and for isolated short lengths where a deep cut may be envisaged, depths up to 12 feet below the bed may have to be considered.

In grouping the strata into the O.P.W. Classification the engineer is not primarily concerned in the geological considerations as an end in themselves, but rather as a method of placing the material in the correct category for a certain machine output. This is essential when it comes to pricing the quantities.

Heretofore the following six classifications of materials have been used :—

| | |
|---|---|
| Type One | Solid Rock—identify it. |
| Type Two | Interlocking or continuous boulders. |
| Type Three | Hard boulder clay with frequent large boulders. |
| Type Four | Medium boulder clay with occasional boulders. Also hard gravel. |
| Type Five | Medium Gravels.<br>Mixed Excavations.<br>Hard Clays, etc. |
| Type Six | Soft Excavation,<br>Soft Clays.<br>Alluvial deposit and Soft Marls.<br>Shingle.<br>Topsoil.<br>Turf, etc. |

These classification details are supplemented by notes on the nature of the materials seen in the banks and in the case of large and medium-sized channels by trial pitting.

Trial pitting involves locating suitable pits about 6 ft. long $\times$ 2 ft. wide by 6 ft. deep at one end, to endorse the engineer's opinion of the strata, or to make him revise it. In the light of experience gained since the introduction of work study principles to excavation works,

the time has come to re-examine our grouping system for classifying materials and this matter is being considered at the moment. Various scientific alternatives have been offered over the last decade, but we have not yet been able to select anything which will beat barring, on the basis of information obtained at such relatively low cost.

Frequently the writing up of the general features is the slower operation for the engineer than booking the actual barrings.

The general features comprise a detailed description of bridges, weirs, mills, etc. down to ditches, drains, post and wire fences, channel flow, self cleansing capabilities and general channel and bank behaviour. This engineer will also be using bar and sledge in his endeavours to obtain depths of foundations for most of the minor bridges. He will still be faster than his colleagues who will be doing all the levelling, but this arrangement enables the survey of each stream to be completed 'at one fell swoop'.

Let us have a quick look at what the levelling engineer is doing. Starting from an Ordnance Bench Mark—or much more frequently from a pair of pegs of known levels, this engineer will run a line of levels on the tops of the pegs at all the points corresponding to the leggings. He will reduce the levels of these so as to evaluate the height of the top of each peg above mean sea level—i.e. Ordnance Datum. This is a stage where accuracy is of paramount importance. Accordingly, on one very major survey recently concluded, the maximum permissable closing error was 0.10 ft., irrespective of distance, for the main river and for all major rivers and tributaries; whilst a maximum closing error of 0.25 ft. was permitted on the smaller streams which had no tributaries of their own. That this standard of accuracy was maintained reflects a measure of thanks to the Ordnance Survey Office who very kindy gave details of levels of their O.B.M's to three decimal places, which enabled their use to the second decimal place.

This engineer will also be levelling the cross-sections at each pegged chainage. He uses the level of the peg for O.D. level and all points above water level are measured by centre hair and stadia. The number of levelled points taken is determined by the detail necessary to plot a close profile of the section of each bank, and by the extent of the callows. Those lands, back from the bank of the channel which we can improve by Arterial Drainage are called the callows. In locating the levels of the river bed, three methods are used but the principal is the same in each. On really small streams (say up to 6 feet from bank to bank) the bed levels are determined by dipping with a graduated rod made from one inch round timber. On large streams and minor rivers a tagged rope is thrown across the channel and from it is suspended a graduated weighted board—say 4″ × 1″ by 6, 8 or 10 ft.—this is the dipping board. On large rivers where use of a dipping board is impractical a tagged rope is stretched across the river and dippings are taken with a long weighted rod from a boat. In addition to doing the long-levelling and the cross-section levelling

this engineer also measures and levels all detailed features, i.e. bridges, mills, weirs, etc. en route. Thus the survey field operations are completed for that channel and when the last watercourse on the season's programme has been surveyed, it is a case of a final check on the equipment, wind-up and return to Dublin. But what happens when the survey party gets to Dublin?

The next stage is to plot on squared paper all the relevant survey data to assist in the preparation of a comprehensive drainage scheme. This is usually plotted on rolls of paper with one inch to 1/10th inch squares. Cross-sections are normally plotted to a natural scale of five feet to one inch, whilst longitudinal sections are plotted to a scale of five feet to one inch vertically and one hundred yards to one inch horizontally. For a typical cross-section see Fig. 1.

Where we have

(1) Present suveyed profile of the channel.
(2) Levels and distances from the bank of various callows to right and left of the channel.

These are plotted immediately the survey is completed for the season —together with details of materials, in bank and under bed, obtained during the survey.

The information on barrings and materials is omitted from Fig. 1 in the interests of clarity.

The D.F.L. (Design Flood Level) and the various choices of a proposed new channel will be added later, during the design, but more about this anon.

Simultaneously with the plotting of the cross sections we have the plotting of the longitudinal sections.

For a typical piece of a longitudinal section see Fig. 2.

We have:

(a) Left Bank. (L.B.).
(b) Right Bank (R.B.).
(c) Design Callow (D.C.).
(d) Water Level.
(e) Bed Profile.
(f) Representation of features—illustrated by a Bridge and a Weir.

Subsequently, at the design stage, other data will be added, such as

(g) Design Flood Level (D.F.L.).
(h) Final Design Invert Level (D.I.L.).
(i) Final Design Base Width.
(j) Final Design Depth of Flow.
(k) Design Run off.
(l) Design Discharge.
(m) Final Design Velocities.

Omitted from Fig 2 in interests of clarity.

(n) Final Design Grade.
(o) Data on Materials, etc.

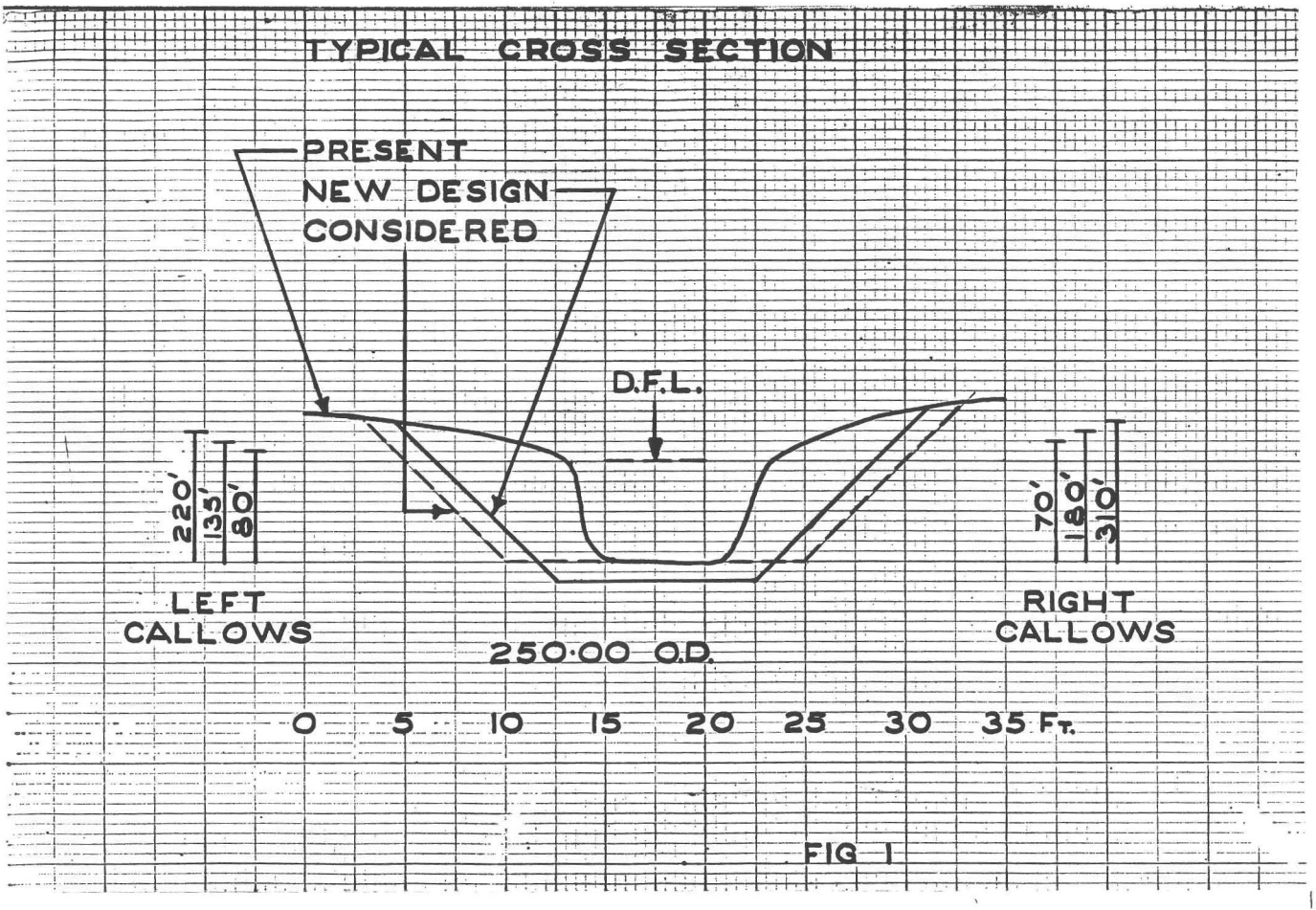

TYPICAL CROSS SECTION
PRESENT
NEW DESIGN
CONSIDERED
D.F.L.
220'
135'
80'
70'
180'
310'
LEFT
CALLOWS
RIGHT
CALLOWS
250·00 O.D.
0 5 10 15 20 25 30 35 Ft.

