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IRISH FORESTRY

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PRACTICAL ECONOMICS OF FOREST OPERATIONS

WITH PARTICULAR REFERENCE TO OPERATIONS ON A PIECE-WORK BASIS

By Liam Condon, B.Agr., Sc.

The world to-day is passing through an era of economic and financial consciousness. International and national opinion is well attuned to the pleas of the economists and financiers for increased production, reduced costs of production, increased savings, etc. High sounding alphabetically-distinguished organisations have been evolved to cope with the inherent problems that exist in the various fields of economic endeavour. No less than many of the more publicised industries and enterprises, does forestry take its place in the deliberations aimed at the achievement of such desirable objectives as the " stabilisation of world economy," " the closing of the dollar gap," " the balancing of internal payments," " the increasing of the standard of living " and other worthy objects. Of forestry it may be said that a vigorous policy pursued to the ultimate in all its varied aspects, would most certainly embrace some feature of all these objectives. On no other commodity is the economy of a nation more dependent than on timber. In all branches of industry, both primary and secondary, it is an essential component. In the domestic sphere it is no less important. It has reached the position there where its usefulness and occurrence have been taken for granted. Familiarity has, in fact, bred contempt. Investigations therefore into problems of forest economy bear, even though indirectly, far more on the everyday lives of the people than is appreciated.

An appreciation of the fundamental principles of forest economics is a pre-requisite to any study of their application to forestry practice. From the very nature of the industry in itself, being a series of operations and activities spread out over a large number of years, diverse problems of economic theory are presented. The slow maturation of trees coupled with the fact that income is periodic, renders normal concepts of profit and loss inapplicable to forestry investments. The simplest concept of a forestry investment as applied to any single plantation is as follows. If all items of income and expenditure from planting to felling for any particular plantation are known, a rate of interest can be worked out which, when used to carry forward at compound interest all items of expenditure and income to the time of felling will, at the

end of that period, balance both sides of the account. This rate of interest is the rate earned on the capital invested in that particular plantation. While this concept is not the " be all, and end all " of forest economics, it is nevertheless a most useful concept for practical purposes, and should always be borne in mind. It will serve to emphasise in the minds of both the administrative and the practical forester alike the very practical importance of the impact of compound interest on the operational set up. £1 spent to-day will at, say, 4% amount in 20 years to £2.2 ; in 40 years to £4.8, and in 60 years to £10.5. Conversely £1 of income to-day will accumulate at 4% compound interest to the same figures for the same periods. Over-expenditure then, in the early stages particularly, or at any period during the rotation, will have a cumulative deleterious effect on the investment as a whole. Conversely, with income a cumulative beneficial effect is obtained as a result of any increase in returns.

Economic forestry is not, however, merely a question of making forestry pay for its own sake. Forest produce is in fact only the raw material for a variety of industries. This raw material is utilised in the manufacture of wood goods and products. If these goods and products cannot be produced at prices competitive in world markets, then the purpose of the industry as a whole is negatived. The fundamental prerequisite of the effective achievement of a competitive price for such goods is the production of the raw material at as low a cost as possible. This can only be done by a sustained and determined effort towards economy in forest operations throughout the rotation. The economics, then, of pure forestry and its related industries are integral parts of the timber industry as a whole, and as such cannot be divorced from each other.

With this appreciation, then, of the economic necessity for keeping costs in forest operations as low as possible will be realised the importance of devoting time and effort to the resolution of the problems involved. It is for the forester to decide on the practical measures necessary to implement the achievement of the economist's objectives. It is claimed by its protagonists that in no other way can this be more adequately and effectively accomplished than by the employment in the industry of the piece-work system.

Without immediately dwelling on the pros and cons of the system as applied to particular operations, a general observation would indicate widespread benefits accrueable from its employment. Personal incentive towards material gain is the panacea of all sagging production curves. Increased output means at the least a reduced percentage of overheads. In practice it will be found that the cost per unit of production will be considerably reduced. Apart from the economic aspect, benefits of another and an equally important nature can be gained through its employment. Relations between labour and management can, under a well organised scheme, be harmonious and mutually beneficial. The morale of the worker is appreciably raised. The significance of this latter factor is of paramount importance not only to the individual

worker but to the community as a whole. It is a well known and deplorable fact, though happily not universal, to find amongst workers the cynical and indifferent attitude to work which characterises the outlook of too many employees in this present age of pecuniary super-consciousness. Work for work's sake is unfortunately a relic of the past. Without surrendering to this lethargy or pandering to the cynic, efforts must be made to overcome the evil by providing remuneration on the basis of value for work done. This is in fact the essence of the piece-work system.

Before arriving at a satisfactory conclusion as to its efficacy or otherwise, an examination of the practical problems involved in its operation will be necessary. The basic principle of the system is that an individual worker is given a particular price per unit for a particular job. This can be adapted to cover a group of workers suitably graded and working as a team as required by the particular operation. In this way advantage, in the first instance, is derived in that the optimum use is made of the labour force available. " Passengers " are immediately pin-pointed and appropriate action can be taken. The value of the introduction of the personal incentive factor has already been mentioned. The extent to which this can influence practice is best illustrated by the following example of an actual operation carried out both on a normal wage basis and on a piece-work basis. (Figures quoted are those prevailing in the West of Scotland in Spring, 1952.) The working gang comprised eight not very experienced workers in charge of a skilled foreman. The operation in question was the replanting of a cleared woodland area on a rough hill-side. The method of planting was " screefing " and notching, the planting distance was 6′ x 6′, and 2 + 1 transplants of Jap. larch and Sitka spruce were used.

The following is an analysis of the results obtained :

(1) *On the fixed wage basis :*
Average daily wage per man. 25/-.
Average number of plants planted per day. 600.
Cost per 100 plants. 4/2d.

(2) *On a P/W. basis :*
Rate paid per 100 plants. 3/3d.
Average number of plants planted per day. 1,000.
Average daily wage. 32/6d.

Thus in this instance output was increased by 66% and the cost per unit was reduced by approximately 22%. Translated into terms of economics and profit and loss this means firstly, because of increased output, a 60% reduction in the charge for overheads. Secondly, recalling to mind the previous concept of a forestry investment, the saving of 22% in the cost per unit or alternatively £22 in every £100 in this, the very first year of the investment, will at 4% C.I. mean at the end of the rotation an ultimate saving of ten times that amount. This combined with the saving in overheads will appear on the credit side of the balance sheet as a very substantial amount. The economic significance of this

is obvious. The individual worker has increased his earnings by approximately 30%. He has given value for wages received and in doing so his voluntary increased effort has produced its just reward. The practical significance of this is equally obvious.

From the strictly economic and from certain aspects of the practical viewpoints, therefore, the advantages of the piece-work system appear indisputable. The word "appear" is used advisedly as numerous pitfalls exist which in the long run can prove costly. The most obvious are, firstly, the tendence to sacrifice quality for quantity, and secondly, the tendence on the part of some workers to avail of the numerous opportunities for fraudulent practices which can, and do, occur. These are real and formidable objections. Both practices, if indulged in to any extent, can negative all efforts at reducing costs by necessitating costly repetition of inefficient work on the one hand, and resulting in appreciable financial losses in operations on the other. While the objections, however, are undoubtedly valid, the problems arising out of them are not insurmountable. They introduce two very important and inter-related factors which have a considerable bearing on the operation of the piece-work system as a whole.

(i) The quality of labour employed.

(ii) The efficiency of the supervisory staff.

With regard to the former the simple fact is that the worker on piece-work must know his job. A capable worker can do his job as efficiently at speed as he can do it in slow time. The man who is capable and efficient will not need to resort to fraud to make his wages. This concept of labour however, human nature being what it is, is idealistic in the extreme and can never be fully achieved in practice. The importance of the second factor is thereby emphasised. In the writer's experience no greater influence is exerted on the success or failure of any piece-work operation than by the efficiency of the supervisor connected with it. He holds the key position in the entire organisation. A good supervisor can quickly discern the efficient from the inefficient. He should, to inspire confidence, be competent to give practical demonstrations where such are required to initiate a willing but unskilled worker. Skimpy or careless work must be checked immediately and if necessary stringent measures taken to ensure against a re-occurrence. To combat fraud he must always be on the alert and possess a complete awareness of what he is up against. He must use his ingenuity to improvise different checks and cross-checks on the units of work completed by any individual worker. This supervisory efficiency must be maintained at all levels. An error in the estimation of the rate to be paid on the part of the staff in managerial capacities, can, likewise, lead to losses and result in higher costs of production rather than lower. Thus, whatever the quality of labour employed, were it even the best, inefficiency on the part of squad supervisor or manager can defeat the purpose of the entire system.

Consideration in detail in relation to individual operations will grant a reasonable picture as to how the piece-work system operates in practice. Generally speaking, over the wide range of forest operations every phase of activity can be adapted to allow for working on a piece-work basis, in the nursery and in the forest (planting, pruning, thinning and final fellings) and in the saw-mill. In some of these operations the system will be found to work more easily than in others. The greatest factor to be dealt with is the diversity of conditions which can exist even in any one individual job. Where the work is confined to rather stereotyped conditions no such difficulty arises.

THE NURSERY : Nursery operations while not in themselves items which come under individual headings in the compilation of a balance-sheet prepared for the estimating of profitableness of a forestry investment, are nevertheless the basis of evaluation for the figure for cost of plants in such computations. This figure in any year's planting programme can reach appreciable proportions and it is important therefore that every effort should be made to keep it at as low a level as possible. On the general principles already established this can be achieved by the employment of piece-work. As against this, however, it must be remembered that first quality nursery produce must be produced as a fundamental to the ultimate cultural success of the forest. Notwithstanding all that has been written regarding the feasibility of combating the inclination to sacrifice quality for quantity it is felt that on this account no unnecessary risks in relation to quality of produce should be taken in the nursery. In common with all young life, seeds and seedlings are delicate organisms and as such should be handled accordingly. Operations therefore involving preparation of seeds, preparation of ground, preparation, sowing, tending and weeding of seed-beds, and lifting of seedlings should not be unduly rushed and are best carried out on a normal weekly wage basis. Once the seedlings have reached the lining-out stage, however, piece-work can be safely employed. Its employment in this particular operation however presents certain difficulties when the method of lining-out by hand is used. The lining-out squad must consist of men of equal ability and deftness, else the pace is dictated by the slowest man in the squad and the purpose of the system is defeated. This equity of ability is very difficult to attain in practice, particularly where large gangs of men are employed. The problem can be overcome in two ways, either by sectioning off the lines and dividing the squad into teams of 4-6 men, each team working independently. With such small teams a greater degree of equality as between individuals can be attained. This method may not, for obvious reasons, commend itself. An alternative is to use lining-out boards. With these the whole squad can work in unison and the less skilled can be put on such jobs as carrying boards or filling-in trenches. Thus every man can be moulded into a position in which his ability is best exercised, and therefore no worker is a drudge or a brake on his fellow-workers. The essence of any such operation is obviously a spirit of team-work.