FIG 1

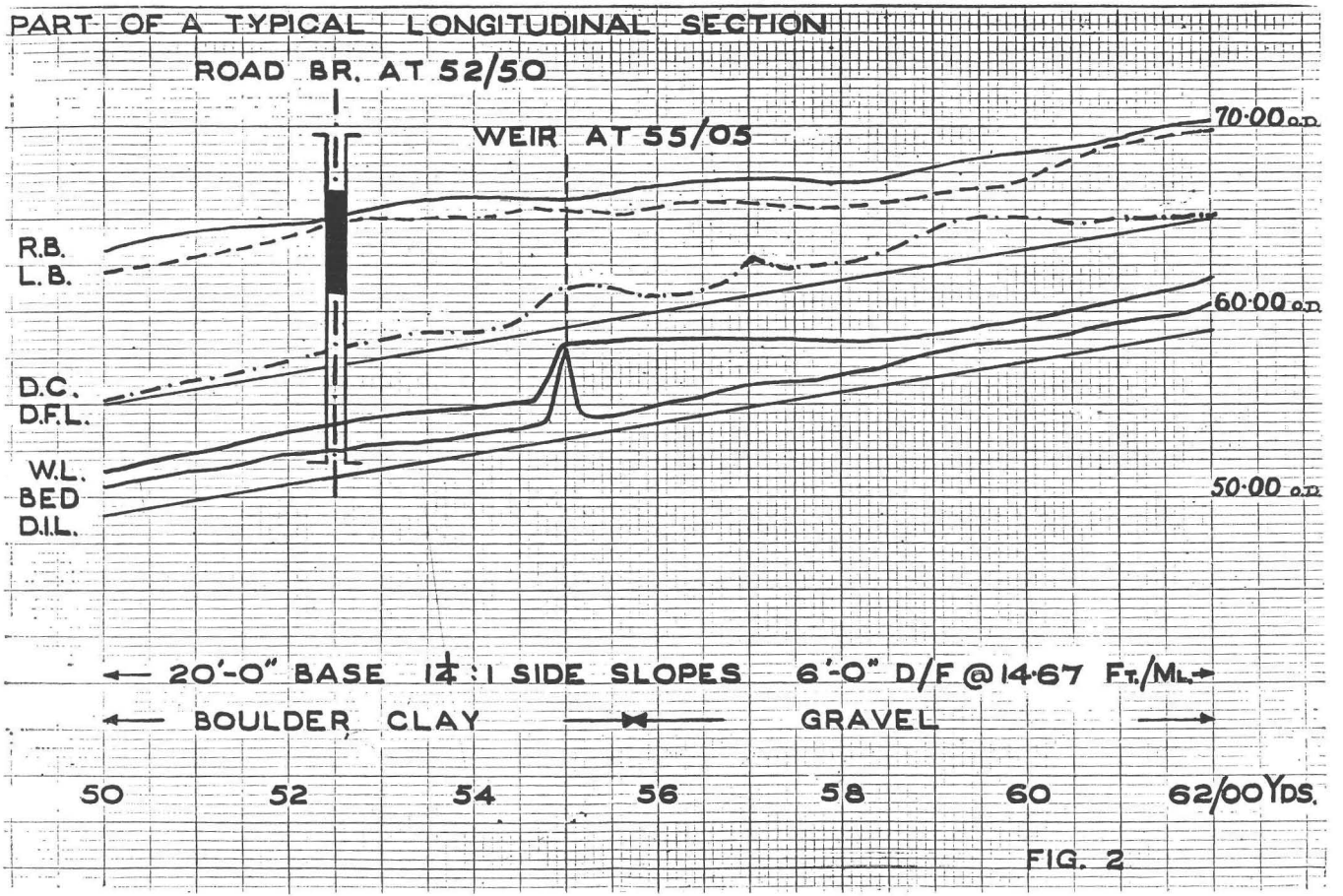

PART OF A TYPICAL LONGITUDINAL SECTION
ROAD BR. AT 52/50
WEIR AT 55/05
70·00 o.D
60·00 o.D
50·00 o.D
R.B.
L.B.
D.C.
D.F.L.
W.L.
BED
D.I.L.
← 20'-0" BASE 1¼ : 1 SIDE SLOPES 6'-0" D/F @ 14·67 Ft./Ml. →
← BOULDER CLAY → ← GRAVEL →
50
52
54
56
58
60
62/00 YDS.

FIG. 2

But more about this when we come to take a quick glimpse at design procedure.

We have not place in an article of this length to enter into the field of channel design. In appending these very brief notes on the subject, we may have a moment's reflection on an occasional important matter and those familiar with the problem are asked to treat the obvious and numerous omissions with an extended charity of silence. If some of the points mentioned provide matters for general interest, the folly of attempting this subject in a few paragraphs will really have been a risk worth taking. Having plotted all the survey data on our rolls, i.e., cross-sections, longitudinal sections, and detailed features, we contemplate the kernel of the problem. What measure of improvement do we provide and how is it obtained?

We must digress slightly. Throughout the country the O.P.W. have a number of small sentry-box affairs frequently near major road bridges, on all major and most minor rivers. These are the automatic recording gauges. They operate continuously and the weekly chart on the drum shows clearly the water level at each hour of the whole week. By analysing these records, together with certain flow measurements, it is possible to plot accurate rating curves for the present pre-drainage discharges; thus we can know the amount of water passing down the river according to the height (depth) of water at the gauge. The availability of a continuous record enables flood frequency analysis to be investigated mathematically, and these can be converted to post-drainage flood frequencies. The complicated problems of rainfall analysis and catchment characteristics—such as size, shape, medial (average) slope, river network, etc. together with other run-off factors, soil, subsoil, cultivation, afforestation and other ecological data are examined.

Our hydrometric organisation has been the subject of frequent praise from eminent overseas authorities and we are proud of having a comprehensive coverage which is rarely equalled in the world to-day.

In one very specific instance, a method of obtaining and analysing the slope factor of a catchment was discovered, in a large and wealthy country, at a research institution which had very substantial funds at its disposal, and on publication it was discovered, that practically the identical methods and solutions had been developed here, and were being used for the previous twelve months by O.P.W. engineers, who, of course, have no research grant and whose primary function is to solve the day to day problems of the Board.

To return to our fields, one question frequently asked is what standard of protection do you give by Arterial Drainage.

Generally we cater for the three year flood. Having stated this we must immediately enlarge and offer a number of reservations. In certain circumstances floods far in excess of the three year flood form the design criteria.

What is the three year flood? It is the flood which will occur or be exceeded—on an average of say ten times in 30 years. This is a loose definition and it is totally wrong to suggest that this will occur or be exceeded once in three years. The three year flood could, of course, occur twice in any one year alone, but *over the long period* it will only be *equalled or exceeded* once per each three year period *on an average.*

If the "equalled or exceeded" tends to suggest, as it does, that if one designs for the "equal" part, we are not equal to the "exceeded" part, we conclude that perhaps some three year floods may be less equal than others—from the design view-point!

Such pessimism can be evaluated mathematically, and when we know the three year or say design flood, we know the value of say the six year flood, which is of course much higher, and which will occur "or be exceeded" five times in a thirty year period on an average. To complete the debit side of the picture, there is the occasional, but very rare, instance where a small pocket of low callow adjacent to a major river is such that to offer the "three year flood" standard of protection might cost thousands of pounds, in extra deepening of main river plus extra under pinning of bridges, and the callow in question might be little better than five acres of cutaway bog.

The credit side is much more frequent and requires more consideration.

Firstly, whilst the line of the Design Flood Level will go over the occasional callow level by perhaps a couple of inches, for every callow level it will go above there will usually be dozens which it will go below, and in a particular instance where the depth of flow is say 6 ft., the callows 6 inches above this flood line, would be enjoying the "twenty year flood" standard of protection. Secondly there are frequently occasions where the design is for a flood much greater than the "three year flood", for portions of a scheme. Thirdly, for large and medium sized sub-catchments the Design Criteria will be to convey the "three year flood" which will flow at or below the design flood level, nevertheless there is a second criterion which we provide. We are providing Arterial Drainage, and we have mentioned flood prevention, we must now turn to the matter of drainage. Again, normally (with reservations) we provide approximately 4′ 6″ of drainage below the design callow level. By this we mean, that we are providing drainage, such that the normal summer water level in the channel is approximately 4′ 6″ below the level of the callow lands.

In the event that the callow lands extend for any considerable distance from the banks of the channel, then extra deepening must be effected to enable the water table to be lowered sufficiently beneath these callows.

If the callow lands in question tend towards swampy conditions, then removing the water will, of course, cause a lowering of the level of these lands due to shrinkage.

The minimum sized channel that is excavated, i.e. 4 ft. base perhaps, 1 :1 or $1\frac{1}{4}$ :1 side slopes has now taken over much of the mileage of channel on some schemes. Taking a specific, yet frequent example, of where a channel drains only a relatively small catchment area, for its size; the "three-year-flood" may only produce a depth of flow of say 3′ 0″. If the callow levels are 4′ 6″ above even the new bed level—and this is usually the minimum, then in that circumstance the callow lands would be flooded only once in 123 years on an average—say eight times in a thousand years.

Fourthly, whilst the "three-year flood" will only be equalled or exceeded once in three years on an average—most of these floods will occur during the winter months. And if we consider the principle growing period to be, say early March to mid-October, then the "three year flood" will only occur or be exceeded—from once in ten years to once in fifteen years—depending upon the catchment and its characteristics, during the principal growing period.

Other considerations arising include the problems of mills and water rights, of water supplies, of local amenities, of fisheries, of lakes, etc.

In the actual selection of the Design Flood Line itself, questions, of back water calculations, draw down calculations and stretches of non-uniform flow will have to be considered and problems of velocities, etc. will have to be solved from their various aspects.

When the Design Flood Level has been fixed the problems associated with going a little deeper to reduce excavation quantities, and to limit excavation costs are of major concern for each reach of main river channel. See Cross-Section Figure I. The deeper proposal illustrates a case of where by excavating deeper, with a narrower base, of course, the total area (or quantity) to be excavated is actually less. But there are practical limits to the depth you can go, and in the event of additional depth incurring harder and more expensive materials, you can reach a situation where the deeper proposal, although involving a reduction in the actual quantities, requires an increase in costs.

Channels which are highly efficient hydraulically, may create high velocities during flood conditions which could entail expensive bank protection. In extreme brevity it may be accepted that the most efficient channel hydraulically will usually not be the cheapest; and most often the "best buy" will be a channel which is neither the most efficient, nor the cheapest although frequently not far removed from either.

These considerations may entail several designs for various depths, with corresponding base widths, for each length of major channel designed and estimated for. The best results will always be obtained by a consideration of all the facts guided in the light of experience and in the final analysis on the question of design there is no formula to replace sound judgment. All this means, of course, having several lots

of quantities and an equal number of estimates for main channel prior to making our final selection.

And so we get our final scheme, B,000 acres improved to a known potential percentage for £D,000.

Having examined all channels which have any possibility of inclusion in the scheme, there comes the problem of eliminations; primarily due to cost—perhaps some of the channels investigated may warrant a financial outlay, out of all proportion to the benefit to be accrued, either in terms of cost per acre improved; percentage of improvement of the potential of the land; or the actual increase in value of the land.

And so we get to our final scheme, draw up the Exhibition Maps, that is those maps which are displayed locally to enable the beneficiaries and others to examine the proposed scheme. The exhibition of maps and the other legal documents are advertised in the newspapers and all interested parties should examine the maps and attached schedules.

At the conclusion of the exhibition period, the observations of the interested parties have to be considered; other Government Departments have to be consulted; and the scheme has to be sent to the Minister for Finance for confirmation, before works can be commenced.

We have described all too breifly some of the procedures involved before we reach this stage but the question "WHEN will they do the work" remains unanswered. To answer "it would start when all the processes described together with a few others have been completed" would not be a fair answer. In present conditions in the engineering situation, one factor has loomed larger than the others in providing the answer. When the final quantities on a particular watercourse have been taken out, together with preparing a financial estimate, the channel is classified under the type of machine, and the duration of the job. It is axiomatic that large rivers are more efficiently and cheaply excavated by large machines. The larger machines are very expensive but as they travel upstream they will eventually reach a point where it is more economical to replace them by smaller machines. If these large machines are on a scheme, and do their job until smaller machines take over, then, after a period of overhaul, a second scheme must be ready to take them without delay and this is the indicator which often fixes the deadline.

Since Chief Engineer Manning produced his universally used formula, staff of the Board at all levels have engaged in minor research and in the field of design have produced innumerable charts, tables and diagrams which have helped and continue to help us reach the deadline.

This has been slightly offset by the application of work study and bonus schemes to Arterial Drainage works resulting in reduced costs, increased outputs and, of course, reduction in time of duration of a

scheme. This presents a new challenge which those preparing a scheme readily welcome.

In the Second Programme for Economic Expansion, Agriculture has been set a target of an annual increase in gross agricultural product of 2.70%; Arterial Drainage contributes towards this achievement and also helps Forestry towards its target.

In this connection the Arterial Drainage programme over the past few years have averaged an improvement of nearly 20,000 acres per annum and the potential improvement of the land has averaged over 70%, and in the case of one scheme, in which over 21,000 acres benefited, the improvement was 110%.

In addition the O.P.W. Arterial Drainage Division has a large maintenance commitment on schemes which were carried out under the 1945 Arterial Drainage Act, and at present watercourses are being maintained which benefit 200,000 acres of land under this heading—at an Annual Gross Maintenance Cost of aproximately 1% of the cost of "doing" the scheme initially. Viewed another way, when an Arterial Drainage Scheme has been completed the engineer will be provided each year with a sum of about $\frac{1}{6}$th of the amount of the annual interest on the capital cost of the scheme, to maintain those watercourses.

We have long overshot our allotted space—and we haven't even mentioned the benefits accruing to Arterial Drainage from Afforestation.

On the subjects we have mentioned we must plead guilty to hedge-hopping.

We will have to conclude—but before doing so, some acknowledgements are necessary.

Firstly, whilst accepting full and sole responsibility for the contents of this article, the writer wishes to emphasise that any views expressed are entirely his own and are not necessarily the views of the O.P.W., at the same time he would like to offer a sincere word of thanks to the Chief Engineer and engineering staff and to all who have so freely made information available.

Secondly, the Presidential Address of Mr. Candy to the Institution of Civil Engineers of Ireland in 1948, has been the source of much of the information on the references to the various Drainage Acts from 1842 to 1945. Whilst this was the only paper specifically consulted, a large number of scientific and technical papers have been published by O.P.W. staff and others, on related subjects for over a hundred years. In addition to what has 'percolated' from these sources, a considerable body of technical data has been available in the day to day working in the office. The writer wishes to express acknowledgement, wherever it may be due.

Lastly, the Commissioners of Public Works are sincerely thanked for kindly consenting to publication.

# *Society's Activities*

## Twenty-second Annual General Meeting

THE Twenty-second Annual General Meeting of the Society was held in the Shelbourne Hotel, Dublin, on Saturday, March 21st, 1964. The outgoing President, Mr. M. McNamara, took the chair at 7 p.m. and opened the Private Meeting.

*Minutes.*

The minutes of the 21st Annual General Meeting, having been published in Vol. XX, No. 2 of the Society's journal, were taken as read and were duly approved.

*Council's Report for 1963.*

During the year 7 meetings of the Council were held and the attendances were as follows :

7 attendances each : Miss Furlong, Messrs. Sheridan, O'Carroll, Luddy, O Neachtain, O Muirgheasa and Swan.

5 attendances each : Messrs. Hanan, and McNamara.

4 attendances each : Miss Cahill, and Professor Clear.

3 attendances each : Messrs. Joyce and FitzPatrick.

The year just gone by marked the Twenty-first Anniversary of the founding of our Society. To celebrate the occasion, a dinner was held in the Gresham Hotel, Dublin and was attended by over 100 members and their guests. The principal guests included Mr. Frank Aiken, Minister of External Affairs, and Mrs. Aiken, Commissioner O'Brien, Secretary of the Department of Lands, and Mrs. O'Brien, Mr. S. Mac Piarais, Mr. and Mrs. S. M. O'Sullivan, Mr. and Mrs. T. Manning, Mr. H. Harbourne, President, Trees for Ireland, and Mrs. Harbourne, and Mr. and Mrs. D. M. Craig.

At the dinner a presentation of Waterford glass was made to Professor Clear to mark his twenty-one years of unbroken service on the Council of the Society. The President presented Mrs. Clear with a bouquet of flowers.

Only one other member can claim the distinction of unbroken service to the Society since its foundation, he is Mr. Craig, our Hon. Auditor and the Council was very pleased to have him and Mrs. Craig as guests at our Twenty-first anniversary dinner.

The annual study tour was extended from our usual three full days to five days and instead of being centred in one town it took the form of a tour starting in Dublin and going by way of Wicklow, Carlow, Tipperary, Limerick, Galway, Mayo and Sligo crossing to Fermanagh and Tyrone and back by Monaghan and Meath to Dublin. The study tour dinner was held in Omagh and our Northern friends introduced

a pleasant surprise of a birthday cake. Before dinner the party was entertained to cocktails by the Ministry of Agriculture for Northern Ireland who was represented by Mr. Elliott. The start of our tour was covered by Telefis Eireann and was the subject of a special Newsview programme.

During the year excursions were held to Killakee Forest, Ossory Forest in the Slieve Blooms, to Clonsast Bog, to the proposed National forest park at Gougane Barra, Rostrevor forest and to Johnstown Castle, Wexford. Early in the year a symposium on *Pinus contorta* was held in Clonmel. The speakers were led by Mr. O. V. Mooney who dealt with the natural range of *Pinus contorta* and its divisions into provenances, its introduction into Irish forests and its development and place there. Mr. J. O'Driscoll outlined the programme for improvement of *Pinus contorta* by breeding and selection while Mr. Hanan dealt with the timbers, its uses, advantages and disadvantages. Mr. Joyce gave a review of the statistics of growth and yield for the species. The meeting was well attended and a lively discussion followed the papers. In addition, Mr. Joyce on another occasion gave a very interesting illustrated lecture in Galway on his visit to Holland where he had attended an F.A.O. study course on sylviculture.

In October, a party of forestry enthusiasts from Brittany, France visited this country. The Society was associated with the Department of Lands in the arrangements for their tour. There were 32 members in the party and the tour covered Co. Wicklow, the Midlands, Co. Clare, Galway, Mayo and back to Dublin.

The Royal Scottish Forest Society had requested our Society to arrange a tour of 8 or 9 days for its members. It is expected that a party of 50 to 60 members will visit us on this tour which will take place next October. The Department of Lands has very kindly promised to extend every help and facility.

The Council has received notice from the Central Examination Board of Great Britain that they are prepared to accept Forester Certificates issued by our Society as qualifying for entrance to the examination for the National Diploma in Forestry. The examination for and issue of Forester's Certificate will be a matter entirely for our Society. The Council is now arranging for the necessary machinery to operate the scheme.

Regarding the publication of the proposed book, a draft is being submitted by Mr. FitzPatrick and it is hoped to get it in its final form by the next Annual General Meeting. Mr. FitzPatrick has had a very onerous and difficult task and the best thanks of the Society are due to him.

The Council also wishes to thank Mr. N. Morris for the excellent arrangements for the extended study tour and the other excursions and activities during the year.

Finally, the Council wishes to extend thanks to the Minister for

Lands and the officers of his department for the help and facilities which they again so generously extended to our Society. They also wish to thank the Minister for Agriculture, Northern Ireland and his officers in the Northern Forestry Service for the co-operation, assistance and hospitality extended to us.

*Treasurer's Report.*

This report was circulated to all members with the notice of the meeting. There being no discussion, the Treasurer's Report was adopted and passed unanimously.

*Motions.*

There being no business under this heading the meeting passed on to the next item on the agenda.

*President's Address.*

The coming of age of our Society has tempted many of us to try to assess the progress of Forestry in Ireland to date.

The early years of the Society's existence saw forestry, like all other enterprises, passing through a difficult period. Timber for fuel and constructional work had to be obtained from our all too meagre tree reserve, and due to a scarcity of materials planting programmes were low.

Viewed against the background of the past twenty-one years the position to-day looks encouraging. To-day five factories engaging in the conversion of home-grown timber into particle and fibre board are in commission. They use between them $4\frac{1}{2}$ million cubic feet of round timber annually. A substantial proportion of the end product from these factories is exported. According to the United Kingdom Year Book of Timber Statistics—1962 Ireland was the largest exporter of chipboard to Britain, accounting for one-quarter of that country's imports at 5,859 tons, valued £280,000. At almost £50 per ton you will note that our timber has gone up substantially in value in the processing. According to the same source our total exports of paper and paper board for 1962 was 16.8 thousand metric tons with a value of £840,000.

It may appear slightly odd that we should be exporting one timber product while at the same time we are importing 90,000 tons of wood pulp and paper in other forms. However, if we can be competitive in the world market in one type of wood product we might be wise to strive for maximum efficiency in that field rather than dissipate our efforts in more diversified fields of production covering all the timber derivatives. Under free trade conditions such a policy would be a natural development. Under such conditions no country aims at full self-sufficiency, but concentrates on those products for which they are by nature best equipped to produce.

On the constructional timber market state forests in the Republic supplied $2\frac{1}{2}$ million cu. ft. to the trade in 1962. That represents

roughly $\frac{1}{6}$th of our softwood requirements. In this field we have to face competition from the highest quality timber from countries such as Finland, Sweden and Norway and if we are going to succeed without a falling off in standard we must first, understand the qualities which constitute good constructional timber and second, we must set out to attain them. In this respect it is encouraging to note that the Institute of Industrial Research and Standards has set up a timber testing station at Glasnevin and have an exhaustive programme in hands to evaluate the properties of the various species of timber included in the national programme. The Institute is also working towards the production of grading rules for constructional timber. It is of interest also to note that pruning methods have been standardised in the forest to ensure knot free timber.

It is not easy to assess the full value of forestry from the employment aspect. We know that there are 5,000 men directly employed in state forestry in the Republic and 1,400 men similarly employed in Northern Ireland but it is difficult to estimate the number employed in felling, haulage and conversion in sawmills and in wood processing factories. There are no figures available but at a conservative estimate the number should exceed 12,000.

What of the future of our forests? It is clear now that we will reach the point where national production of wood will equal national demands before all our potential forest land has been utilised. An outlet for our surplus produce will then become vital. It is encouraging, therefore, to note that according to F.A.O's European Timber Trends and Prospects 1950-1975, Europe will have become a timber importing area by 1975. At the Fifth World Forestry Conference, Dr. Egan Glesinger, Director, Forest and Forest Products Division, F.A.O., produced elaborate figures to substantiate his statement that despite substitution, per capita consumption of industrial wood has risen over the last decade in nearly every region in the world. It, therefore, appears that we need have no fears about over production in forestry for a long time to come.

A notable event in Irish Forestry was the visit by a group of forestry enthusiasts from Brittany, France. These people had chosen Ireland as having conditions similar to their own and problems similar to theirs and they believed we could help them. They were particularly interested in our progress with western peat afforestation in which field they regarded us as leaders.

It will have been seen from the reports of the Minister for Lands for some time past now that *Pinus contorta* has taken an important place in our afforestation. However, it will also have been seen that *Pinus contorta* shows a wide variation in its success and development. Much of the variation can be attributed to provenance. In the year under review the Department has taken a major step to ensure that we get the best and most suitable provenance of *Pinus contorta* seed. It sent a special mission to Western America to select suitable areas for

seed collection and make arrangements to ensure that we would get seed only from those areas which we have chosen.

*Proposed Activities for the Year.*

The convenor Miss Furlong had the proposed activities for the year outlined. This year's study tour would take place in Brittany, France. The proposed date was the end of August and beginning of September. The departure from the usual time was due to the late decision to hold a foreign tour. The programme for local excursions would be as follows:

April—Delgany—*Pinus radiata*—a discussion on growth trends.

May—Abbeyleix—Management of private estate with emphasis on group planting.

June—Castleshane—Discussion of silviculture treatment of elm, oak and other hardwoods and thinning of Norway spruce and Sitka spruce on dry site types.

July—Newport—Growth of coniferous species on old red sandstone.

September—Hillsboro—Tree felling competition.

Confirmation of Election of Council for 1964 as follows:

*President,* M. Swan; *Vice-President,* C. Kilpatrick; *Secretary,* J. O'Driscoll; *Treasurer,* A. M. S. Hanan; *Editor,* M. J. Sheridan; *Bus. Editor,* P. Joyce; *Hon. Auditor,* D. M. Craig; *Councillors, Grade I,* M. McNamara, S. Campbell; *Councillor, Grade II,* E. Joyce; *Councillor Associate,* Miss E. Furlong.