THE FOREST: *Establishment of Plantations:* In this initial phase of a forestry enterprise no returns are forthcoming to offset the expenditure involved. When returns do appear, on the commencement of thinning operations, it must be remembered that they have a great burden to bear in making up for the costs involved *ab initio*. Bearing in mind also the fundamental concept of the cumulative effect of compound interest on each and every pound spent in establishment and this over a period of from fifty to sixty years, saving of expense in these early stages is all important. Every effort must be made to lighten the burden on the credit side of the balance-sheet so that both sides of the A/c will ultimately balance. Again it is claimed that piece-work efficiently employed will go far in achieving the desired economics.

Clearing and Burning: This operation which is a preliminary to planting on many types of ground can be, as is well known, a very expensive business. When continued over an indefinite period it tends to become a monotonous and time-killing occupation. The greatest advantage in introducing piece-work then is in the provision of the incentive for sustained effort. Its introduction however presents certain difficulties. Scrub is normally so scattered and diverse in nature that a unit of work is difficult to define. Where the scrub is fairly uniformly distributed and of a constant density a rate per square chain, or per acre, between a group of evenly graded workers, can be readily arrived at. This rate will naturally depend on the density and type of scrub involved. Where scrub is scattered and lacks uniformity the method of working depends to a great extent on an experienced supervisor. A good man can by inspection of an area to be cleared arrive at a round figure for which the job can be accomplished, and sets the job on the basis of this particular price for the field, or the clump, or thicket, or whatever such unit of area as may be determined by him.

An alternative method of introducing the incentive factor into this operation, and one which, because of its simplicity, might perhaps have wider appeal, is in the granting of a bonus per acre, again taking into account the density of scrub involved, this bonus to be divided amongst the squad on completion of the allotted task.

In clearing operations, once a piece-work rate or a bonus has been decided upon, strict supervision can be dispensed with as the operation does not require any great degree of skill and any ommissions on the part of the workers are immediately self-evident.

Fencing: This operation is normally a "must" in all forest enterprises in this country. The expense involved is almost legendary and is indeed a great deterrent to the replanting by private individuals of the numerous small parcels of felled woodland which are scattered through various parts of the country. More attention should perhaps be paid to the possibility of replanting without rabbit fencing, by a vigorous and sustained drive against vermin of all types, particularly rabbits. The writer has, in the past, been associated with an estate in the West of Scotland, where rabbits are plentiful, but where 400 acres of young

plantations have been successfully established without rabbit netting being used, but where a sustained offensive against vermin was a first priority job.

Where fencing must be tackled, however, it can be organised to a high degree of efficiency and economy on a piece-work basis. For operational purposes it will be necessary to divide the work into two phases.

(1) Transport and spreading of materials.
(2) Erection.

(1) The former is a variable factor depending on the distance and type of terrain to be covered, and also on the type of transport available. This latter item is most important where hill-fences are involved and vast tracts of relatively inaccessible ground have to be covered. The costs of spreading materials on this type of ground can reach a very large proportion of the total cost of fencing. Two alternatives exist for the spreading of materials in these cases.

(a) Horse and sled.
(b) Track-laying or crawler type vehicles.

The former is the slow but sure method. All that need be mentioned in connection with it, from an economic point of view, is that in these days of high wages (for men and horses) time means money, and every pound spent unnecessarily is again increasing the burden on subsequent income.

In the writer's experience, mechanisation is a sure way of saving expense in this phase of fencing operations. With the correct type of crawler vehicle the time factor can be cut to one-sixth of that spent in the former method. This does not necessarily mean a reduction of five-sixths in the cost involved, as admittedly, working costs are higher with machinery. The margin involved, however, it quite adequate to allow amply for this and still result in a saving of as much as forty per cent. The heavier types of crawler tractors are not the best for this type of work. The most suitable machine is a war-developed track-laying vehicle of the amphibian type known as the "Weasel." With this machine phenomenal performances can be achieved. It resembles the Bren-gun-carrier in appearance. When stripped of its non-essential features (armour plating, guns, etc.) it weighs only about 35 cwts. Its ground pressure per square inch is about 2 lbs. It is powered by a 30 H.P. engine and is equipped with two gear ranges (high ratio and low ratio) giving 8 forward speeds and two reverse. It can reach a speed of 15-20 M.P.H. over moorland. With sled trailer attached it has a capacity of from 60 to 80, 5′ stobs with 6 to 8 straining posts per load. No ground is too soft for it (it floats). Drains can be crossed without bridging and the edge of the drain will not be broken down. Petrol consumption is high, approximately 20 gallons per 9-hour day. On rocky ground the tracks are liable to breakages. Its initial cost is not high (second-hand ex-army machines were once available at £150-£200. They are now costing £400 to £600. The possession of this

machine does not necessarily eliminate the horse altogether. In some cases a combination of both will be required to cope adequately with all conditions.

In determining a piece-work rate for such an operation experience (as in all operations when variable factors have to be taken into consideration) is the only basis on which the rate can be arrived at. It is normally expressed as a rate per yard of fence to be erected.

(2) This is a phase of the operation where rates may, to a certain extent, be standardised. Variable factors are not so likely to occur. In extreme cases some allowances may have to be made for exceptionally rough ground. In practice, however, the necessity for doing so does not often arise, as on most jobs good working sections will exist which will offset the bad ones. The rate is best made up on the basis of a price per yard per wire, with a separate rate for digging straining post-holes and erecting strainers. Erection of gates and watergates should also be separately rated. Some operators may, however, prefer an all-in inclusive rate per yard, this to include the carrying out of all work involved in the erection of a satisfactory fence for the purpose required. The writer has found, however, that on the latter basis, if too great a proportion of strainers are required or too many gates or water-gates to be hung, and too many depressions and hollows to be overcome, the operator will tend to cut down below the minimum required the number of straining posts, skimp the erection and proper hanging of gates and not take pains with the depressions and hollows : either that or pack up the job and look for more money. On the former basis all items are cut and dried for him and a more satisfactory job is the result. In the case of rabbit-proof fences it has been found that the work can be considerably speeded up, and consequently done at a lower rate, by, instead of trenching the lower outurned portion of the netting along its entire length, merely turning it out on top of the ground and securing it with a flat boulder or sod about every yard or so. The vegetation subsequently growing under and through the netting will quickly get a grip on it and hold it as firmly as if it were trenched all the way. This has been proved to be satisfactory from a protection point of view. It has in fact proved advantageous to the trapper. Rabbits will in a short time discover the weaknesses at points where the wire still lies bare on the ground before the vegetation has gripped it. They will make openings and tend to use these regularly. Traps or snares set at these obvious points will provide a regular daily quota of captures. These weak points may later be made secure.

The following figures may help to illustrate how erection rates are arrived at. (Again rates quoted were those prevailing in the West of Scotland in 1951-52.)

Basic rates :—Plain or barbed wires		1½d. per yd.
Netting wire (laid as above) ...		4d. „ „
Digging straining post holes, and erection of strainers		3/- — 4/- each

Erection of gates (including gate posts)	25/- „
Erection of water-gates	10/- — 30/- „

Thus a fence consisting of, say, 5 plain wires and 1 barb, with stobs at 6′ centres would be at the rate of 9d. per yard with 3-4/- for each straining post (depending on the nature of the ground) and 25/- for erecting each gate and 10-30/- for each water-gate depending on its size. For a rabbit-proof fence consisting of two plain wires and 42″ netting and stobs again at 6 centres 7d. per yard would be the rate with similar allowances for the other items as above. By extending the stobs to 9′ centres which would be ample for a fence of this description a saving of approximately 1d. per yard would be effected.

Draining: This is an operation the unit cost of which can be variable in the extreme. Two broad categories are recognised, opening new drains and cleaning or re-opening old drains. A range of prices can, however, be adapted to suit the individual sets of conditions which occur. Peat ground normally provides the optimum conditions for working, the peat being easily cut and easily lifted out. This type merits the lowest rates. At the other end of the scale is a stiff gley in which the soil will stick to the implements like glue or rough stony ground where pick and shovel are constantly required and consequently progress is slowed down considerably. (In the former type the worker should always try to maintain a pool of water at his feet in which to dip his implements periodically. This reduces the tendency for the soil to adhere tenaciously to the spade or shovel or pick.) Another factor which must always be allowed for is the size of drain required. Again two broad categories are recognised here, viz., leaders and laterals. Taking these factors into consideration then, a range of rates might appear somewhat as follows:—

Peat drains — laterals	3/- to 3/6d. per chain
„ „ — leaders	5/- „ 6/- „ „
Stiff gleys, or stony ground — laterals	6/- to 6/6d. „ „
„ „ „ „ „ — leaders	12/- „ 13/- „ „

Intermediate types such as in normal mineral soils would be at intermediate rates.

It will often be found convenient and economical to combine mounding with draining. This is achieved in the case of planting at 6′ x 6′ by spacing the laterals at 24′ centres and as the drains are cut and cleaned spreading the turfs or mounds two on either side of the drain the first being 3′ from the centre of the drain and the second 9′. An equitable rate for this combined operation would be approximately 4/6d. per chain.

In the case of the second broad category of drain types, viz., the old drain, no hard and fast sets of conditions can normally be determined. In old woodland ground especially, these drains can be filled with a variety of obstructions which render normal rate-fixing procedure

invalid. Rate-fixing can be based only on experience, and rates can vary from 5/- to 30/- per chain.

In drainage operations as a whole, however, maximum economy is achieved by the employment as far as possible of drainage machinery. To such machines soil types are on the whole a matter of complete indifference. Certainly the range of its susceptibilities to soil types is considerably reduced in comparison to that of manual labour. Machine drainage rates on the same basis of evaluation as the manually made drains above would be for all types from 2/3d. to 2/9d. per chain. Considering that drainage will in some cases be as intensive as 300 chains per acre, this will involve a considerable saving in expense which would more than justify the substantial investment of capital necessary for their purchase.

Planting: This, the preliminary cultural operation in the establishment of plantations, holding as it does such an important position in the annual programme of afforestation in this country, merits a thorough investigation as to the feasibility of operating on a piece-work basis, both from an economic and a practical point of view. An example from actual practice has already been quoted as an illustration of the effect of the system as a whole which indicates the economies that can be effected in planting costs. These being effected in the first year of the rotation have a pronounced influence on the ultimate economic picture. To reduce this statement to figures ; say, for purposes of easy evaluation, the cost of planting was £5 per acre. A 22% reduction in unit cost (as per the illustration) reduces the cost per acre by approximately £1. This applied to a planting programme of 100 acres would mean an overall saving in one year of £100. This amount capitalised at 4% for 60 years amounts to approximately £1,000. These figures speak for themselves, hence from the economic point of view the advantages of the piece-work system appear indisputable.