*Any Other Business.*

There being no further business the meeting concluded.

The public meeting commenced at 8 p.m. A paper entitled "The Potential and Economic Aspects of Forestry on Marginal and Submarginal Land" was read by Mr. D. R. Johnston, Chief Officer, Management Section, British Forestry Commission, Alice Holt. This paper appears as the first article in this Journal. A second paper read by E. A. Attwood, Rural Economy Division, An Foras Taluntais, appears as the second article. Papers were also read by Dr. W. H. Jack and Mr. T. McEvoy.

Dr. W. H. Jack, in his paper, said: The system of land tenure in Ireland has a very important influence on the use of marginal land. Many Irishmen feel that they not only have a right but a duty to own land and even if they emigrate they often feel obliged to hold on to an existing farm while at the same time not expecting any great monetary return from the land which is often worked as one unit by other members of the family. Farm ownership has mostly passed by

inheritance and the average farmer is content to obtain his daily needs without considering any return on the capital value of the property. Current land prices include an "expectation" value for agricultural subsidies which in Northern Ireland are approximately 16/- for basic subsidies and 33/- if allowance is made for fatstock guarantees per annum per acre per annum of hill land. The small average size of farm and a lack of economic appreciation by the farmer make the acquisition of large compact areas for forestry difficult and greatly increase establishment, maintenance and supervision costs.

Where unemployment is high, as in Ireland, the creation of more employment per unit of land area by changing from marginal agriculture to a forest land use is a very valuable social tool. One must not forget the view of many agricultural economists that the efficient hill sheep farm will only employ two to four men per thousand acres and consider this figure, rather than current employment statistics, when considering the relative merits of agriculture and forestry as employers. This does not run contrary to Mr. Johnston's criticism that employment in industry may create more wealth per worker but can, in fact, be treated as a palliative until sufficient national industry can be encouraged or created—the resulting production, in fact, helping to create a wood-based industry. This does not mean that forestry should be treated as low grade employment and it is farcical that my family would get more money were I an unemployed person in Northern Ireland than if I were an unskilled forest worker.

One must not forget that in afforesting marginal land one is dealing with very variable sites. An assessment of Forestry Commission quality classes for Sitka spruce in Cam Forest where 1,400 acres of this species had been planted in pure blocks gave the following percentages by area :—

| Forestry Commission Quality Class | Percentage of Land Area | Remarks |
|---|---|---|
| III | 20 | Nil |
| IV | 36 | Nil |
| V | 23 | Nil |
| (a) | 7 | Leaders growing at 18″ and over per year but total height not up to Forestry Commission Quality Class standard. |
| (b) | 9 | Leader growth 12″—18″ per year. |
| (c) | 5 | Leader growth under 12″ per year. |

These figures were obtained by assessing to the nearest half-acre and many of the different yield classes were closely situated in space. This heterogeneity and the difficult wind climate of Ireland requires

much more detailed supervision and better trained foresters than large expanses of sheltered uniform ground.

Mr. Johnston gave a reasoned argument on why interest rates on capital must be considered but this argument cannot always be valid when dealing with national assets and economies. His comparison between the interest rates of Scandinavian integrated wood processing and wood growing concerns indicates how a broad assessment can equate low and high interest rates within different sections of the same industry. Thus, if Northern Ireland, which imports £13 million worth of wood and timber imports, or 20 million cubic feet round wood equivalent per annum could produce this from 250,000 acres or one-third of its hill land, surely it is better from the national point of view than the current gross output from *all* hill land of approximately £4,500,000 per annum. Expressed in a somewhat different way, the current gross output per acre per annum for hill land in Northern Ireland, excluding the value of pigs and poultry, is some £5.8 which would only require a timber production, valued at 2/- per hoppus foot at roadside, of 54 hoppus feet mean annual increment or half the growth rate of Forestry Commission Quality Class V for Sitka spruce to equal it. One must also look at possible trends in timber consumption and here it is interesting to compare the per capita consumption of wood in 1962 in a few countries.

| Country | Industrial Wood Metres Cubed | Paper Consumption Kilograms |
|---|---|---|
| U.S.A. ... ... ... | 1.93 | 192 |
| G.B. ... ... ... | 0.64 | 97 |
| Northern Ireland ... ... | 0.41 | 59 |
| Republic of Ireland ... | 0.30 | 40 |

Finally, let me remind you that in a journey through Ulster it would be pleasant to pass from Beaghs via Ahoghill, Meenakeeran and Derrygonnelly to Ballybeagh. Could this ancient forested country not, with benefit, be re-afforested and if the exotic conifers now being used are to become part of the local heritage, would it be wrong to call *Pinus contorta* and Sitka spruce the 'hairy yins' and 'jaggy boys' as they are known in County Fermanagh.

Mr. McEvoy in his paper said, that it probably was a mistake to think in terms of an industrial rate of interest around 7% without free choice of land and management objectives. It was true he said that best forest land yielded high returns in interest and the choice was clear to the private grower. For the state it is different as there were pressures to use marginal forest lands.

He went on to say that our western peats were, in the economic sense, our most controversial planting site; there were so many unknowns. He thought, however, that if we adopted an intelligent approach to site selection on these peats and used a good coastal strain

of *Pinus contorta,* we should get quality class II growth, giving at least 80-85 H. ft. M.A.I., and thus we would have the increment that Hummel and Grayson considered was critical to yield 3½% on capital outlay.

He said that there was a lot in what Mr. Johnston said when he talked about simplified silviculture on marginal sites: wider spacing, elimination of thinnings, and short rotations.

Mr. Johnston referred to high capital cost of providing permanent employment for a man in forestry, but in this country 75% of these costs were labour costs and it was a resource we had in abundance in our rural areas.

It was particularly true in forestry, he said, that the end product—the mature tree—should not be looked on as an end product as such but rather as a stage that passed on to the sawn log and finished up as an armchair, Sunday newspaper or sheet of plywood. Due to the high cost of transport it was not possible to have a forest industry without a forest.

He ended on this note that if we could get an area of western peat to produce 80 H. ft. of pulpwood a year, this could produce a ton of ground wood pulp worth £30 or a ton of newsprint or chipboard worth say £50 in terms of balance of payments. Compared with this the national average for agricultural production (including turf) was less than £20 per acre.

The President in his closing address said that in all our discussions we come back to the faustmann formula—costs incurred during the rotation versus receipts all brought to some point in time at compound interest. Compound interest was the common enemy therefore, as it was the single factor that affected the result of our calculations. Hence, we tried to convince ourselves and others that forestry was entitled to a low rate of interest.

Mr. Swan went on to say that should we not consider rather how useful and necessary timber was. The very fact alone that we had to import £12-14 millions worth of timber and timber derivatives only emphasised the need to grow it. Further, he said, the last war taught us and most other countries the danger of depending on imports of an essential commodity.

The President ended by saying that he saw no reason why this country, having the climate and the soil to produce excellent crops of timber, should have to import from countries whose capacity for timber production was less than our own.

He thanked Mr. Johnston and the other speakers for their papers and the meeting was brought to a close.

# SOCIETY OF IRISH FORESTERS

## Statement of Accounts for Year ended 31st December, 1963.

| 1962. | | | Income | | | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| £471 | 17 | 11 | To **Balance from last Account** | | | | | | 300 | 18 | 1 |
| | | | ,, **Subscriptions received :—** | | | | | | | | |
| | | | 1 | Technical Grade 1. | 1960 | 1 | 0 | 0 | | | |
| | | | 2 | ,, ,, ,, | 1961 | 2 | 0 | 0 | | | |
| | | | 11 | ,, ,, ,, | 1962 | 11 | 0 | 0 | | | |
| | | | 63 | ,, ,, ,, | 1963 | 63 | 0 | 0 | | | |
| | | | 2 | ,, ,, ,, | 1964 | 2 | 10 | 0 | | | |
| | | | 8 | ,, Grade 2. | 1961 | 4 | 0 | 0 | | | |
| | | | 21 | ,, ,, ,, | 1962 | 10 | 10 | 0 | | | |
| | | | 95 | ,, ,, ,, | 1963 | 47 | 10 | 0 | | | |
| | | | 3 | ,, ,, ,, | 1964 | 2 | 10 | 0 | | | |
| | | | 1 | ,, ,, ,, | 1965 | | 10 | 0 | | | |
| | | | 1 | Associate | 1960 | | 15 | 0 | | | |
| | | | 3 | ,, | 1961 | 2 | 5 | 0 | | | |
| | | | 13 | ,, | 1962 | 9 | 15 | 0 | | | |
| | | | 99 | ,, | 1963 | 73 | 10 | 0 | | | |
| | | | 7 | ,, | 1964 | 5 | 15 | 0 | | | |
| | | | 1 | ,, | 1965 | | 15 | 0 | | | |
| £247 | 15 | 0 | | | | | | | 237 | 5 | 0 |
| £6 | 16 | 8 | ,, **Interest on Investments** | | | | | | 6 | 16 | 8 |
| £306 | 6 | 10 | ,, **Journals and Advertisements** | | | | | | 308 | 6 | 4 |
| | — | | ,, **Badges sold** | | | | | | 11 | 2 | 0 |
| £1,032 | 16 | 5 | | | | | | | £864 | 8 | 1 |

| 1962. | | | Expenditure | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|
| £71 | 17 | 7 | By Stationery & Printing ... | | | | 116 | 8 | 1 |
| £475 | 4 | 0 | ,, Printing of Journal and reprints of articles | | | | 302 | 4 | 0 |
| £48 | 18 | 8 | ,, Postages ... ... ... | | | | 72 | 7 | 5 |
| £39 | 18 | 4 | ,, Expenses re meetings ... | | | | 32 | 19 | 0 |
| £1 | 17 | 9 | ,, Bank Charges ... ... | | | | 2 | 4 | 0 |
| | | | ,, Honorariums : | | | | | | |
| £12 | 10 | 0 | Secretary ... ... | 12 | 10 | 0 | | | |
| £12 | 10 | 0 | Treasurer ... ... | 12 | 10 | 0 | | | |
| | — | | Editor ... ... | 20 | 0 | 0 | | | |
| | | | | | | | 45 | 0 | 0 |
| | | | ,, Trees for Ireland— | | | | | | |
| £3 | 2 | 6 | Affiliation Fee and Dinner | | | | 3 | 1 | 0 |
| | — | | ,, Deficit on 21st Anniversary Dinner | | | | 42 | 2 | 5 |
| | — | | ,, Entertainment of French Foresters | | | | 22 | 2 | 0 |
| | | | ,, Expenses—Diploma Conference, | | | | | | |
| £40 | 19 | 6 | Edinburgh ... ... | | | | | — | |
| £25 | 0 | 0 | ,, Purchase of Projector ... | | | | | | |
| £300 | 18 | 1 | ,, Balance in Bank ... ... | | | | 226 | 0 | 2 |
| £1,032 | 16 | 5 | | | | | £864 | 8 | 1 |

**CERTIFICATE :** I have examined the above account have compared it with vouchers and certify it to be corect, the balance to credit being £226 0s. 2d. which is on current account at the Ulster Bank Ltd. There is also a holding of £200 Dublin Corporation 5% Redeemable Stock 1968/73 and a holding of £200 Prize Bonds. Credit has not been taken for Subscriptions due for 1961 10s. 0d., for 1962 £15 10s. 0d., and for 1963 £57 5s. 0d. which were outstanding at 31st December, 1963.

**22nd February, 1964.**

**85 Harcourt Street, Dublin 2.**

D. M. CRAIG, Hon. Auditor.

# Annual Study Tour

## Tour of Brittany

FOR its tour of 1964 the Society decided to go to Brittany. This decision was prompted largely by the visit of Breton foresters to this country the previous year when many firm friendships were established.

A party whose members finally settled at thirty-one, left Dublin Airport on Sunday, the 30th of August, on the first leg of the journey to London. After a short wait in the sweltering London heat we boarded a B.E.A. flight for Dinard and arrived there on schedule; a welcome breeze cooled our heated brows as we alighted.

After we had passed through the customs we were met by the Conservateur des Eaux et Forêts-Bretagne, M. de la Croix Vaubois, who welcomed us to Brittany and after introducing his staff and our interpreter, Melle. Eno, gave us an outline of our tour. As well, we were given a booklet containing details of our trip and also, a general description of Brittany and detailed descriptions of the places we were to visit. We spent our first night in Dinard and before night-fall we had a chance to see the town.

A brief description of the geology and ecology of Brittany is in place here and as well a general outline of the forestry scene.

The soils of Brittany are composed almost exclusively of primary soils derived from silicious rocks of Precambrian, Cambrian and Permien age. An upheaval of acid and base igneous magma towards the end of the carboniferous period caused folding in the sedimentary strata. The granite core is now exposed in large masses.

The non-calcareous nature of the soils has left its mark on the flora of the country in that it is nearly all calcifuge; in this fact it contrasts with the rest of France.

The beech and oak grow naturally in Brittany. The silver fir it is thought was introduced during the middle ages. The forest floor vegetation is typified by *Vaccinium myrtillus* often associated with *Pteridium aquilinum.* On best soils, *Ilex aquifolium* and *Taxus baccata* are found with *Juniperus communis* on dry stony or sandy areas. In badly drained areas *Molinia coerulea* and *Juncus* species are dominant.

Coniferous species *Pinus sylvestris, Pinus pinaster, Abies alba, Abies grandis, Picea excelsa* and *Picea sitchensis* have been introduced.

Heaths cover a large area of Brittany. (In Finistere and Morbihen alone they constitute 1/5 of the total land area). The typical plant species to be found here are *Ulex gallii, nanus* and *europaeus, Calluna vulgaris, Erica cinerea, cillaris* and *tetralix* and also *Molinia coerulea.* Efforts are being made in many places to afforest these heaths and we were to see some of these during our tour. The job of securing land to plant was in many cases proving a difficulty.

The State forest administrative region of Brittany is divided into four departments: Cotes-du-Nord, Finistere, Ille et Vilaine, and Morbihan. At the head of the region is a Conservateur and over each department is an Ingenieur en chef des Eaux et Forêts.

The professional organisation of the private forest owners has in the region a union of the syndicates of "Sylviculteurs" owners and one technical association for forest instruction: the A.T.V.F. In the department there is one syndicate of "Sylviculteurs" owners and one centre of Forest technical study: the C.E.T.E.F. which is headed by a forest officer and forest adviser.

Brittany is the least afforested province of France. The percentage under timber is under 6%. In three departments the situation is as follows:

| | *Private forests* | *State forests* | *heaths* |
|---|---|---|---|
| COTES-du-NORD | 75,000 acres about | 6,250 acres | 150,000 acres |
| FINISTERE ... | 75,000 acres about | 10,750 acres | 300,000 acres |
| MORBIHAN | 137,500 acres about | 6,750 acres | 310,000 acres |

In Cotes-du-Nord and Finistere, private forests consist of 4/5th coppice and coppices with standards and in Morbihan softwood coppice amounts to 87,500 acres.

We are told that in recent years efforts were being made to step up afforestation both on state and private property. One of the recent remedies adopted for private lands has been the introduction of the "Pisani Law", the aims of which are to encourage co-operation, to popularise methods of intensive sylviculture and to compel the owners of big and medium forests to have planned management.

The State we learnt gave many inducements to private owners. These are (1) the landowners can by contract entrust the management of their lands to the State. (2) Measures to encourage the association of forest properties: loans and fiscal privileges for reafforestation and forest conservation to associated landowners in "groupments forestiers" (forester associations). (3) Reductions in taxation are provided for transfers: the new landowner can have exoneration of three-quarters of his taxes for 30 years on condition that the State controls his management. (4) Above all comes the "Fonds Forestier National" (National Forester Fund). It provides state grants, loans and labour contracts and gets its own life blood from a tax on the proceeds of forest exploitation. The eventual aim of the F.F.N. is to afforest 2,500,000 acres.

*First Day (August 31st).*

ON our first day we visited the domanial Forest of Villecartier under the leadership of M. de la Fouchardiere, Ingenieur en Chef-Cotes-du-Nord. This forest covers an area of 979 hectares, (2,447 acres). The forest consists primarily of beech and oak which is managed on a 180 year rotation. This rotation is divided into six periods of 30 years. The forest is regenerated by the gradual opening of the canopy at the

end of the rotation. The old trees are all removed 20 years after the first opening is made; by this stage the young beech are well established and the gradual process of thinning out the poor quality stems begins. We were told that a good mast year occurs once every 4 or 5 years. The last good year they had here was in 1961.

The rock is composed of granite with gneiss and micaschist. The soil is a white clay strongly mixed with sand. The top few inches have a thick humus layer.

The forest has a temperate, humid, climate owing to its proximity to the sea, and was particularly suitable for the growing of beech. In the less fertile areas of the forest the exotic conifers were being introduced. The species used were Douglas fir, Sitka spruce, *Abies grandis* and *Tsuga heterophylla.* The European species of Scots pine, Norway spruce and Black fir have been growing on the poorer areas for eighty years.

We were told that the beech of Villecartier was formerly used exclusively for the wooden shoe industry. To-day the good quality beech is in demand for veneer and furniture but poor quality timber was difficult to sell even for firewood. We learnt that only the State went in for growing beech and oak on these long rotations as obviously it would be uneconomic for a private individual to do this.

We were also shown two small nurseries, one of two acres and one of five. In these nurseries we saw very vigorous growth of all species. A feature here was second growth in late summer on a good many species; this in particular was evident on Japanese larch, which was (1 + 2) years and 5 ft. high. Other species grown were Norway spruce, Douglas fir, *Cedrus adlantica,* Corsican pine, Scots pine, Lawson cyprus, Sitka spruce and beech.

We learnt that in this nursery nearly all weeding was done by women; no chemicals were used.

Another interesting fact that came to light during our discussions was that there were two types of forest workers. The first, were those paid by the month who earned about £10 per week, these were usually local farmers, and then, there were those who earned their money on a piece rate basis, these started work at any time and they usually had a second job as well.

As time was short we had only a very brief stop at a poplar nursery. Of principal interest was the very fast growth of the young trees.

After an excellent lunch in Dol at the Hotel de Bretagne we drove on to St. Malo and most of the party went for a walk along the ramparts of the old town in preference to a visit to the Quic-en-Groigne museum.

In the afternoon we visited the mammoth hydro-electric works called the Rance Barrage. We saw here that engineers had succeeded in the first step of putting a dam across a narrow section of a long inlet of

the sea and thereby harnessing the fast tides that course in and out. At the time we saw the works, they had at last succeeded in connecting the temporary dam across the inlet after much arduous work on everybody's part. The turbines were now in the process of construction and the dam proper would then be built around them. Giant locks permitted ships to pass up and down the Rance or inlet.

M.J.S.

*Second Day (1st September).*

Under the guidance of M. de la Fouchardiere the day began with a journey along the Cote d'Emerande in brilliant sunshine and a fresh north wind.

We moved west via St. Lunaire, Cape du Décollé, St. Cast. to Cape Frehel, and Erquy in sight of wide sandy beaches, granite cliffs and buildings, brightly coloured boats, and fishing villages all the way.

On Cape Frehel there was a wonderful display of gorse, heather, and other flowering plants in bloom on the heath, which contrasted with vertical columnar cliffs of red granite, with racing currents below, and numerous sea birds overhead.

After an excellent lunch in Chatelaudren came a visit to the Forest of Malaunay.

This was a rather flat area of 1,400 acres of poor coppice and scrub on an impermeable soil.

Past usage and wartime fellings had left an irregular mixture of scrub oak, sweet chestnut, and alder with much broom.

The property was purchased for the production of commercial conifer plantations, by the "Compagnie des Polders de L'Ouest" about seven years ago, and our party was welcomed on the land by M. Fortin, President of the Compagnie, who was introduced by M. de Kerouartz, President of the Syndicate of Forest Proprietors of Cotes-du-Nord.

The reafforestation was carried out under a very interesting contractual arrangement, by which the owners agreed to accept a working plan prepared by the National Forest Service, and controlled and supervised by the Local District Forest Officers, who made estimates and awarded the work to private contractors.

The cost was met from the "Fonds Forestier National," a special fund, managed by the Ministry of Agriculture, and derived from a tax on sales of forest produce, which is an important sector of the French economy.

The money spent is regarded as a loan, secured against the forest crop, and subject to the very low charge of $\frac{1}{4}$th% interest.

There are tax concessions up to the stage where saleable produce becomes available. Thereafter, the State takes half of all receipts until the outgoings have been reimbursed.

All operations are to be subject to the Forest Service approval up to the time when the crop becomes free of debt. Full control will then pass to the owner.

There are generous conditions in favour of the owner of the land in the event of fire or other disaster.

As 60% of the able bodied men in the region work in the fishing fleet during the summer, and labour is available only in winter, forest work has to be mechanised, and tending of plantations must be arranged to suit.

In Malaunay, a heavy tractor, fitted with a toothed dozer blade, which tore up and pushed aside the scrub, without removing much soil, was used to clear lanes, which averaged about ten feet wide.

These were planted with three lines of Japanese larch, Sitka spruce or Douglas fir according to soil moisture and condition of fertility. Silver fir was interplanted.

This arrangement was not rigid, and if the scrub was tall the lanes were wider and might accommodate up to five lines of plants, and in patches of short scrub they were narrower and might only take two lines.

The pricipal troubles were with stagnant water, and a strong regrowth of broom. Drainage solved the first, and, in order to avail of the nitrifying action of the broom, weeding was limited to cutting half of each strip in alternative years.

The young conifers were 1.8 metres tall (5¾ ft.) approximately when planted and spacing was 6½ × 6½ ft. 55% to 60% of the area was cleared, and it was intended to allow the strips of scrub to remain to provide shade from sun scorch, and to help clean the conifers.

It was predicted that a yield of 3,300 cu. ft. per acre would be obtained at 40 years: at present prices this could be felled to yield 21,000 Frs., per acre, or £1,500 approximately.

Silver fir was intended to form a long term crop when the other species were felled.

The total cost of bringing the young crop to a stage where the conifers were safe from weed competition was stated to be 2,000 Frs. per hectare, or £58½ per acre.

The plantations of four to six years old were vigorous and of good form.

The next stop was at l'Antic, where M. de la Fouchardiere and his family had their own forestry project.

The land was flat, with a heavy structureless clay soil, difficult to drain, but reasonably fertile.

Thirty hectares had been purchased from fourteen tenants, and the fragmented condition of the agricultural holdings was indicated by the fact that there were fifty small plots of land involved.

When the tenants took to sea fishing for their livelihood, oak and birch scrub, with prunus and *Rhamorus* (buckthorn) species, spread over the land. Purchases were made from time to time, and the more open parts were rotavated, while lanes were cut through the taller scrub, and planted with shade bearing species.