However, the success of the entire forest enterprise depends to a large extent on the efficiency displayed in the practical accomplishment of this phase of the work. From this point of view, however, no inherent disadvantages would accrue from the use of P/W. It is an established fact which has been well proved in practice that transplants can be planted out as well and as efficiently at a steady rapid rate as they can be by taking ample time to it. A deftness and celerity is achieved in a short space of time by a capable practised man and this can be maintained by him for the entire length of a working day almost without variation. Periodic testing by the supervisor on the efficiency of planting by individual men will almost certainly maintain the degree of efficiency at a high rate.

It might be claimed that the system could possibly fall down through fraudulent practices by employees to such an extent that its purpose would be defeated. This would be the case if as much money could be fraudulently converted as to negative the saving involved. In practice this is veritably impossible. Any large-scale fraud such as would be necessary to achieve this would be immediately self-evident. As pay-

ment to employees is made after the completion of work, where any such large-scale fraud is evident, payment can justifiably be witheld and thus no loss is incurred. Petty offences will, however, be attempted, and no doubt successfully at times. An efficient supervisor, however, can combat these practices by various checks and cross-checks. A strict account should be kept of the number of plants issued to each man. Random " line checks " can be carried out, that is counting the number of plants in a line and cross-checking against the number of lines planted and plants issued. Or alternatively " bundle checks," that is unobtrusively observing the point where an individual opens a new bundle and likewise later observing the point where the last plant in the bundle is inserted and counting the intervening plants and cross-checking with the number in the bundle. If any discrepancies are discovered the severest action should be taken with the individual concerned. In this way a supervisor can build up a fear against the consequences of any sharp practices and thus eliminate to a great extent even petty offences. In fairness to workers it should be mentioned that good capable men generally possess an inherent sense of honesty and it will be found they will not resort to such measures to make a wage. They have no need to.

In large scale planting operations on a P/W basis it will be found useful and economic to have boys available for the purpose of distributing plants. Where men are engaged on planting at a rate per 100 it is unfair to expect them to leave off work to collect plants from scattered depots. Also a considerable loss of time and loss of production is involved. The distribution of plants is a job which is well within the compass of any boy and will facilitate considerably the smooth running of the operation as a whole. Employment of boys of school-leaving age should, in fact, at all times be encouraged. In many operations, as well as planting, they can be fitted into the economic picture with advantage. They will become imbued with a sound sense of forest consciousness which they, in their inimitable fashion, will pass on to their compatriots. Likewise when recruited at this stage they are, in embryo, the skilled forestry workers of the future.

Grass Cleaning: This, the next operation in the natural development of the forest, is one which is not readily adaptable to the P/W system. The finding of plants in lush vegetation is a task in which, even for the most expert, extra speed is not always possible. Also when due care is not taken numerous decapitations of plants can occur. Grass-cleaning, however, constitutes a field of activity where boys can be employed to an almost unlimited extent and by doing so economies can be effected. The work is not arduous or over-difficult. The writer has on numerous occasions employed schoolboys during summer holidays on this work and the work has been done efficiently. They must, however, be under constant and strict supervision.

Brashing and Pruning: This phase of work is one in which economy of expenditure is of the utmost importance. It is an expensive

operation which produces no financial return. Benefits will undoubtedly accrue to the crop in that the resultant brashings provide a very valuable source of humus to the soil and the nutriments thus provided are ultimately absorbed by the crop. Movement through the forest and subsequent thinning operations are facilitated. No return in hard cash is, however, forthcoming and economy is therefore essential. Again operating on a P/W basis or alternatively a bonus system, are the only methods by which the desired speed of work can be attained. Pruning or brashing is a monotonous occupation and no amount of driving and supervision will achieve the same result. Rates for the operation are based on a price per acre (between a group of workers) or per square chain per individual worker. They will vary with the species involved and the planting distances. Larches will be at the foot of the scale with Sitka spruce at the top. Pines and firs will be at intermediate rates.

Other methods combined with P/W can be employed to reduce costs. One of the most practical perhaps, although not attractive from the marker's point of view, is the marking of the first thinning before brashing. In this way the number of trees on which the pruning saw is employed is cut in some instances by as much as 40%. The trees to be taken out in the thinning can be brashed down with an axe. This is a much more rapid operation and will effect a considerable reduction in the cost of the operation as a whole.

Thinning : The thinning of plantation is a phase of forest operations which will henceforth form a large proportion of the work to be carried out in our forests. It is the stage in the forest investment where returns begin to appear. Bearing in mind the vast expenditure which has been incurred to bring the plantation to this stage, it is of paramount importance to ensure that these returns be maintained at the maximum possible throughout the successive thinnings. Recalling again the previous concept of the forestry investment, money realised at this stage will accumulate at compound interest to the end of the rotation.

By carrying out the thinning operations on a P/W basis costs of production can be kept at the minimum. This ensures the maximum returns.

For operational purposes the work is divided into three categories :—

(i) Felling and snedding or trimming.
(ii) Extraction to ride or roadside.
(iii) Cross-cutting into required lengths.

Rates are based on a price per pole for categories (i) and (ii) and on a price per 1,000 linear feet or per cu. ft., for category (iii). It is in the striking of an equitable rate per pole for the former that the success of the whole operation depends. This price per pole is based on the average cubic contents of the poles to come out in the thinning. This must be accurately worked out. The following will illustrate why this accuracy is necessary. If the price per pole were based, say, on an average cubic content of 1 cu. ft. per pole for 1,000 poles, and the work was proceeded with on this assumption, and if in the final actual measurement of produce for sale purposes it was discovered that the

1,000 poles amounted only to 750 cu. ft., *i.e.*, the actual average being .75 cu. ft., then 33% more than was necessary has been expended on the operation, and the purpose of the P/W system has been defeated. In early thinnings a large range of sizes of poles will inevitably exist. Rates of growth will have varied considerably, and different species will exist in different parts of the same compartment. For early thinnings therefore the compartment will have to be sub-divided into zones of relatively uniform rates of growth and an individual average arrived at for each zone. This may also have to be resorted to in later thinnings but to a lesser extent, as the crop tends to become more uniform in the later stages.

Rates for felling and trimming are fairly uniform throughout. In first thinnings an increase in the normal rate per cubic foot is generally necessary to compensate for the very small size of pole involved. The work involved does not vary in proportion to the size of the pole. This will, however, be compensated for by a similar reduction being possible when the final thinning stage is reached, and large poles are involved.

Extraction rates will naturally depend on the distance to be covered. Basic prices per cubic foot are normally fixed on a distance unit of 100 yards. This rate is increased proportionately for every subsequent 100 yards. Rides and roads should be so spaced that no " drag " in excess of 300 yards should be necessary before the poles can be put on a timber wagon or two-wheeled " monkey." When rides are laid out, the fact that they will inevitably be used for extraction should always be borne in mind. On rough hillsides where rides are generally unsuitable for wheeled transport, and roads are few and far between or non-existant, the only economical method of extraction is by overhead wire systems. Patent elaborate equipment for this type of work is available from various manufacturers. Where the volume of timber to be extracted is adequate and continuous, the initial expenditure involved is more than covered by the economies effected in extraction costs as a result of the employment of such equipment. In small areas, however, no such elaborate means are necessary. Satisfactory and economic results can be obtained with a single span of No. 4 plain wire with perhaps 1 doz. or even ½ doz. suitable pulleys. Where more than one span is required simple intermediate supports can be devised which any blacksmith can manufacture. Intricate braking systems, as occur on the patented devices, can be replaced by the simple expedient of erecting at the base of the run a buffer composed of an accumulation of branch-wood and trimmings. It is of interest to note that hill farmers in Norway use these simple methods of overhead transportation almost exclusively for the extraction of farm produce and firewood from their holdings on the steep hillsides.

Cross-cutting into required lengths can, for the larger sizes of poles, be combined with the felling and trimming operation. This will involve an increased price per pole for this phase of the operation. Where small poles are concerned, however, handling costs in extraction are maintained at the minimum by handling the pole in its full length. If

cross-cutting into numerous small lengths is required, *e.g.*, for pitwood, fencing materials, etc., this operation is best carried out at a central roadside depot by a portable mechanical saw. This is done at a rate per 1,000 linear feet. By increasing this rate accordingly, loading on to lorries can be combined with it.

Hence at every phase of the thinning operation, provided the estimation of the rate has been accurate, the supervisor can at any time, by an examination of the returns know how the operation is progressing financially. This is important, in that if costs are too high in any phase of the operation an analysis of the figures will indicate where this occurs and steps can be taken to remedy the position. For subsequent operations he will be able to estimate accurately in advance the cost of such operations. He is, in fact, in complete intimate touch with the operation from an economic as well as a practical point of view. This constitutes a natural encouragement to the supervisor to maintain a constant interest in the operation.

Clear Felling: This operation brings to a close the forest investment. Clear-felling costs being incurred in the final year of the rotation will not, even if excessive, have the same deleterious effect on the investment as a whole as those incurred in the earlier stages. Nevertheless a slackening off in effort is not justified even in the home stretch. Many a race has been lost because of this. Again P/W can bring about the desired economy of expenditure. It is important to remember that the ground must again be used for the succeeding timber crop. No adverse legacies therefore should be allowed to follow on from one rotation to the other. Numerous clear-felled areas have been left in such a condition that large-scale clearing and protection schemes have to be embarked upon before re-planting can be carried out. This can be avoided by including in the P/W rate all the necessary work involved in leaving the site clear and ready for replanting. The rate is based on an inclusive price per cubic foot for timber felled. This, then, allows the next rotation to commence to a great extent with a clean sheet as far as preparatory work is concerned. This gives the succeeding investment a decided advantage when the balance-sheet for that period is being formulated.

Conclusion: The importance of maintaining costs at the lowest possible level in all operations throughout the rotation has been indicated, to some extent at least. How this is effected is entirely immaterial in the long run. It is suggested, however, that the piece-work system is a possible and very practical means to this end. This system is employed extensively in forestry in other countries. In Britain, where conditions and problems are somewhat similar to our own, the system is widely used by the Forestry Commission, particularly in planting and thinning and in some phases of nursery work. In private forestry circles in that country no other method of working is visualised where the system can be applied. It is of significance, too, that the F.A.O. Report on Forestry in Ireland recommended its introduction to some extent into operations here. It is offered therefore as a means to an end—economic forestry.

THE ESTABLISHMENT OF FOREST SEED ORCHARDS IN NORTHERN IRELAND

By K. F. Parkin, M.S., B.Sc., F.R.Met.S.

During the recent visit paid by members of the Irish Forestry Society to Northern Ireland some interest was aroused by the grafted larch plants in the nursery at Newcastle forest. These grafts are the foundation of a forest seed orchard and although this is still in an early experimental stage it may be of interest to readers to know something of the aims, hopes and methods of the investigations.

THE SEED ORCHARD

A seed orchard may be described as a group of trees specially selected and treated so as to provide a frequent supply of seed of a known strain.

Briefly, this is accomplished by grafting scions taken from outstanding (elite) trees on to healthy stocks of the same, or a closely related species and by special treatments inducing the grafts to produce an early and regular seed crop.

Seed orchards have been in production for some time in Denmark, Sweden and the United States and most forestry-minded countries have now adopted the idea. In Britain the Forestry Commission have laid down a seed orchard at the Alice Holt Research Station and others are being prepared in widely scattered parts of the country.

THE VALUE OF SEED ORCHARDS TO FORESTY IN NORTHERN IRELAND

The forestry programme of Northern Ireland for many years to come will hinge upon the establishment of exotic conifers—mainly Sitka spruce, Contorta pine and the larches. The home supply of seed is negligible so that the forestry service is almost entirely dependent on the supply from commercial seed dealers. While the integrity of these men may be beyond reproach they suffer certain unavoidable handicaps which limit the reliability of their seed sources. For instance, their normal collection methods do not always enable a classification of seed according to parental strain, and they are always at the mercy of the natural periodicity of seed crops which may leave them without supplies of a particular seed for a number of years. To have a reliable home supply of seed from trees of known superior qualities has obvious advantages.

Northern Ireland makes somewhat exacting demands upon the trees it grows. Rainfall is high, sunny weather scarce, frost may occur on almost any day of the year and the soil covering the bulk of the potential

forest areas is peaty and acid. All these demand a high degree of adaptability from the introduced species and it is obvious that only certain strains will be able to thrive to give a final crop of timber. It has been shown that the qualities of adaptation peculiar to certain tree strains are inherent, so that to ensure a maximum potential development in the future plantations only seed of a suitable strain should be employed. To obtain this seed from dealers is practically impossible, whereas if the seed were collected from trees which have already grown to maturity under the exacting conditions of this country the chances of producing a successful timber crop are much more favourable. Unfortunately, there are very few existing stands of mature high quality exotic conifers in this country from which seed could be collected, but there are many outstanding individuals scattered around. Through the medium of seed orchards their qualities may be passed on to future generations.

It is of particular importance that the trees now being planted in Ireland should be of the highest quality for there are many indications that subsequent stands will be obtained by natural regeneration.

LOCATION OF A SEED ORCHARD

As for fruit orchards—to which seed orchards are closely akin—a great deal of care must be taken in the choice of site, for a single detrimental environmental factor can easily destroy the result and expense of several years' work. The requirements which may be considered essential are listed below and in addition to these the routine protection and hygiene procedure of normal nursery operations must be carried out.

(i) A rich, easily worked sandy-loam soil ;
(ii) A long growing season ;
(iii) Freedom from early or late killing frosts ;
(iv) Protection from strong winds, particularly cold and dry easterlies ;
(v) Shelter from early morning sun ;
(vi) Isolation from stands or individual trees of the same or similar species which may provide pollen for un-controlled fertilisation, or which may act as a source of insect attack or disease.

Given all the above factors and assuming that the trees are well grafted and healthy, a seed orchard should provide fertile seed from 4 to 8 years after establishment and with annual regularity thereafter.

SEED ORCHARD ESTABLISHMENT

The first requirement when establishing a seed orchard is a supply of healthy, well rooted stocks which should be 2+1 yr. or older plants,

12 to 18 inches high. For the most successful grafting these should be in pots in a greenhouse where temperature and humidity conditions can be controlled, but large greenhouses are not often available to the forestry service so that outside grafting must suffice. For this the rootstocks should be in lines at least 12 inches apart with the same distance between plants. It is advisable that the plants should have been in the lines for at least one season before grafting and they should be carefully pruned to give six inches of clear stem immediately above the soil level.

The next consideration is the collection of suitable scions from the selected elite trees. These should be healthy, robust shoots of the previous year's growth from 2 to 4 inches long. They should be collected towards the end of the winter dormant period but before any signs of flushing have occurred. Suitable material is usually confined to the vigorous branches in the upper crown and, since elite trees approaching maturity are often tall and difficult to climb, collection is often a problem. One alternative to climbing is to shoot down the ends of the upper branches.

For the grafting operation it is preferable that the rootstock should be flushing while the scion remains dormant; this may mean storing the scion in cold damp peat in the dark for a time if no cold storage facilities are available. No definite dates can be laid down for these operations owing to the unpredictability of the early spring weather in this country and to the varied time of flushing of the different tree species. The order of flushing in any area remains the same, however, and this linked with other phenological observations will give a good indication of when scions of any particular species may be collected.

For coniferous species variations of the "Veneer Side Graft" prove most successful, the scion being inserted into a slit cut in the stock, where it is held firm by raffia and carefully waxed to prevent drying out. The stock is then cut back, usually in three stages, so that the rising sap is diverted gradually into the developing scion, which should be firmly grafted by the end of the first season.

After a further season in the transplant lines the grafted plants should be ready for removal to the seed orchard site. Here they should be planted at about 15 feet apart so that the developing crowns will have plenty of light and freedom. During the establishment period the ground between plants may be utilized for seed beds or transplant lines.

Various methods of inducing early seed production have been tried, some of which are still in the experimental stage. These include root pruning, partial girdling, temporary strangulation, chemical methods and artificial drought. Root pruning appears to have given the best results to date but more efficient methods may come to light in the near future.

ABSTRACT

Drainage in the Forest District of Bjursfors

By Gustav Lundberg

Bulletin of the Royal School of Forestry, Stockholm, Sweden.
No. 8. 1952.

AROUND the turn of the century, and coinciding with the general growth of interest among foresters in the possibilities of drainage of boglands or waterlogged forest soils, a very comprehensive scheme of drainage operations was initiated in the forest experimental district of Bjursfors, which lies in the counties of Vastmanland and Kopperberg in mid Sweden.

These experiments in drainage were due to the initiative of the Director of the Forestry Institute, Professor C. G. Holmerz, who was responsible for the administration of the area. Trials were carried out on every type of bog in the belief, which was then current, that every form of peat was suitable for forestry purposes, irrespective of the intrinsic quality of the peat, if only it were thoroughly drained. Bog drainage technique at that time was in the experimental stage and was mainly based on the principles applied to the drainage of tillage land. This led in general to a great deal of unnecessary or useless ditching. Further, the cultural methods applied to the crops following their establishment on the drained area produced very variable results, both negative and positive.

These drainage trials provided in the ensuing years very valuable subject material for studying, on the one hand, the relative forest values of the different peat types and, on the other, the effectiveness of the drainage systems and cultural operations applied.

Professor Gustav Lundberg, who is the author of this Bulletin, has been in touch with the work since 1902, *i.e.*, over a period of 50 years, and during that time he has seen the crops develop and has measured the yields on the representative sample plots, which have been regularly recorded since 1923. He gives in this Bulletin the results of the experiences gained by himself and other workers, notably Professor Carl Malmstrom, in Bjursfors and other areas. The Bulletin deals with the basic objects of peat drainage for forestry purposes, discusses the worth of the various peat types for timber production, and finally explains the technique of water regulation and the handling or cultivation of the drained bogs.

Developments on the experimental areas up to 1923, together with details of the ecological changes and sample plot assessments were written up by Eric Lundh in 1925.

The present Bulletin deals with the subsequent developments and includes tables of yields and increments from the various sample plots.

Among the most valuable conclusions arrived at so far, the following are worth reording :

Drainage Technique

In comparison to the thoroughgoing preparation prerequisite in the reclamation of peat bog for agriculture, where one must consider not alone the need to provide conditions suitable for tillage implements but that in addition most tillage crops are very sensitive to a high water table, drainage for forestry purposes is much simpler.

On bogs suitable for reclamation, *i.e.*, bogs of the type which after drainage make good forest soil, there is no need to worry about the water actually in the bog, so long as conditions allow for a drying out sufficient to encourage establishment and development of the crop. This drying out is brought about by evaporation and later by the trees themselves which become powerful factors in the drainage of water through their transpiration systems. Therefore, all that is necessary is to trap, by a system of strategically placed ditches, all water that flows on to the reclamation area from outside in such quantities or under such conditions as to promote the growth of bog forming plants.

These trap drains must, of course, be linked up in a suitable lead-off drainage system to ensure that the water be led off from the area into streams or watercourses. Special precautions must be taken to prevent the system from becoming ineffective due to the sinking by shrinkage of the drained bog below the level of the trap and run-off drains.

As the growth of bog forming vegetation is dependent on a constant, all the year round, water supply (this however does not necessarily apply to high bog or blanket bog), occasional waterlogging or flooding after rain is of no great importance. The usual sources of trouble are associated with the occurrence of impervious layers which cause springs to break out in the drainage area, or when there is a constant inflow from higher lying boglands or neighbouring peat covered uplands.

The frictional resistance of peat to the lateral movement of water is so great that it can only be overcome on very steep slopes. This type of water movement, lateral seepage, can be practically ignored. The depth of the drains is not, therefore, of major importance. The main thing is to have the drains deep enough to allow for the fall of ground, the shrinkage of the peat and the quantity of water that they may be called on to carry.

The fall in the drains themselves is of major importance, particularly in regard to their maintenance and efficiency, a fall of 1 in 150 to 200 is desired in the trap drains and 1 in 300 to 1 in 400 for the lead-off drains.

Where the fall is too little the drains are liable to block up, due to an accumulation of growth, or a collection of leaves and rubbish. Where the fall is too great undercutting and erosion of the bed may result in the banks caving in and blocking the drains.

The Bjursfors technique of drainage can be put briefly as follows :

1. Trap by means of contour drains (laggdiken) all water flowing

from higher levels, particularly water from poor peats or sterile soils.
2. Catch all water breaking out as springs or flushes by means of forked drains (fonggaffeldiken).
3. Carry the water from 1 and 2 as required, by means of lead-off drains (tegdiken) to the natural watercourses or main drains.

Where mains have to be dug great care is taken to insure that the site of the main is at the lowest point of the basin floor ; this applies only to basin bogs, of course.

Readings are taken of the surface levels on a series of transects, the depth of the peat is sounded, this providing a series of bog profiles, the lowest points are connected up to give the lie of the main or sub-main drains. The reason for this is to avoid the risk of the drain becoming useless due to bog shrinkage. If the drains are at the very lowest point they can be deepened to keep pace with the sinking bog surface. Otherwise the time may come when they may lie above the lowest point, when they may cease to function, fill up and the whole process be put into reverse.