Tsuga and Sitka spruce were the main species with smaller amounts of Japanese larch, Corsican pine, *Abies grandis, Pinus contorta, Sequoia,* and *Crypthomeria japonica.*

Spacing was 2 metres ($6\frac{1}{2} \times 6\frac{1}{2}$ ft.), and the young plants were 20" tall ($\frac{1}{2}$ metre).

Careful drainage was necessary as water tended to lie on the surface in wet weather.

Although the land was fertile, M. de la Fouchardiere favoured the use of manures in order to overcome weed competition quickly.

Due to local climatic factors the date of flushing of buds might vary between mid March and mid May. Spring frosts could be troublesome, especially for strains originating in more continental climates.

All the plantations promised to be highly productive, and in the oldest, at nine years, a few Sitka spruce had leaders up to 1.7 metres ($5\frac{1}{2}$ ft.).

The earlier purchases were made for 80 to 100 Frs. per hectare (£$2\frac{1}{2}$ to £3 per acre) but more recently up to 600 Frs. hectare (£18 acre) had been asked; which was regarded as proof that the land was unfit for agricultural use.

The owners' great pride and satisfaction in the plantations was obvious and an enthusiastic discussion took place. The effect in stimulating owners of similar lands to plant was stressed.

The day ended at our overnight stop in the delightful holiday resort of St. Quay Portrieux.

E.J.

*Third Day (2nd September).*

The members boarded the bus at 8.30 a.m. and in brilliant sunshine we left St. Quay Portrieux behind and drove to the Bois de la Salle Castel. Here we were welcomed by the owner, the Marquis de Saint Pierre, and after a short walk through old woodland with species ranging from oak and beech to silver fir and Scots pine we arrived at a small plot of Sitka spruce.

Chief Engineer, M. de la Fouchardiere explained to us that this stand which was planted 55 years ago was the oldest block of Sitka spruce in Brittany. The original site was considered poor supporting mainly species of *Juncus* but the fact that 100 ft. in height had been reached by the Sitka spruce augured well for the future of this tree on similar sites in Brittany. It was mentioned by one of the party that this particular stand would, according to B.F.C. yield tables, be classified as

quality class II and on hearing this M. de la Fouchardiere remarked that so far no yield tables had been published for Brittany.

Moving on we next came to a stand of 51 years old tsuga, a tree which grows quickly under suitable site conditions. There was much evidence here also of natural regeneration of silver fir which had been propagated by the old silver fir growing close by.

After seeing a sample of a board cut from a Sitka spruce tree growing on the estate our visit to the Bois de la Salle Castel terminated. Mr. Swan then thanked the Marquis de Saint Pierre for allowing us the privilege of visiting and inspecting his woodlands.

Back once more in the bus we headed for the town of Treguier, passing en route the River Trieux. During our short stay here we sampled the atmosphere of a Breton market with its bewildering assortment of clothes, foodstuffs and miscellaneous objects of all shapes and sizes. The XIV century Cathedral with its cloister we also found impressive. However, time did not permit us to tarry too long in this quaint town and so on we travelled to Guingamp.

Our arrival at the home of the Marquis de Kerourtz was heralded by two musicians in native Breton dress, playing traditional airs on the bagpipes and a bugle-like instrument called a bombard. The magnificent banquet to which we were then entertained by the Marquis and the Breton forest owners was certainly one of the highlights of the tour

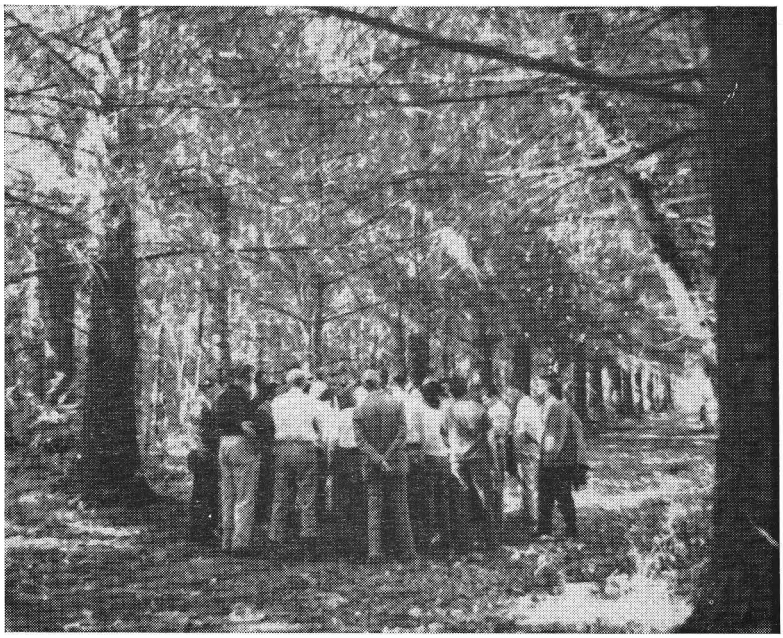
and everyone of us will long remember the delightful singing of traditional Breton songs by the pretty brown-eyed girl. At the end of the meal Mr. Swan thanked the Marquis de Kerourtz, his gracious wife and the forest owners for their wonderful hospitality and generosity and it was with much regret that we bade farewell and continued on our journey.

T.McG.

*Third Day (afternoon).*

(Visit recorded by Mr. McNamara, as owing to upset in plans the remainder of the party were not at this scheduled stop).

Visit to wood of "Le Restmeur" belonging to Comte de Kerouartz, President of the Syndicate of the Forest Owners of Cotes-du-Nord.



"Le Restmur" covers an area of 100 acres and is situated at an altitude of 300 ft. The soil is a deep white moist clay derived from decomposed granite. The wood carries a covering of coppice oak, birch and hazel with a sprinkling of 120 years old oak, beech and sweet chestnut trees. Near the avenues and rides fine specimens of Corsican pine and silver fir of the same age are to be seen.

Since 1937 the Count has directed his efforts towards the changing

over from coppice to exotic conifers, mainly Sitka spruce, *Tsuga heterophylla* and *Abies pectinata,* the latter by means of natural regeneration. The first plantation of Sitka spruce was laid down in 1937 after the coppice had been removed from the site. The spacing used was 2 m. × 2 m. Some of the trees have now attained a diameter of 14″ and a total height of 72 ft. The plot was thinned in 1962 and a check showed that the annual growth over the previous 4 years averaged 4 ft. per year. This first effort at introducing Sitka was on a small scale (only 500 trees being used) but as demand for firewood increased in subsequent years, leaving more cleared ground available for planting, a further 15,000 spruce were planted. On account of the difficulties caused by the war these latter trees did not get all the attention they required and coppice re-established itself, but on the whole the vigorous trees survived and are now well clear of the coppice.

The first plantings of *Tsuga heterophylla* were carried out in 1946-47. The species was introduced mainly as an under-storey through coppice and standards. Hand in hand with this artificial planting went the natural regeneration of silver fir, so that to-day, the conversion of the wood from coppice to fast growing conifers has progressed a long way. Further cutting back of the coppice under-storey will be necessary —particularly with the tsuga and silver fir.

In the course of discussion Count Kerouartz emphasised that a tree has a definite life cycle and if kept in check for a part of its life would

never attain the volume it would have attained under full light conditions. For example the Count pointed out a plot of *Abies pectinata* 60 years old which had an average B.H. diameter of 9" and a total height of 80 feet. The crop was grown under an over-storey of sweet chestnut and was not released until its 40th year. As a contrast the owner was able to point out a silver fir 60 years old with a mid-diameter of 15" and timber height of 60 ft. Another example was 70 years old with a mid diameter of 19" and a height of 72 ft. He said that a silver fir felled during the last war measured 570 cubic feet.

Field trials carried out by the Count with *Eucalyptus gunnii* showed the blue variety to be more resistant to winter frost than the green variety. The blue strain of the species was undamaged by 20° of frost while the green suffered severe damage under similar conditions. Plots of *Larix occidentalis* planted in 1958 would suggest that the species grows more vigorously under the conditions prevailing in Brittany than in Ireland. As appears to be the case in Brittany generally, poplars on the estate are not doing as well as in other parts of France. This is probably due to the lack of calcium which is prevalent over most of the area—pH is 4 to 4.5.

*Fourth Day (3rd September).*

At 8.50 a.m. the party left on foot from Hotel d'Angleterre in Huelgoat. The forest being visited was the Domanial Forest of Huelgoat made up of three series with a total area of 590 hectares.

1st Series—101 hectares—of relatively young Conifers.
2nd Series—380 hectares—of Regular Forest of Oak and Beech.
3rd Series—109 hectares—of Coniferous Amenity Forest.

The area being visited was part of the 3rd Series which was beside the town. The leader was M. Morize, Ingenieur en Chef, who had spent fifteen years in this district. He had left the area only two months previously and had returned to lead the tour as his successor had only arrived on the previous day.

The valley is strewn with colossal granite boulders of every shape and size. Paths and natural arches around and between the stones are favourite tourist walks. Many people visit the area to see the stones and for the peace and quiet of the old woods. There are many connections also between the boulders and ancient legends and folk tales. As many of these huge rocks are scattered through the forest the aim here is to supplant the old Scots pine by natural regeneration and planting. The old Scots pine crop were originally planted on heath. They are being gradually removed and replaced by silver fir and Norway spruce. These will give a cleaner forest floor than at present and so make the woods more traversable for tourists. Many of the large granite blocks are in a ravine and a torrent of water usually cascades through the rocks. However, during our visit there was only a trickle of water as the area had had three months of drought.

In the wood we visited La Hutte de Sastotier—the shoemaker's hut. Here an old man made beech clogs and wooden souvenirs. Clogmaking was part of the old woodland craft, and it was kept alive by the sale of wooden souvenirs to tourists. The party arrived back at the Hotel at 9.50 and proceeded west by bus to see the forest groups of Coat Compez and Quillivian.

*Forest Group at Coat Compez.*

As we proceeded westwards the land got poorer and large areas of waste heather were to be seen. Finisterre is the least wooded part of France with only 4.4% of ground under forests but it has as high a proportion of heathland as 16%. The heaths are generally found on light shallow soils over granite. One of the aims of State forest policy is the afforestation of these heaths, but it is difficult to make progress as the heaths are nearly all privately owned in small portions by farmers who are often wary of the idea of afforestation of their lands. Indeed the very smallness of the individual holdings presents problems and very often while a majority in a certain area, might be willing to have their lands planted there is always the one or two who object; the objectors lands very often being surrounded by those willing.

To overcome this difficulty a new system was started called the "Groupement Forestier". One such group was the Forest Group of Coat-Compez. This is an area of 65 hectares owned by nine people and planted in 1959. Prior to planting the area was covered with furze two feet high. The preparation of the ground consisted in clearing lanes 2.5 metres wide, leaving bands of 1 metre wide uncleared. The clearing was followed by subsoiling at a depth of 50 cms. In the subsoiled land slag was spread at a rate of 580 k.g. per hectare. The clearing was carried out by using a caterpillar tractor with a shovel in front. The cost of mechanical work was as follows :—

(1). *Clearing and Subsoiling*—27.600 F. (£2,001) i.e. 424 F. per hectare (£30 per h.).

(2). *Providing and Spreading Manure*—5.670 F. (£411) i.e. 97 F. per hectare (£7 per h.).

In addition to the above, in the unwooded part, draining was necessary at a cost of 811 F. (£58).