Forest Growth on Reclaimed Bog

Except on very deep bogs, the main factor which influences the growth of trees on reclaimed bog is the composition of the peat itself, especially with regard to its content of the main essential nutrients for tree growth, lime, potash and phosphate.

The supply of nitrogen will be usually forthcoming from the products of decomposition of the plant remains in the peat. The rate of decomposition will be speeded up if the supply of mineral nutrients is present in quantity and the process tends to accelerate as time goes on.

The mineral content of peat varies enormously, and depends entirely on the nature of the plants from which the bog was formed and on their demands on and content of the minerals in question. The quality of turf for reclamation may, therefore, be said to depend on :

1. The hydrological conditions under which the bog grows, that is, the quality of the water on which the peat forming plant communities depend for their growth.
2. The geological structure of the district.
3. The climatic conditions.

The so-called ombrogenous bogs, which are characterised by a more or less convex development of the bog surface, are dependent on climate. Their water supply comes almost entirely from precipitation as snow, rain or dew. They are, therefore, questionable subjects for forest reclamation because of the poor mineral content of the turf.

The so-called soligenous bogs which are flushed with water from the surrounding, higher mineral soils are very suitable for reclamation. The quality class of these soligenous bogs varies enormously and can be related directly to the quality and nature of the flushing water. The richness of the flushing water supply is bound up with the local geology ; soils or rocks rich in bases give rich (hard) water, siliceous or acid soils or rocks give poor water. Soligenous bogs of large extent are less attractive than those of limited size. Extensive bogs of any origin in

regions of high humidity are unattractive subjects. The soligenous bogs in Bjursfors have all given excellent results after drainage with mean annual increments from 100-200 cubic feet or, in other words, yields which are on the average twice as high as on the best mineral soil in this area. In other areas, however, especially in extensive soligenous bogs in Norrland, results have not been so good.

The so-called topogenous bogs, *i.e.*, basin bogs can develop into either soligenous or ombrogenous type bogs depending on the richness in plant food of the water supply and on the general climatic conditions.

In the classification of bogs other systems are in use in addition to the water source method. These include a study of the plant ecology, the degree of humification and other methods, all of which have proved useful.

Afforestation and Silviculture on Drained Bog

Due to climatic conditions the only trees available are Scots pine, Norway spruce and birch. Of these the spruce is away ahead as a timber producer. The pine establishes itself more quickly than the spruce but in time the spruce overtakes the pine or birch in mixed stands and greatly excels both in final yields.

The only drawback to the spruce is its susceptibility to damage by late spring or early summer frosts, which do no damage to pine or birch. It has been found impossible to establish spruce on bare reclaimed bog except by using advanced nurses of pine or birch. Spruce has shown, however, amazing powers of recovery from repeated frostings, and crippled bushes have invariably made good trees as conditions improved. In addition it has the power to throw off the effects of shading and suppression, no matter how long or intensely it has suffered as soon as the suppression elements are removed it comes away in normal fashion. These factors combine to give the spruce a unique value for bog planting. In addition it is observed that spruce grown on peat rarely suffers from butt rot.

The afforestation of reclaimed bog in Bjursfors is mainly by natural seeding from the surrounding forest. It is important to preserve any scrub pine or birch which may be present to provide protection against frost. Since drainage depends to a great extent on the action of the tree roots and the transpiration from the crowns, thinning is delayed until the draining process is well advanced. Spruce continues to develop under a birch canopy, better in fact than when the birch is removed. Too heavy thinning of birch often results in a check of the spruce, and may if excessive, result in the death of the young spruce. The explanation given is that the spruce which develops in shade has a particularly sensitive foliage, weak in palisade tissue and easily damaged by frost or bright sunlight.

With regard to cultivation and the use of nurse plants it is observed that spruce should preferably be planted under the shade of nurses. Turf planting is recommended and, better still, the more recently (in Sweden) developed technique of ploughed strips.

ABSTRACT

The Rabbit Problem on Gotland Island

Bulletin of the Royal School of Forestry, Stockholm, Sweden
No. 9 1952

This Bulletin deals with the rabbit problem on Gotland Island. It appears that the wild rabbit was deliberately and systematically introduced into Sweden as recently as 1905 (Skane) and 1907 (Gotland) in order to provide a new game animal of commercial value. This step was taken only after study of similar introductions in Central Europe and with a detailed knowledge of the occurrence of the wild rabbit in the Meditteranean regions where they originated.

It was well known that the stock of rabbits in their native region remains relatively constant, though with occasional peaks in especially favourable years. Characteristic, too, is the fact that the wild rabbit in that region very seldom becomes so abundant as to be capable of inflicting real damage. The stock there is stabilized. It is kept down by inexorably active natural limiting factors, primarily small predatory animals, but also disease.

In Gotland, however, the rabbit has developed into a plague due to favourable environmental factors and absence of predators and parasites. It appears also that the ordinary methods of control, trapping, snaring, shooting, gassing, etc., are quite ineffective. Rabbit premiums and other inducements to exterminate rabbits have been of limited value and the numbers continue to mount.

This Bulletin gives many statistics to prove the ineffectiveness of ordinary methods of control. These statistics include returns from shooting clubs, local councils running premium schemes, etc. The growth in the rabbit population is plainly evident from the returns of numbers killed and returned for premiums ; there was almost a 20-fold increase between 1945 and 1950 in premiums paid out (2,681 kroner in 1945, 45,413 in 1950).

Many startling statistics are provided by other countries to show the damage and destruction wrought by rabbits. Australia provided the best example of a country that has suffered unparalled losses since the first release of rabbits in that continent in 1859. Further, in spite of the fact that rabbits have become an important item of export—millions of pounds worth of skins and flesh are exported each year—new and extreme measures are being put into force to try to exterminate this pest.

The Bulletin then deals with new methods of extermination which are being tried out in Australia and also in Sweden. The most promising new weapon in the war against this pest is a virus called Myxomatosis, which is specific for the rabbit, has a high mortality (in most reported

experiments, 100 per cent) and is highly contagious. This disease has been studied by a number of research workers, particularly in Australia under the leadership of Dr. Ratcliffe of the Wild-life Survey Section in Canberra.

The disease is caused by a micro-organism, the virus Myxomatosis cuniculi, which originally mutated from the virus that causes common rabbit fribrosus. It originated as a disease of tame rabbits but can readily infect wild rabbits.

In Sweden the experience with the inoculation of wild rabbits with Myxomatosis began in May, 1938. Eighteen trapped wild rabbits were inoculated and released in warrens on the Dufeke estate. About one month later numerous diseased rabbits were observed—which were easily caught, killed and buried. The number of sick rabbits continued to increase till the end of the year, when the disease had spread to the outermost confines of the colonised region. Statistics to show the extent of the decimation are given. Hares were absolutely unaffected.

The properties that render Myxomatosis a serviceable agent in the measures against rabbits are primarily the following :

Specificity : Myxomatosis is specific for the rabbit—It does not attack the closely related hare nor any other type of animal.

Contagiousness : It is chiefly transferred by blood-sucking insects—mosquitoes and fleas, etc., and by direct contact.

Preparation of the Virus : The virus is readily prepared, is easy to store and transport.

Inoculation of Wild Rabbits : This can be easily done on a large scale on trapped rabbits which are released among their fellows.

Virulence : Virtually all reports indicate high contagiousness. The virus occurs in varying forms in respect to virulence and only a type having high contagiousness is recommended for use.

Humanitarian Considerations

Resorting to disease for the purpose of combating pests of economic significance is by no means novel. For the destruction of small pests (insects, rodents) there are in use to-day throughout the world both indirect methods—designed to promote the spread of mycoses, bacterioses and virus diseases, and direct methods consisting of laying of bait treated with pathogenic micro-organisms. In Gotland the wild rabbit constitutes a serious menace to forestry and agriculture—it can only be ranked with rats as a menace.

It appears that this method of combating rabbits has been used in Australia with mixed results. The hope that Myxomatosis would eliminate the rabbit like magic from Australia has not been fulfilled. The large scale inoculations still being done, however, show that the method has given good results.

Listed among the measures proposed for the organised destruction of rabbits in Gotland is Public Enlightenment. M. Notini writes on this

important matter: "The public must be enlightened more effectively than hitherto as to the significance of the wild rabbit as a destructive animal. It seems wrong for a campaign to be pursued by a central body on behalf of the wild rabbit as a source of meat and fur and concurrently *against* the wild rabbit as a destructive pest. It is essential that the true state of affairs be brought to the knowledge of the public; namely, that the value of the flesh and fur of the wild rabbit is negligible in relation to the immense damage it inflicts on the rural economy of Gotland."

REVIEWS

British Forestry Commission Bulletin No. 9—Poplars

By T. R. Peace, M.A.

Published by H. M. Stationery Office, London. Price 7s. 6d. Net.

The Forestry Commission Bulletin No. 19, which has just come to hand, is an excellent work which represents a milestone on the road towards a better understanding and more widespread use of poplars.

The great possibilities of this genus of trees for rapid timber production combined with its relative amenability to fashioning towards this end at the hands of the Plant-breeder, have caused a considerable amount of special attention to be showered upon it during the past two decades or so. Much work has been done in several European countries, notably in France, Italy, Holland, Belgium and Germany, as well as in the United States and Canada.

Every country must, in the last resort, decide upon the suitability of tree species for large-scale use within its own area, by experimentation or research of one form or another. The British Forestry Authority commenced the examination of quite a large number of poplar clones, in the years just preceding the last war, by laying down trial plots in several parts of the country. War-time conditions brought the work to a virtual halt, but with the return of peace it was resumed, and on a wider scale than before. In 1950 steps to encourage the more widespread planting of poplars by private landowners were taken, and provision for the payment of a special grant with this object in view was made. To pave the way for the increased planting, and to assist in ensuring that it would be carried out to the best advantage of those immediately concerned and of the nation as a whole, a very helpful Leaflet—No. 27—on Poplar planting had been published. Heretofore a comprehensive, practical and not too technical work on poplars has not been available in the English language. This Bulletin, a well illustrated and concise survey of the subject, adequately meets the needs of those contemplating the establishment of poplar crops or who are in search of information as to the treatment and protection of such crops.

Prepared by Mr. T. R. Peace, M.A., who is one of Britain's leading authorities on this subject and who is responsible for the Poplar Research activities of the Forestry Commission, the Bulletin aims to give a matter-of-fact and up-to-date account of poplar propagation, cultivation, protection, etc. Continental experience has been drawn upon, and many references are given, but recommendations are based upon home research, except in such instances as where it has not yet advanced sufficiently to be of practical assistance.

Touching upon the botanical aspect of the subject, the important question of nomenclature, and the geographical distribution of the various sections, the author goes on to supply useful notes on some thirty or more species, varieties and hybrids. A handy key for the classification of poplars into their major sectional groups, and for the identification of a number of the more important species, etc., is given. Silviculture is dealt with in a thorough and lucid way, right from the selection of a nursery site to the questions of pruning and thinning. Establishment costs are dealt with briefly and interesting information on rate of growth and yields is supplied. In the third chapter insect and fungus pests which attack poplars and inorganic agencies which adversely affect them are dealt with, and control measures are recommended in some cases. The fourth and final chapter provides much useful data on the properties and uses of poplar timbers.

In the chapter on the silviculture of the Poplars it is worth noting that Great Britain is considered as falling into three distinct climatic regions. The first—the southern region—is classed, in the light of present knowledge, as being quite safe for poplars, especially Black Poplars and their hybrids ; the second—the lowlands of north England and Scotland—is not quite so safe ; and the third—including the whole of Wales and the mountainous areas of Britain generally—is left under a shadow of doubt. The four varieties of poplar at present favoured by the Forestry Commission—xP. serotina, xP. serotina narrow-crowned variety, xP. robusta and xP. gelrica are given as a " safe choice for the southern half of England." In view of this it is obvious that the recommendations supplied in the Bulletin cannot be assumed to be altogether applicable to this country. Despite this fact, however, we realise that British conditions more closely resemble our own than do those of even our nearest continental neighbours. Work done on silvicultural and allied problems in Great Britain must, therefore, have a not-too-remote bearing on similar problems which arise in Ireland, and *vice versa*. Consequently, we welcome the new Bulletin and we feel certain that poplar growers and others who may consult it will find it extremely interesting and of great material value.

N.O'M.

Report on Forest Research for the Year Ending March, 1951

Published by H.M. Stationery Office, London Price 4s. 6d. net

From its foundation after World War I, the British Forestry Commission has regarded research and experiment as an integral part of its programme. Research in timber and forest produce is carried out by the very fine Forest Products Research Laboratory at Princes Risborough. This is under the aegis of the Department of Scientific and Industrial Research but works in close co-operation with the Commission. Up to 1929 the Commission itself was restricted to research

directed to an immediate economic result in relation to forestry, but since then it has financed research of a more fundamental nature—mainly by means of grants to Universities and kindred institutions for specific research projects. To date 1.6 per cent of the total expenditure of the Commission has been spent on research.

The White Paper, Post War Forest Policy (1945), recognised that the problems of British forestry called for a considerable expansion of the Research organisation. A central Research Station was opened in 1946 at Alice Holt and staff and facilities have been built up steadily since then. Expenditure on research in 1950 at £130,000 was little short of the total for the decade 1930-'39. The results are now becoming evident and this publication is the third (and at 139 pages the largest) of a new annual series summarising the work in progress in this field.

Part I, 112 pages, is devoted to the work carried out by the Commission's own staff. This includes work on tree seeds, provenance and genetics, nurseries, afforestation methods, mixtures, rates of growth and yield, pathology, and mechanisation. Part II deals with work done by outside Institutions. It includes investigations on nutritional and sterilization problems in nurseries ; on soil mycology, soil fauna, physical and chemical properties and profile changes ; botanical variations in larch species and in Sitka spruce.

It will be appreciated that work is now under way on every aspect of forestry, but it must be admitted that as yet many of the projects are still in the preliminary stages and it will be some time before results which can be applied with confidence in the forest are available. Many of the projects are of their nature long term and it takes some years to train staff in methods and routine for new lines. It is therefore unfair to expect definite recommendations at such an early stage. However, it is evident that real progress is being made and already some interesting and valuable facts have emerged. In the following paragraphs a few points from the report are briefly mentioned but they are not to be taken as either exhaustive or representative.

Tree Seeds : Viability tests of home collected seeds indicate very wide variations in seed quality and suggest the advisability of a test *before* large scale collection. Combined with rapid viability estimates based on the new embryo colour staining technique, this work promises an early return in better and more economical seed collection.

Experiments on soaking seed for from one to thirty days before sowing have shown no advantage with Sitka and Norway spruce, Japanese larch and Scots pine.

Nursery : Laying down to grass-clover for two years had little or no beneficial effect on the growth of Sitka seedlings in a " conifer sick " nursery. This calls into question a method of " resting " nurseries on which considerable reliance has been placed here. On the other hand, acidification of Sitka-sick nurseries has given a very good response, Sitka one year seedlings being 2.5 inches high. On alkaline or neutral soils ammonium sulphate acts both as a manure and an acidifier.

Tests have confirmed the marked superiority of suitable grits over soil for covering small-seeded conifers, *e.g.*, Sitka.

Very promising results in weed control in seed beds have been obtained with light mineral oil sprays. Extended trials are being planned.

Altogether nursery research is proving very fruitful and it has already modified very considerably the traditional nursery methods.

Natural Regeneration of Scots Pine in the Highlands: Although this subject has been under investigation for 20 years, results are disappointing and it is now feared that nature, having been obstructed so ruthlessly during the past century, may be unable to effect regeneration unaided. Grazing and burnings have caused the development of a tough, felted raw humus layer, thus increasing swampiness, peat development and general soil deterioration. To reverse this process and re-establish thriving pine woods will not be easy.

Provenance: Only very tentative conclusions can be drawn from the work to date but there appears to be substance in the belief that Alpine larch provenances are unsuited to the British climate, being very liable to canker and die-back.

Afforestation: Useful experiments have been laid down to test out the best species and mixtures for difficult sites. Scattered individuals of a number of more exacting species are being tried in a matrix of the expected safest species—usually Sitka or Pinus contorta. By heavy phosphatic manuring of the exacting individuals it is hoped to produce a mixed crop of uniform growth.

Oak-larch Mixtures: In view of the many plantations consisting of hardwood groups in a conifer matrix laid down in Ireland under Dr. M. L. Anderson's direction, readers will be interested in the study of oak-larch mixtures. The larch is consistently the faster grower and it seems clear that the full beneficial effects of larch shelter are becoming apparent only in the pole stage. The zones of rooting of the two species are found to be quite different. There is an interesting discussion on the number and spacing of oak in the groups, spacing of groups and use of alternate strips of oak and larch.

Derelict Woodlands: Investigations are directed to finding economical methods of bringing scrubland back into commercial production. Clearance of 12-ft. strips leaving up to 10-ft. strips of hazel scrub under which the brush is piled appears to have advantages and careful comparative costings are being made.

Shade and Beech Growth: Investigations suggest that height increment of beech at light intensities as low as 20-25 per cent is not inferior to growth in the open. Light under a closed canopy of mature beech can be as low as 2 per cent.

Diseases: A very interesting account of the life cycle of the spruce aphis, *Neomyzaphis abietiniae*, is given. No male has ever been recorded nor is there any evidence of the existence of an egg stage. Propagation

is entirely by the production of living young and may continue through mild winter weather. It is calculated that in a favourable season the potential reproduction of a single aphid would be 430 millions. Fortunately natural controls intervene !

Heather in Checked Plantations: Screefing the heather *(Calluna)* has had a remarkable effect in the second year, Sitka showing a marked recovery from chlorosis with a higher nitrogen content in the needles. Apparently there is severe competition for the available nitrogen but details of cause and effect have still to be worked out.

It is hoped that the few points noticed in this review will encourage every forest officer to secure a copy of this valuable and stimulating publication. It is written with the minimum of technical statistics and jargon so that the non-specialist forester can derive the maximum of benefit and information without resort to " wet towel " methods of study.

T.McE.

Ecology of American Forest Species

Erosion and Reafforestation

O.E.E.C. Documentation. Technical Assistance Mission No. 18

Published by the Organisation for European Economic Co-operation, Paris

This publication is concerned with the relationship of forest trees to their environment in the light of human interference for economic purposes. It is an account of the adventures of a group of European forest-scientists in search of the real, though sometimes intangible, benefits of contact in the field with North American forest trees which have become important in European forestry.

The sections of the work dealing with the north-western coniferous forests are, naturally, the most carefully prepared and the most interesting ; though none of it is light reading. The various authors are all continental foresters and have not always succeeded in expressing their ideas in everyday English ; added to this, typographical errors are frequent, especially in technical terms and specific names of shrubs and herbage associated with the forests.

It is interesting to note how many of our garden shrubs appear in the list of species associated with the " Forest-types " studied by the team, *e.g.,* Gaultheria shallon, Acer circinatum, and Berberis nervosa, with bracken, hardfern, Polystichum and the Western American species of many of our native wild genera of shrubs and herbs in the Douglas Fir forest type.

It might be helpful to outline from a typical subject studied the approach used in this Bulletin :

" Typical Sitka spruce Forest also called Fogbelt Forest." Then follows an account of the geographical occurrence which in its distribution over the altitudinal range from sea-level to 1,700ft. corresponds with what might be stated in a report on the species in Ireland. Next comes a statement of the tree species accompanying Sitka, namely Tsuga heterophylla, Thuya plicata, Douglas Fir, Alder (spp. rubra), Acer macrophyllum, cherry, etc. Stress is laid on the tendency of Tsuga to become the dominant species due to its great shade-bearing qualities. This fact is constantly mentioned in the accounts on all the western forests, which may be a surprise here, where Tsuga has not been used very extensively as yet.

The rich shrub, grass, and moss layers are next dealt with.

Climate is then considered, and although rainfall figures given (59 ins. to 129 ins. with 90 ins. average) are higher than ours, distribution and type of rainfall correspond closely with Irish conditions, as also does temperature.

The typical soil in a spruce forest carries about 1 inch of dead needles and 2 inches of dark brown crumbly decomposed organic matter, followed by 2½ft. or more of soil depth penetrated by the root system.

There is, of course, much more detail than is given here but this may serve as sufficient illustration.

Similar surveys have been given for Douglas Fir, Black Poplar, Oregon White Oak, Silver Firs, Western Hemlock, and Sequoia, together with various subtypes and blends of types among these trees.

Pinus contorta is not treated in the same way but from an utilisation point of view as " the most agressive and hardy species of the Western region," suited to colonisation of poor sandy and peaty soils and burnt over areas. There is evidence that it is regarded with some suspicion as falling off in growth rate after about 35 years and then becoming subject to bark beetle damage.

Douglas Fir receives the most detailed attention of all on account of its wide distribution and the many forms suited to particular environments. An anology is drawn with Scots pine and the authors go to some pains to point out the extent to which the same principles of behaviour, treatment, etc., apply.

Particular stress is laid on the great volumes attained in virgin stands. These stands apparently consist of 3 to 5 Douglas fir per acre standing in a matrix of Tsuga and Thuya, which, though not much more than half the height of the Douglas, are still, by our standards, very large trees.

Considerable stress is laid upon the drier and warmer soil conditions required by this species, as compared with Sitka spruce.