(3). *Plants Used.*

| | | | |
|---|---|---|---|
| 83,900 | Sitka spruce at a cost of | 28.700 F. | (£2,080). |
| 7,800 | Spanish chestnut at a cost of | 2.200 F. | (£159). |
| 700 | Lawson cypress at a cost of | 220 F. | (£16). |

The Sitka spruce came from Belgium. The young trees were mattock planted in the subsoiled lands at intervals of 2 m. for the Sitka spruce, and 2½m. for the Spanish chestnut; there was 11 ft. between the lines. In every tenth line Spanish chestnut was planted; the broadleaved trees were to provide humus.

Total cost of the work excluding the digging of drains came to

64,000 F. (£4,639) or approximately 930 F. per hectare (£67 per hectare).

*Groupement Forestier de Quillivian.*

Over the hill from the Coat Compez plantations we visited the Quillivian Block. A group of twenty-two owners was formed in December 1958. The lands totalled 94 hectares. The preparation of the ground in this block was somewhat different. Ploughing, somewhat similar to our own, was followed by subsoiling. Half metre wide bands were ploughed at 2½ metre intervals. The subsoiling went to a depth of 40 to 50 cms. No subsoiling was done in the direct seeded area. The subsoiled bands were spread with slag at a rate of 500 k.g. per hectare or 200 grams per plant for pines and 250 grams per plant for the rest.

*Cost:* *Ploughing and Subsoiling* —39,500 F. (£2,863).
*Provision and Spreading Manure*— 4,400 F. (£317).
140 K.gram of maritime pine seed were sown on 18 hectares— 3,300 F. (£239).

| | | | | |
|---|---|---|---|---|
| 51,600 Scots pine | planted in | 27 hectares | 8,500 F. | (£616). |
| 5,700 Red oak | | | 911 F. | (£66). |
| 18,500 Japanese larch | „ | in 9 hectares | 3,170 F. | (£229). |
| 82,000 Sitka spruce | „ | in 51 hectares | 15,800 F. | (£1,145). |
| 7,000 Douglas fir | „ | in 3 hectares | 1,720 F. | (£124). |
| 4,000 Abies grandis | „ | in 3 hectares | 931 F. | (£86). |
| | | 93 hectares | | |

The plants were put down by mattock planting at distances of 1½ metres apart for pinus and oaks.

3 metres apart for Japanese larch, Sitka spruce and Douglas fir.

5 metres apart for *Abies grandis.*

Total cost 78,000 F. (£5,655) or 882 F. per hectare (£64 per hectare).

*Elevation:* of both plots approximately 280 metres.

*Fencing:* No fencing used as there were no sheep or cattle to trespass on planted ground.

*Roads:* Road sites are left now—roads will be constructed later.

*Markets:* No markets yet—later it is hoped to have markets for poles and pulp.

*Rotation:* No rotation laid out—the policy is wait and see.

About a mile from Le Faou the party stopped to see Cranou Forest. This is an oak forest approximately 130 years old, treated as regular high forest; it covers an area of 603 hectares. The forest lies approximately 25 miles from Brest and is much frequented by tourists at all times but especially when the daffodils are in bloom. After a brief stop

at Cranou the party left for the peninsula of Crozon—a beautifully barren cape extending westwards into the Atlantic. Having spent some time touring this rugged area the party travelled to Quimper for the overnight stop.

Before our dinner at the hotel the party had the honour of being welcomed to Quimper by the Prefect of Morbihan. After a short address to the party which was replied to by Mr. Swan, his Excellency chatted with the members and then departed as he had to preside at another function.

A welcome guest at the dinner was Mr. Mac Piarais, Assistant Secretary of the Department of Lands. At the end of the meal Mr. Mac Piarais was presented with a beautiful set of dinner ware by the Breton forest owners. This was a gift presented in gratitude for the hospitality of the Forestry Division when they (the Bretons) visited Ireland the previous year.

The party were entertained afterwards by open air singing and dancing of Breton folk-tunes. On request a few stalwart members sang Irish songs and were enthusiastically clapped by the large crowd. At the end of the evening our President was presented with a large china soup cauldron. He gave a short speech in Irish in thanks.

To close the evening our entire group sang the Irish National Anthem.

FF.

*Fifth Day (September 4th).*

On Friday morning, M. Morize, Engineer-in-Chief for Rennes, bade us farewell and introduced us to M. Hermite, Engineer-in-Chief for Morbihan.

M. Hermite welcomed us to his district and expressed regret that we were not favoured with a fine day. He led the party on a tour of the Arboretum of Camors.

The arboretum is situated 30 kms. north-east of Lorient and 25 kms. from the coast. It lies at an altitude of 100 m. The climate is mild but late frosts sometimes cause damage to early flushing species. The soil is a rather shallow brown podsol which overlies a granite subsoil.

The arboretum was laid down in 1934 with 80 plots of conifers, each plot measuring 10 m. square. Approximately 50 plants were used per plot. Failures were replaced in 1938 and some additional plots were laid down in 1941 and 1955.

The most successful plots noted were of *Larix leptolepis, Picea obovata, Picea omorica, Pinus contorta, Pinus insignis* and *Pinus muricata.*

Of interest to our party was the satisfactory rate of growth. This was attributed to the climatic conditions prevailing in Brittany which

appear to favour greater autumn growth than we are accustomed to in Ireland.

In the afternoon we were treated to a delightful tour in the Gulf of Morbihan. Here we saw the little island of Berders where Count Dillon of the Irish Brigade lies buried. Along the shore we saw fringes *of P. insignis, C. macrocarpa* and maritime pine which showed no apparent signs of exposure.

Our one regret for the day was that circumstances prevented us from meeting Madame de Saint-Georges as originally planned.

M.McN.

*Sixth Day (5th September).*

On the last day of our official tour we left the town of Vannes and soon ran into the rain that we had encountered the previous morning. This rather spoiled our visit to the ancient forest of Paimpont and we had to be content with a view through the rain washed windows of the bus.

Our booklet told us that the forest of Paimpont, of coppice origin, had been subjected to the ravages of centuries of misuse. It had in turn supplied timber for the needs of the smith shops, glass-trade, potteries, brickyards and also during various wars its reserve had literally been mined. A few efforts had been made to replant portions of it at various times in the past but these had not been very successful. The booklet went on to explain that the cause of these failures could be attributed to poor soil, fires and rights of grazing that still exist. In conclusion it was hoped that Weymouth pine, Japanese larch, Douglas fir and the spruces could be introduced provided they were fenced off from the game. Scots and maritime pine would constitute the basic coniferous crop.

We had what can only be described as a magnificent farewell lunch at an old chateau in Paimpont. Speeches followed by M. de las Croix Vaubois, Conservateur des Eaux et Forêt, and our President, Mr. Swan. Mr. Swan thanked everybody concerned for what had been a most memorable and varied tour. He said that it would be difficult for him to mention by name everybody he should thank, however, he felt he should mention two persons in particular, one was Melle. Eno, our interpreter, who had been not only his interpreter but also companion, philosopher and guide during the tour, and the other was Miss Furlong, our convener, who had so ably looked after us all during the tour. He went on to say that we would all return to Ireland with happy memories of our visit and there would be many he felt sure who would return again now they had this wonderful chance to see the country and its people. Thus our tour of Brittany closed and the party dispersed some returning home and others staying on for another few days or weeks.

M.J.S.

# *Reviews*

## FOREST RESEARCH IN NEW ZEALAND, 1963

*Forest Research Institute, New Zealand Forest Service.*

IN this report for the period 1963 one is again struck by the formidable programme being undertaken by a limited research staff in a very extensive range of forestry activities.

The Directors review and branch reports are outlined in two sections. Administration, policies and the broader implications of the year's work are presented in the former. The increasing importance of the electronic digital computer as an essential tool for forestry research is pointed out. It is significant that in New Zealand as elsewhere the impossibility of fully containing the numerous variables which are involved, for instance, in silvicultural, provenance and genetical analysis without the aid of the computer, is realised. Easy access, however, must be readily available to enable the computer to be used properly as a research tool and as yet, it is pointed out, this is not the case in New Zealand. It is felt that the heavy investment to date in forest research easily justifies the acquisition of one. The necessity for other up-to-date equipment, such as the electron microscope, is also recognised.

Adequate facilities are regarded as of prime importance, even more so than attractive salaries, for the retention of a good research staff. Though £140,000 was allocated for a new forest products research laboratory, that professional vacancies remain is blamed on the lack of proper facilities at the Institute.

Exchange of ideas and personnel with other countries has paid dividends to the Institute but grants for approved research at New Zealand Universities are felt to be inadequate to carry out many potentially promising investigations.

In the branch report of annual progress one is struck by the great importance of *Pinus radiata,* and by the enormous investment in the species. That in every field of research the species assumes such an important place, indicates the extent to which forestry in New Zealand depends on *P. radiata* and the energies which will be directed towards its preservation.

Pruning and thinning dominated the silvicultural scene and a symposium was held during the year at the Institute. The most significant achievement was the analysis of permanent sample plots data from thinned stands of *P. radiata.* Large numbers of punch cards are being used to bring the plot calculations up to date. A universal method was derived for the prediction of increment and yield under different thinning regimes. All increments were plotted against height as an independent variable, instead of age, so that the final yield table for any particular locality or site was based on the actual

height/age relationship without any attempt to harmonise such curves for different sites. Total and final crop yields were shown not to differ greatly under a variety of thinning treatments. There is a suggestion that *P. radiata* may be grown on a short rotation with associated pruning treatments and Douglas fir on a long one. The subject of pruning treatment is still open to question. It is held that pruning the first 18 ft. log is practicable, but that pruning the second 18 ft. log is not. It is felt that a 7-8 inch knotty core is far more realistic than one of 6 inches as a very drastic pruning schedule is needed to achieve the latter.

In the economics of management it is realised that pruning costs can pale into insignificance as compared with thinning and so the possibility of thinning to waste in difficult areas (i.e. without recovering the material) is discussed.

Costings showed that the establishment of Douglas fir is 50-100% more expensive than *P. radiata.*

Local volume tables were constructed and tested for different species and were found satisfactory. Mature hardwood volume tables were also produced, with sets of diameter/volume tables for 23 exotics. Crown closure/basal area relationships were investigated with the aid of aerial photographs. Large numbers of variables caused the abandonment of further thinning treatments on spacing trials—though thinning was applied to one considered uniform enough.

The first exotic forest survey was completed. Three tables show distributions of areas by conservancy, species, age classes, etc. *P. radiata* features most prominently, covering 65% of total area. The area planted in the last 10 years was 12% of the total, compared with 52% in 1926-35. 431 volumetric plots have been measured for accurate computation and maps and data of the surveys have been photographed.

An economic survey for land use was carried out in the Bay of Plenty in a 25,000 acre area.

Genetic studies have been carried out on *P. radiata* and other species, especially with regard to open pollinated families but a general lack of well designed experiments is felt. It is believed that hybrid vigour contributes more than do additive genetic effects, to the great phenotypic variation in vigour of *P. radiata.* Studies in mating patterns have also been carried out. Pruning of seed orchards to increase flowering was found effective.

Provenance research concerned *P. pseudostrobus, P. patula* and *P. montezuma* and 30 Douglas fir provenances. Analysis was greatly simplified by use of the computer in assessing 6 year old field trials in *P. nigra* and Douglas fir.

Growth of exotics on soils unsuitable for agriculture, especially the volcanic ash soils of North Island was studied. N. and P. deficiencies were investigated.