For sheer spectacle the Coastal Redwood forests of California surpass all others, and, although few suggestions for the use of this species in Europe are made, the visiting party give a brief account of the ecology

of these forests, laying stress on their awe-inspiring beauty, complex nature (two tree layers, a shrub canopy and an herb layer of vegetation all contribute to the complete picture) and the immense standing volumes of 100,000 to 140,000 cubic feet per acre.

One of the most important objects of the study was the question of genetics and, in particular, of seed origin. This is, perhaps, the most important section of the work. Among the points made is the fact that good health in Sitka spruce and freedom from both disease and insect damage are closely connected with high humidity in the soil and in the atmosphere. With Douglas Fir it is stated that it is intolerant of competition for soil and light ; that it is relatively drought resistant, and that seed from certain regions where the populations are extremely heterogeneous, due to wide variations in conditions within a restricted area, are the most likely to yield selections successful in new environments. There is also the suggestion that regions similar in the duration of growing season may suit the same variety though other considerations seem unfavourable.

Another section that deserves mention is headed " Growth, Yield and Thinnings." In the comparison drawn it would appear that the fastest growing European stands have, on an age for age basis, a height and volume growth corresponding to medium to lower rates in Western America. This, it is suggested, may be due to the use in Europe of the more fertile sites for agriculture and the confinement of forests to poorer quality soils, but is also due in part to the thinning practices adopted in Europe, so that the total production over a period is nearly the same for both. It is made clear that there are few markets for thinnings in America and that this will be a major research subject there for some time to come.

A useful analysis is given comparing production in pure spruce stands and in various percentage mixtures of spruce and Tsuga of the same age and on similar sites and the conclusion drawn is that the total volume production is approximately the same in all cases, though the number of trees per acre vary widely.

Altogether this Bulletin is most interesting and informative and may be strongly recommended to anyone concerned in forestry in Ireland.

J.E.J.

The Changing Wild Life of Britain

By H. L. Edlin

Published by B. T. Batsford Ltd., London. Price 21/- net.

This latest of Mr. Edlin's books deals primarily with an aspect of natural history about which it is most difficult to obtain information, the wild animal life of the country, both native and introduced, and secondarily with some aspects of plant life.

Most authors deal with only some fraction of the subject, birds, amphibians or plants, or perhaps with a single group of mammals such as rodents, but Mr. Edlin has attempted to give a popular and reliable summary of all the larger forms of wild life, both plant and animal, in the very modest space of 180 pages of text. This, of course, has restricted the amount of space he could devote to each, and in the case of plants and the smaller animals he has confined his account of living relationships to the uncommon forms or to representative groups, notably tillage weeds and animals associated with mankind. He is particularly interested in the dependence of these apparently very vigorous populations on man for their survival.

The central purpose of the book appears to be to give an account of man's influence past, present and possible future on the creatures that share the land with him. It is fascinating to read about the effects of ancient settlements, the hunting and pastoring methods of different periods of history, and present day trends.

At this point it may be observed that while ancient and recent Irish relationships have been well written, the present day position is not so clearly dealt with, and this constitutes a challenge which can only be met at home by the people who live and work on the spot.

Mr. Edlin is specially interested to account for the great increase in populations of rare and almost extinct species of birds of prey, sea birds, wild cats, martens and so on during the past 50 years.

It is delightful to find that Mr. Edlin is such a hopeful man, well disposed to all living things, and happy to adopt newcomers to the scene.

The value of his outlook to foresters is perhaps best demonstrated in the chapter headed " New Trees Secure a Foothold."

The question of introduced species is usually argued on a narrow front of economics versus sentiment, and needs the wider treatment given in this book, in which suitability to environment, to changing climate, and appropriateness to more ancient history than that of the enclosing of land within cosy hedges are given just importance.

Finally, the illustrations are excellent.

J.E.T.

OBITUARY

JOHN CROZIER

(1864 — 1952)

THE death of Mr. Crozier has removed from our midst one of the oldest and most popular of the foresters of Ireland. Occurring as it did during a printing strike, the sad news reached us late and it was not possible for the Society to be represented at the funeral.

Mr. Crozier had a long and varied experience of forestry in Scotland before he took up duty, in January, 1910, as assistant to the late A. C. Forbes in the Forestry Section of the Agricultural Branch of the former Department of Agriculture and Technical Instruction for Ireland. He remained with it through its many vicisitudes until he retired in 1933 in the capacity of Acting Director. When he started the State Forests comprised a total of 9 centres containing about 7,000 acres and before he left the number had risen to 44 with a total of over 52,000 acres.

He had very decided views on sylvicultural matters and held to them tenaciously. At the same time, he was always ready to discuss new ideas and he brought to any discussion a very practical outlook which was invariably refreshing if, sometimes, a little disconcerting to the rabid enthusiast. In retirement he maintained a keen interest in the progress of State Forestry, which he viewed with a critical, and in some cases, an unfavourable eye. At the Annual General Meeting of the Society in 1944 he was elected with acclamation to Honorary Membership, being the second person to be so honoured. Though his health, in later years, did not permit him to join the excursions of the Society, he was a regular attendant at all its meetings held in Dublin.

While we will miss Mr. Crozier as a forester, those of us who had the privilege of knowing him well will miss him most as a very sincere friend, whose generosity in advice and assistance could always be relied upon, though like so many of his countrymen, he kept this particular light hidden under a bushel.

To his wife and family we tender our sincere sympathy.

TO A SUCCESSFUL LANDOWNER AND LOVER OF TREES

Nature repeats—in many wondrous ways,
As if by instinct, what the past hath wrought.
Not always perfect, sometimes she portrays
A sense of weakness—hopes which came to nought.

Man, he was born to carry out God's will,
To love and cherish through his span of time
Beauty-of-living—far more radiant still
When man proves worthy of a life sublime.

Man with his errors—all of which do tell
Most contra-wise, especially if he fail—
Must help his neighbours and estate as well.
Only by duty can our hopes prevail.

Even the beauty of our countryside—
It cannot thrive forever unless we
Each in a lifetime faithfully confide
In all around us, in our Deity.

.....

So, as you leave to face the Great Unknown,
May your example prove a worldly gain.
May others say—" He came into his own ! "
We shall remember a Life—not lived in vain.

Ashtown.

COVER PHOTOGRAPH

Our cover photograph shows one of four European Larch trees (Larix dicidua, Mill) growing at Doneraile Court, Co. Cork, seat of Viscount Doneraile. These trees are some of the original introductions of this species to this country, the plants having been sent from Scotland by the second Duke of Atholl in 1738.

The Larch, which is native to Europe, was planted for ornamental purposes in Britain for nearly one hundred and fifty years before its value as a timber tree was recognised about 1728. By that time the Duke of Atholl had initiated experiments in the growing of larch for timber and his work was continued by his successors on a large scale, the fourth Duke planting 27,000,000 trees on 15,000 acres. About the same time the Society of Arts offered gold medals for larch plantings, and for essays on its economic importance.

The tree in our cover photograph was grown as a park tree and is, consequently, a coarse rough-branched specimen. It has, however, a girth of thirteen feet ten inches at breast-height, is healthy and bears abundant cones.

The photograph was kindly supplied by Viscount Doneraile.

NINTH ANNUAL EXCURSION

THE 9th Annual Excursion of the Society was held in Northern Ireland, with Bangor, Co. Down, as our headquarters. As on previous excursions, all arrangements for travel, accommodation, etc., were looked after by our Excursion Committee. We were once again favoured by good weather and thanks to the excellent arrangements and careful planning of the itinerary by our hosts—the Forestry Division of the Northern Ireland Ministry of Agriculture—our trip was both instructive and enjoyable.

FIRST DAY, TUESDAY, 27th MAY (Report by A. J. Hanahoe)

The excursion commenced with a visit to Glenarm Forest. This forest, containing some 450 acres, is situated in the magnificient glen of Glenarm on the east coast of Co. Antrim. It is well sheltered from the prevailing wind and has good deep soil on its steep slopes.

The first plantation met with was originally one of pure ash which was clear felled during the first world war. In 1929 the resulting coppice stools were thinned down to one stem per stool at about 25′ to 30′ apart. The ground was afterwards under-planted, with Tsuga and Norway spruce mainly. All the ash now have clean straight boles and light crowns. We were informed by Mr. Parkin, District Officer, that the intention was to leave the ash for another 30 years.

On joining the waiting buses we were brought to another point in the forest where a number of lorries were ready to take us over a recently constructed road up a steep hillside. Most of our members were amazed at the gradient and wondered how the many bends could be negotiated. We were in capable hands, however, and with little difficulty the powerful 4 wheel-drive trucks made the going seem very easy indeed. In convoy we journeyed along the hillside contour through an interesting closed young stand of larch until a halt was called by our guides.

Getting out of the lorries we were faced with a stiff climb straight up a steep hill. All our members, despite advancing years for some of the party, took to the job of getting to the top with alacrity. Near the summit we were shown a badly cankered larch stand out of which one acre had been heavily thinned and under-planted with Tsuga. The cause of the canker was the subject of a lively discussion in which many members took part. It was the opinion of most that it was due to the heavy nature of the soil and some members qualified this theory by referring to the ground flora in which a luxuriant growth of bluebell predominated. The number of trees left standing was given as 250 for the acre block.

After we had descended the hill the lorries again came to our aid and brought us to a number of 21-year-old plantations of larch and spruce. Many of the better quality Japanese larch had been selected for the final crop and high pruned. The cost worked out at about 6d. per tree.

We were then shown a 10 H.P. McConnell Sawmill Unit purchased at a cost of £275 complete. It was interesting to note that the converted light thinnings cut into 4′ lengths were being sent to Irish Wallboard Co. at Athy.

In beautiful sunshine, pocket lunches were enjoyed along the banks of a rippling stream. At this stage our older members renewed acquaintanceship with Mr. D. Stewart, retired Forestry Director for Northern Ireland, who for many years worked in Mountrath and other forests in the midlands before going northwards.

Parkmore Forest, at the head of Glenariff, was next visited. Here we were shown over a newly built forester's house at 900′ elevation. We were informed that the cost of the building was £2,200 approximately. Convenient to it we were shown a forest worker's house, only something less elaborate in style. The forest itself, comprising 1,461 acres, is divided into two blocks by a high lying county road. The plantable portion at 800′ to 1,000′ is for the most part covered by a shallow layer of peat over mineral soil. Planting operations began in 1950. Cuthbertson and Beggs ploughs were used in the draining operation.

Our next stop was at Ballypatrick Forest, comprising some 4,000 acres, the greater portion being covered with a layer of peat but sheltered from the prevailing west winds. It was here that Mr. Parkin told us of the experiment to discover whether sheep will seriously damage a young S.S. plantation established on grassland. He explained to the party that an area of 4 acres of 4-year-old spruce was fenced in and that 50 sheep with their lambs were allowed to remain 3 weeks there. There was no apparent damage to the young trees, the only noticeable change from the adjoining ground being that the grass was shorn bare by the intensive grazing.

The party was next taken in lorries over freshly constructed forest roads to a high plateau where ploughing operations were in progress on moderately deep peat showing some evidence of a Sphagnum surface cover. In a short, rather dense vegetation Calluna tended to be dominant to Eriophorum and Scirpus. A sprinkling of Vaccinium was also present. We were told that the intention was to have the area planted up with pure S.S.

A rather interesting feature in the drainage work on the slopes was that all the secondary drain mouths were left shallow for a distance back from the point where they opened into the main drains. This, the party was informed, was done with a view to the prevention of erosion. In the construction of the new roads the peat was removed down to the mineral soil. The roads in all cases were left sufficiently wide to allow for side drains where necessary.

This concluded our forestry activities for the day. Returning to our base at Bangor by an inland road we were again given an opportunity of viewing some delightful Co. Antrim scenery.

SECOND DAY, WEDNESDAY, 28th MAY (Report by J. E. Johnston)

For this, the second day of our excursion, we journeyed inland, our first stop being at Portglenone nursery. This is a small nursery and only recently opened. The soil is light, deep, and easily worked, and the production of seedlings will be the main use of this nursery. Several experiments are in progress here, on the time of sowing of Sitka spruce and on the covering of seed beds with a peat and sand mixture. Unfortunately none of the experiments were sufficiently advanced at the time of our visit to show significant results.

Transplants intended for use in farm plantation schemes brought about a discussion of the Ministry's scheme for the supply of young trees to farmers at cost price. Some members held that this could lead to unfair competition with the nursery trade ; others, however, felt that the great need for shelter on farms necessitated such a scheme, because farmers often could not afford to spend much on long term investments, and did not always fully appreciate the value of shelter trees.

Mr. Parkin described the method used in the control of " cut worms " with Paris Green and bran bait. These control measures had become necessary following an attack on Abies procera seedlings the previous July.

Although this nursery had been in continuous use for three years it had not received or required manurial treatment. Members commented on its clean and carefully tended appearance.

Next followed a series of brief halts at some of the Bann Dumps, Bracknamuckley, Gortgole, The Vow, Castleroe, where we saw interesting demonstrations of successful treatment of river drainage spoil heaps. Originally these plantations were laid down for amenity purposes only but they are now being developed into valuable stands. This process is well advanced on the Castleroe and Gortgole Dumps.

The results of efforts to assist the growth of checked pines on bare scree by the addition of peat mould and by Semsol were examined. Of these treatments, the ameliorating effect of humus on surface conditions appeared to be the best. On almost all sites the absence of development of any effective form of cover other than that provided by the plantations emphasized the value of this work.

Following the tour of the Bann Dumps the party was entertained to luncheon in Portsteward by the Minister of Agriculture, N.I., who was represented by Mr. Harkness, Secretary of the Department.

In the afternoon a visit was paid to Springwell Forest. Here we were met by Mr. McPherson, the District Officer, and shown over an area where some 400 acres of S.S. plantation in the thicket stage which had been destroyed by fire in 1946. An interesting discussion on the dangers of fire in young plantations and the protective measures to combat them developed.

At this forest centre labour supply is a problem and in an effort to solve the difficulty the nucleus of a new village has been formed around the forester's house. At present only the forester's house and eight

workmens cottages are under construction, but it is planned to develop further and to include a school and shopping centre in the village.

THIRD DAY, THURSDAY, 29th MAY (Report by J. J. Maher)

On Thursday, 29th, we travelled south by Strangford Lough through fertile, undulating country charmed by sea and the numerous lakes set in its hillocks. Our destination was Tollymore Park, formerly the residence of the Earl of Roden. As we approached from Newcastle the ancient oakwoods skirting the base of Lukes mountain—a north-western peak of the Mourne mountains—and the extensive coniferous plantations stretching to the upper slopes, presented a very pleasing picture.

This estate containing 1,194 acres was purchased in two lots, and with the exception of 100 acres reserved for agriculture, it was planted between 1932 and 1950. At the time of acquisition the old hardwood and larch crop had for the most part been exploited. Stands which remained were preserved as examples of what can be grown on this sheltered fertile silurian site with an average rainfall of 60 inches. It has always been noted for the excellence of its larch, beech and silver fir, and the magnificient stands and individual trees of these species seen justified this high opinion. One silver felled about 10 years ago is said to have measured 670 cubic feet.

European larch in mixture with hardwoods was used to plant up the low-lying ground. It was also the main species used over the remainder of the estate but gave way to Douglas fir, pure, wherever there was a rank growth of laurels and rhododendron. In the Larch-hardwood mixtures it was observed that the mixture by lines was doing best. Another interesting and controversial contrast was seen in the Douglas fir area, planted in 1935, through almost impenetrable rhododendron. The spacing above the road was 10′ between the lines by 5′, and this gave erratic growth but on the whole a good plantation. On the lower side of the road, with closer planting, higher stocking resulted, but with a decided reduction in the volume of the individual dominants.

Also seen in this forest was a small portable sawmill powered by a Blackstone oil engine. It is utilized largely to provide material for the Ministry's forests. Examples of gates, stakes and other produce were seen.

A short distance to the rear of the demolished mansion is a walled garden which is now used as a nursery. It was to one corner of this garden that all eagerly made their way to see what might be termed the first cradle of a forest seed orchard in this country. This work, recognised by horticulturalists as of paramount importance in the propogation of elite trees best suited to a locality or particular environment, has only been recognised by foresters in comparatively recent times. This is the first attempt here, and judging by the high percentage strike of Japanese larch and hybrid larch scions grafted on to transplant stocks they have got off to a flying start. It is intended to follow on with Scots

pine and spruces next year. The system of establishing a seed orchard may be described briefly as follows: Stocks as transplants are lined out in the normal way. Then in March, immediately before the buds flush, scions are selected from elite trees and grafted on to the stocks at about 4 to 6 inches above the root collar. When the scions have struck the stocks are cut back $\frac{1}{3}$ and when the growth of the scion has been firmly established the transplants are planted out in a selected site—the orchard.

After an *al-fresco* lunch in the shade of the beautiful cedars lining the avenue we travelled to Rostrevor Forest, via the mountain road. This forest, previously part of the Canning estate, was purchased from a Mr. Lyon in 1928. It contains 3,996 acres—2,072 acres of which were planted between 1930 and 1946. The remainder is considered unplantable at present.

Our first glimpse of this forest was just beyond the mountain crest. To the Wicklow forester it was a familiar sight—spruce in general check on a molinia clad granitic slope. There was a general discussion on how best to treat this site type. Mr. Weston, in a short talk, summed up the general opinion that molinia on this type was a deceptive indicator and with normal treatment it would have been best to plant P.C. He was in favour of the coastal type.

On travelling down slope we came to the Silurian formation and walked through a sessile oak wood which had been underplanted with a variety of species, Thuya plicata, Sequoia sempervirens, Cryptomeria Japonica and Tsuga heterophylla. All species average approximately 18′ in height and are putting on a steady height growth. Treatment is the problem here. Should the standards, gradually becoming stag-headed, be felled now or allowed to remain to the maturity of the understorey? The general opinion was that gradual removal of the standards would be best and would result in very little physical damage to the understorey.

In this woodland is a small nursery with very promising seed beds of Scots pine, Thuya plicata, and Red Oak. Also seen was a 250 gallon trailer water tank which might best be used to fill knapsack sprayers for fire fighting.

Our last stop was at an old sessile oakwood with a sprinkling of cherry and ash, beautifully situated on a moderately steep slope overlooking Carlingford Lough. Clear felled areas and large openings were planted with Douglas fir about 8 years ago. Above the oak woodland Scots pine was defoliated whilst Abies noblis used in mixture with it was growing quite well. Still higher, up to 1,200′ feet, Sitka spruce was planted and so far was healthy and putting on steady growth.

After a very enjoyable tea in the local hotel we travelled back to our base via Downpatrick where we visited the Cathedral and St. Patrick's grave.

At the conclusion of our tour and as a mark of our appreciation the Society entertained all those associated with our excursion to dinner.

DAY EXCURSIONS FOR 1952

As in previous years the Society continued its policy of arranging day excursions to places of interest to its members. During the year excursions were held to the State forests of Glen Imaal, Donadea, Ossory and Delgany (Glen of the Downs) by kind permission of the Minister for Lands.

For two of these excursions, those to Glen Imaal and Ossory forests, the main interest was centred in the sylviculture of young plantations in the early thinning stages and many interesting and lively discussions arose. Also discussed were the problems of the establishment of conifer crops on reverted hill pasture and submarginal lands.

At Donadea forest the main interest was in the newly constructed forester's house. This is a prefabricated timber dwelling and is the second of its kind to be erected, the first is at Gorey forest. On a short walk through the demesne the problems of the sylviculture and management of mixed hardwood/conifer crops were discussed. Of special interest at this centre was an unusually promising oak stand, the seed for which came from the Province of Guelders in Holland.

At the Glen of the Downs the Society had the opportunity of seeing how some of the problems of preserving the amenities of this noted beauty spot whilst at the same time removing an old and establishing a new crop had been tackled and successfully overcome. A small but excellent stand of eucalyptus attracted considerable attention.

Membership Application Form

I desire to become a member of the Society of Irish Foresters, and enclose Cheque/P.O./M.O. for ....., being subscription for year .....

Full Name .....

Occupation .....

Postal Address .....

Signature .....

Date .....

Block Letters

To be forwarded when completed to the Secretary at Albert Agricultural College, Glasnevin, Dublin.

CONDITIONS OF MEMBERSHIP

(EXCERPTED FROM THE CONSTITUTION)

Article V.—The membership of the Society shall consist of two Orders, namely : Technical and Associate.

TECHNICAL MEMBERS shall be persons desirous of promoting the object and at the time of election resident in Eire, who are employed for their whole time in forestry or any branch of natural science closely connected with forestry, or who have been so employed for at least five years, or who, though not so employed hold a degree or diploma in forestry of a recognised University or College, in all cases subject to the approval of the Council.

TECHNICAL MEMBERSHIP shall be divided into two grades, namely :—

Grade 1—Being Forestry Inspectors; professors, lecturers, graduates or holders of diplomas of Universities or Colleges; Head Foresters, and others of an equivalent status.

Grade 2—Being Foresters, Foremen Foresters and others of an equivalent status, including students at Universities or Colleges, not being restricted to Grade 1.

ASSOCIATE MEMBERS shall be persons desirous of promoting the object but not qualified for technical membership, subject always to the approval of the Council.

Members shall subscribe annually to the Society's funds according to the following scale of subscriptions :—

Technical Members, Grade 1, shall pay	...	...	£1 0 0
Technical Members, Grade 2, shall pay	...	...	10 0
Associate Members shall pay	...	...	15 0

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