Entomological research involved investigations into the tortricids

and *Sirex,* showing Douglas fir to be more susceptible to the former than *P. radiata.* Insect damage to Eucalypts was examined and assessments of wood borers were made. Mycology mainly concerned nursery diseases. 6 Methyl bromide chloropicrin was found to be an effective soil sterilant reducing loss in the nursery.

Saturated solutions of 15 lb. amonium sulphamate crystals per gallon is an effective poison to control weeds and 2, 4, 5—T and 2, 4—DP are shown to be promising selective weed killers in *P. radiata* plantations, and 2, 4—D for Douglas fir.

Indigenous forest research with emphasis on the podocarps with regard to their susceptibility to animal damage, viability and shade tolerance, is being undertaken.

Animal research into living habits and population dynamics is under way. Watershed surveys, climatological and geological studies in forest terms are being carried out. Reafforestation investigations with reference to *P. contorta* as a pioneer are continued.

In the field of timber products and wood chemistry, shrinkage, the study of microfibrillar angle and heartwood formation in *P. radiata* is being assessed. Pole properties of *P. ponderosa,* seasoning, drying and wood preservation are all under review. Wood density of Douglas fir has been investigated. A study of steam effects on *Notofagus fusca* (Red beech) was initiated. 36 wood rotting fungi were isolated. Wood chemistry dealt mainly with analysis of wood cellulose in *P. radiata* and to a lesser extent with lignin extracts in Douglas fir.

The Report concludes with an account of Institute services—biometrics, library and publications. A list of professional staff is included and publications by staff, undertaken during the year are reported.

The Bulletin contains 4 tables and 16 photographic plates and is very comprehensive in its coverage of the year's work. Some indications of the research budget compared with the total State forestry budget would have been interesting. Perhaps a better dispersion of photographs and more illustrated diagrams would have aided the digestion of the very wide range of information.

G.G.

# TWENTY-SECOND GENERAL REPORT OF THE MINISTRY FOR AGRICULTURE FOR NORTHERN IRELAND, YEAR ENDED 31st MARCH, 1963

Review of the Forestry Section.

*Published by Her Majesty's Stationery Office, London. Price 5/6.*

THERE are a total of nine-and-a-half pages of this 82-page report devoted to forestry, four of which comprise a detailed appendix analysing the acquisition and planting of land for forestry throughout Northern Ireland. From these four pages and the first two sections of the report one can match progress of acquisition with that of planting. With a planting programme of 5,000 acres per annum the existence of a plantable reserve of 29,809 acres shows that, up to the present, the purchase of land has kept a comfortable distance in advance of planting. At first glance the acquisition of 7,858 acres during the year suggests that the land market is still buoyant but it is to be appreciated that 2,836 acres were already in the possession of the Ministry so that, in fact, some 5,022 acres, or a mere 22 acres in excess of the programme were obtained. The Ministry expresses its fear that the problem of land acquisition is going to become more acute in the future.

Accepting that publicity is a form of education I find it interesting to note that, of the 19 sub-headings in the report, education, in one guise or another, is referred to in nine of them. Development of public interest in forestry was fostered by means of talks and exhibitions which totalled 34 in the year. Tree felling and fire-fighting competitions not only ensured a raising of the standard of work but also drew large audiences. A unique feature of education was the establishment of a small demonstration nursery at Pomeroy where, incidentally, a full programme of courses was maintained to include foremen, leading labourers, specialist operators plus refresher courses for foresters, District Forest Officers, school teachers, etc. The value of amenity forestry need hardly be stressed as a means towards useful publicity and increased appreciation of forestry by the public. In the United States and Canada the intangible benefits have long been appreciated and in Europe the pace is rapidly increasing to provide recreational facilities in the forests, which indeed contribute not only to the well-being of a nation but can be quite lucrative. In this respect Tollymore Forest Park attracted 26,792 visitors, a number of whom camped there.

The highest degree of public awareness of forestry is obviously gained by promoting the participation of the public in the planting of trees. To this end £10,000 were paid out in grants for the planting of nearly one million trees under three schemes which allowed for the planting of from 100 trees upwards. That a grant should be given for such a small number of trees indicates that state aid is available for the establishment of shelter belts, a most desirable association between forestry and agriculture. From an assessment of the figures

it would appear that approximately 450 acres were planted under the Planting Grant Scheme (i.e. where the unit for the grant was at least two acres). This is a healthy sign ensuring active participation of the people of Northern Ireland in the forestry programme and as a consequence a keen and probably gently competitive interest in the development of forestry and the marketing and utilisation of forest products.

Forestry operations have been improved by mechanisation, and of the machinery used the more intriguing are a "special swamp machine" and a 4-wheel drive tractor with large diameter wheels. Both vehicles assist in preparation of ground, from hauling and fertilising to ploughing and scrub cutting. Two 4-wheel drive articulated tractors were brought from the United States. These machines have a turning radius of 69 *inches,* can "operate under all ground conditions" and are equipped with logging arches. With such a high degree of versatility it should be most intersting to see them at work harvesting timber in dense stands.

Sales of forest produce in all classes from round timber to Christmas trees yielded the comfortable figure of £270,000. A feature that pleased me in relation to the sale of timber was the effort exerted to promote the use of post and rail fencing along road developments and it seems that now there are demonstration sections of this type of fencing in all countries; the results should be pleasing both financially from the forester's viewpoint and aesthetically from everybody's viewpoint.

But why was reference to the monetary angle restricted to the two figures quoted above? Even an outline table indicating in round figures the expenses involved in this well-rounded programme would do a great deal to tidy up the loose ends and complete the picture for us. This omission appears glaring in face of the wealth of figures quoted for grants, subsidies and costs in agriculture and horticulture embodied in the rest of the report.

L. U. G.

## *Miscellaneous*

# Commonwealth Forestry Institute Library, Oxford

## — *Microfilming Project*

By M. V. LAURIE,
Professor of Forestry, University of Oxford.

THANKS to a very generous grant from the Ford Foundation of New York, it will now be possible to make the contents of the library of the Commonwealth Forestry Institute, Oxford, available internationally.

This library has existed since 1908 and through its continuing policy of collecting the forestry literature of the world, is now probably the most complete library of its kind in existence. Its holdings of literature on tropical forestry are particularly extensive.

In close co-operation with the Commonwealth Forestry Bureau the library has built up a comprehensive card catalogue of world forestry literature classified and cross-referenced under the "Oxford Decimal System" which is now the internationally accepted classification for the documentation of forestry knowledge.

The library is not a lending library and hitherto its resources have only been available to students, research workers and others able to visit Oxford. The purpose of the grant from the Ford Foundation is to make these resources more generally available and particularly in order that developing countries may have access to the contents of the library and its indexes.

It is intended to put all important literature in the library on to microfilm within three years. The first task will be to microfilm the bibliographical card indexes which could form the basis for requests for microfilm copies of specific items. This will be followed, to the extent that copyright clearance can be obtained, by all the more important and less accessible periodicals and serial publications. Books, unless specially asked for, will be done later on.

The grant from the Ford Foundation will provide the capital equipment for the unit and will also cover the cost of the first negative and positive copies for record purposes. The supply of microfilm copies will be made on request at the bare cost of production. To start with, this will only be available in standard (35 mm. unperforated) microfilm form and in order to use it, microfilm reading equipment will be necessary. Later on it is hoped to supplement it by a photo-printing service on paper working from microfilm negative, but the cost of this will be much higher than for microfilm (probably three to five times as much). It is expected that microfilm will cost less than

2.8 pence per "frame" covering two book pages or ten index cards,—minimum charge 7/6d.

The unit commenced operating at the middle of February, and orders for the card index and for the Commonwealth (formerly Imperial) Forestry Institute Papers and Memoirs can now be accepted.

It is felt that a great debt of gratitude is due to the Ford Foundation for making possible this wide dissemination of literature in forestry hitherto hidden away in the Commonwealth Forestry Institute Library. It is hoped that full advantage will be taken of it.

# Visit of Scottish Foresters

THE Society was host to a party from the Royal Scottish Forsetry Society who visited Ireland from 2nd to the 9th October. The party numbered 25 and was led by their President, Major R. N. Jardine-Paterson. A comprehensive tour was arranged for them which included visits to the Wicklow area, to the Ballyhouras, to the famous Burren country to our planting on western blanket bogs and to forests in Northern Ireland.

The Society wishes to express its thanks to the Minister for Lands of the Republic and to the Minister for Agriculture for Northern Ireland for their kindness in receiving and entertaining our guests and for the help and co-operation of their Departments in arranging the Study Tour. We are also indebted to An Foras Taluntais for permission to visit the Peatland Research Station at Glenamoy and to Mr. O'Hare, the Station Manager and his staff for their assistance and hospitality.

A unique occasion during the visit was the meeting of the Presidents of the three Societies: The Royal Scottish Forestry Society, The Royal Forestry Society of England, Wales and Northern Ireland and The Society of Irish Foresters, at Baronscourt Estate, the home of His Grace the Duke of Abercorn, President of the Royal Forestry Society of England, Wales and Northern Ireland.

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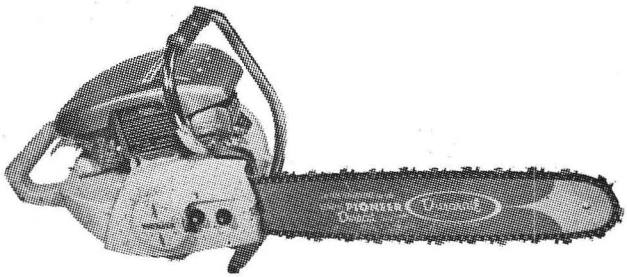

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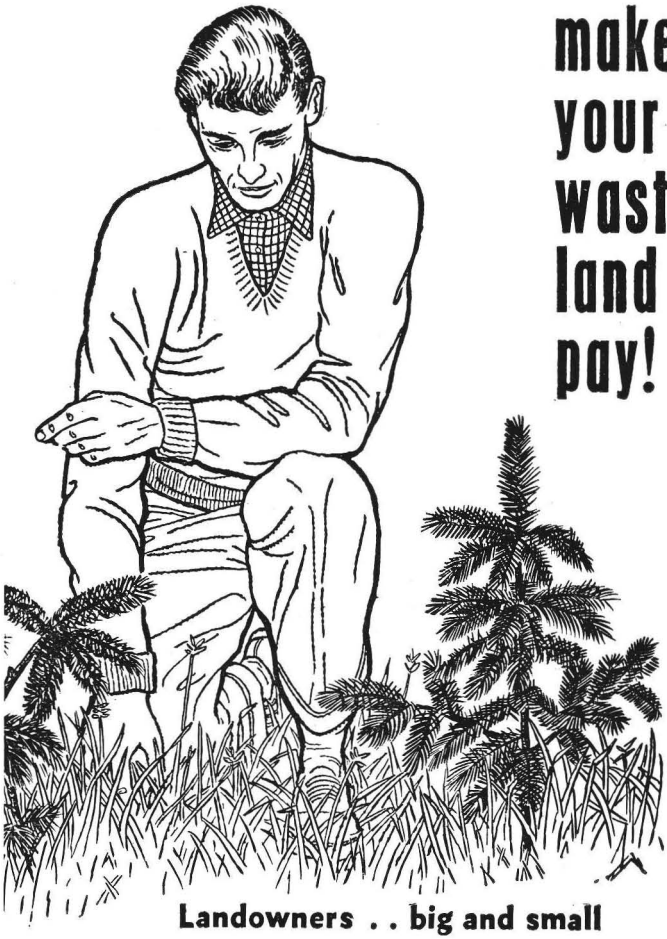

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